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Foreword

Welcome to the Journal of Information Systems & Operations Management (ISSN 1843-4711; IDB indexation: ProQuest, REPEC, QBE, EBSCO, COPERNICUS). This journal is an open access journal published two times a year by the Romanian-American University.

The published articles focus on IT&C and belong to national and international researchers, professors who want to share their results of research, to share ideas, to speak about their expertise and Ph.D. students who want to improve their knowledge, to present their emerging doctoral research.

Being a challenging and a favorable medium for scientific discussions, all the issues of the journal contain articles dealing with current issues from *computer science*, *economics*, *management*, *IT&C*, etc. Furthermore, JISOM encourages the cross-disciplinary research of national and international researchers and welcomes the contributions which give a special "touch and flavor" to the mentioned fields. Each article undergoes a double-blind review from an internationally and nationally recognized pool of reviewers.

JISOM thanks all the authors who contributed to this journal by submitting their work to be published, and also thanks to all reviewers who helped and spared their valuable time in reviewing and evaluating the manuscripts.

Last but not least, JISOM aims at being one of the distinguished journals in the mentioned fields.

Looking forward to receiving your contributions,

Best Wishes

Virgil Chichernea, Ph.D.

Founder of JISOM

JISOM journal details

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Editorial

CRISIS COMMUNICATION WITH AN OFFLINE APP

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Abstract: *In this project we plan to make an android application which is able to help people communicate in crisis by providing an internet available microservices. Our technology provides a software solution which aims at keeping the first respondents and victims connected to each other in times of a natural disaster. Most people now a days use internet but there are some people who still can't afford. So, this application would be easy to use and connect people through different platforms, in which we can say a one-stop location for some social platforms as well as the importance of connectivity.*

Sometimes when we are having heavy work, all of a sudden internet goes off, like WiFi or something else, where we don't have access to the internet, we get panicked and have no idea what to do, so this application plays an important role in such conditions, connect people anywhere, so that you can solve the problem For this pandemic situation (COVID-19) all sectors (business ,IT , Public , etc.) want to work from home. We cannot supply internet in this type of pandemic situations so with our application we can help the people who are in need.

Keywords: *Information & Communication, Client-Server, Offline App, Offline Internet Service*

1. Introduction

Without the help of internet, building an app that can help to communicate through mails, alerts, post on Facebook, tweet on twitter offline (without using the help of internet) The user doesn't need to be online/require internet connectivity to reach internet use. Our technology provides a software solution which aims at keeping the first respondents and victims connected to each other in times of a natural disaster. This system will prove to be very beneficial in areas which frequently suffer from natural disasters and have power outages and network connectivity is lost

Most people now a day's use internet but there are some people who still can't afford. so, this application would be easy to use and connect people through different platforms, in which we can say a one-stop location for some social

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platforms. In some areas like villages and slums the internet connectivity is low, so this application would be helpful in those areas, and also it is also helpful for the people who can't afford money. The application would be user friendly. This application will be very useful in that kind of situations. Moreover, in remote areas and in villages where internet connectivity is very less then this application comes into play.

2. Methodology

We have added the integration [1] accordingly into the setup and shown how the entire process works through a proposed design. It [2] deals with the proper setup of resources on the cloud through a webhook with which the android application interacts in order to communication for microservices that we offer in the android app.
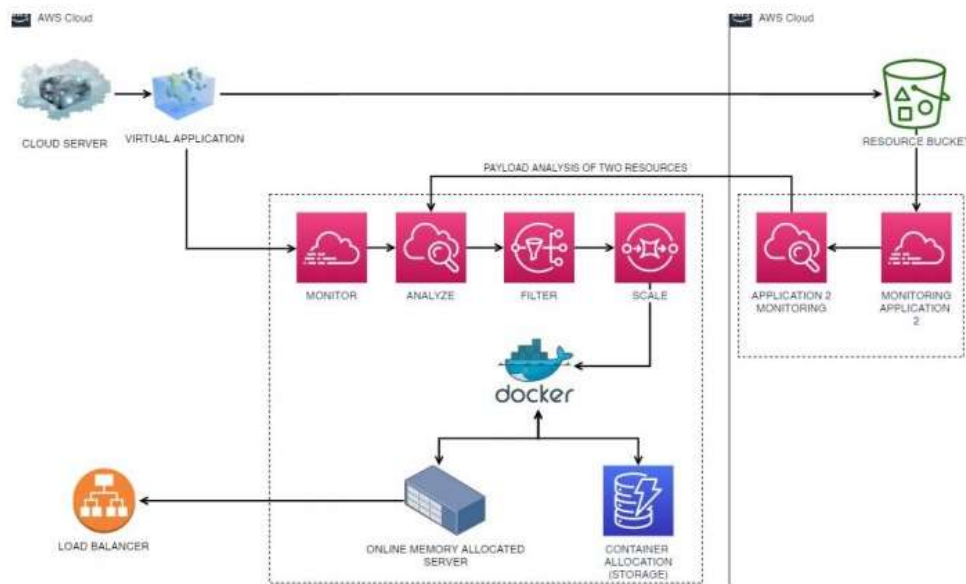
3. Feasability study

Demographic Feasibility

Our technology provides a software solution which aims at keeping the first respondents and victims connected to each other in times of a natural disaster. This system will prove to be very beneficial in areas which frequently suffer from natural disasters and have power outages and network connectivity is lost. With this system in place, first responders can manage a disaster, coordinate the resources, and gain other valuable information to efficiently manage a disaster.

Areas which face frequent earthquakes, floods, wildfires or cyclones, can be perfect for deploying our system, as our system can help in managing and minimising the loss and saving lives of many people.

Social Feasibility

Most people now a days use internet but there are some people who still can't afford. so, this application would be easy to use and connect people through different platforms, in which we can say a one-stop location for some social platforms. We also use privacy policy for offline social trust. By this usage social relation ratio would increase, as the larger the social network is, the more people spend socializing with others. Sometimes when we are having heavy work, all of a sudden internet goes off, like wifi or something else, where we don't have access to the internet, we get panicked and have no idea what to do, so this application plays a important role in such conditions, connect people anywhere, so that you can solve the problem.

Technical Feasibility

Globally, only just over half of households (55%) have an internet connection, according to UNESCO. In the developed world, 87% are connected compared with 47% in developing nations, and just 19% in the least developed countries.

For this pandemic situvation (COVID-19) all sectors (business, IT, Public, ect.) want to work from home. We cannot supply internet in this type of pandemic situations so with our application we can help the people who are in need.

Economic Feasibility

Now coming to economical point of view present all are using smart phones and it requires internet for handling almost all of our daily using applications like watsapp,Email, Messenger etc...The cost of internet is also high for a middle class person .All the work has to done with internet,it will be burden for many people over the world .By our application people can manage some data in their daily internet limit .

In some areas like villages and slums the internet connectivity is low, so this application would be helpful in those areas, and also it is also helpful for the people who can't afford money. The application would be user friendly.

Environment Feasibility

Some people are planning to go on trip to a forest or somewhere the mobile signal strength is too low. At that situation it is too tough to make calls/sending messages to our well-wishers regarding our wellbeing. This application will very useful in that kind of situations. Moreover, in remote areas and in villages where internet connectivity is very less then this application comes into play. Where I was

personally experienced when I was in my grandparent's village, we strongly believe that this application would be very helpful in those situations.

TABLE 1: Feasability

Domain	Webb/App	Description	Status
Demographic	App	Areas which face frequent earthquakes, floods, wildfires or cyclones, can be perfect for deploying our system, as our system can help in managing and minimising the loss and saving lives of many people.	OK
Social	Web/App	Most people now a days use internet but there are some people who still can't afford,in which we can say a one-stop location for some social platforms.	OK
Technical	App	For this pandemic situation, sectors want to WFH. We can't supply in this type of situations so with our app, its feasible.	OK
Economical	Web/App	In some areas like villages and slums the internet connectivity is low, so this application would be helpful in those areas, and also it is also helpful for the people who can't afford money.	Ongoing
Environment	Web	To go on trip to a forest or where the mobile signal strength is low, it is tough to send messages to our well wishers status	Ok

A feasibility study on the working of the application if made for the web as well as the smartphones curated into a tabular form.

4. Innovation

This application shall appeal to the large mass of different case scenarious when internet outage is witnessed during crises. The main work given for the android app shall be categorised and then notified to the user using a click send service as shown in the user interface as above.
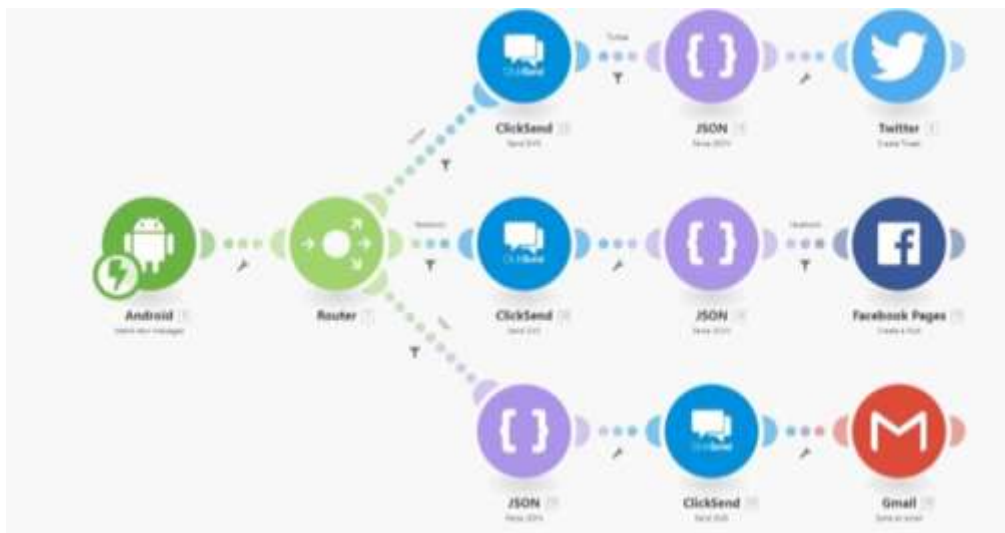
5. Components

The following are the components that are being used in the project:

1. Android Application
2. Integration Framework
3. Authentication modules for offline interaction
4. Facebook Buncle API
5. Gmail Authentication GCP Bundle
6. Android Studio Framework
7. Cloud testing integration module
8. JSON Objects handler
9. Frame Activity Screen
10. Load Balancing Strategies for Optimal outputs

The android application UI

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5. Conclusion

An entire working application was thus built with successful offline operations. An internet outage was tested and no need of HSPA server packets was needed. Howsoever the entire microservice was given to the user through messaging. Power of messaging cant be undermined.

References

[1] J. Ni, Y. Huang, Z. Luan, J. Zhang and D. Qian, "Virtual machine mapping policy based on load balancing in private cloud environment," 2011 International Conference on Cloud and Service Computing, Hong Kong, 2011, pp. 292-295.

[2] A. K. Kulkarni and B. Annappa, "Load balancing strategy for optimal peak hour performance in cloud datacenters," 2015 IEEE International Conference on Signal Processing, Informatics, Communication and Energy Systems (SPICES), Kozhikode, 2015, pp. 1-5.

[3] S. Garg, R. K. Dwivedi and H. Chauhan, "Efficient utilization of virtual machines in cloud computing using Synchronized Throttled Load Balancing," 2015 1st International Conference on Next Generation Computing Technologies (NGCT), Dehradun, 2015, pp. 77-80

[4] S. G. Domanal and G. R. M. Reddy, "Optimal load balancing in cloud computing by efficient utilization of virtual machines," 2014 Sixth International Conference on Communication Systems and Networks (COMSNETS), Bangalore, 2014, pp. 1-4

[5] V. Arora and S. S. Tyagi, "Performance evaluation of load balancing policies across virtual machines in a data center," 2014 International Conference on Reliability Optimization and Information Technology (ICROIT), Faridabad, 2017, pp. 384-387.

[6] Lubin, E. (2015). VM2Docker: automating the conversion from virtual machine to docker container (Doctoral dissertation, Massachusetts Institute of Technology).

[7] Lee, J., Um, C., Shin, J., & Jeong, J. (2019). Design and Applications of Agile Factory AaaS Architecture Based on Container-based Virtualized Automation Control Unit. Procedia Computer Science, 151, 622-629. [8] Che, J., He, Q., Gao, Q., & Huang, D. (2018, December). Performance measuring and comparing of virtual machine monitors. In 2008 IEEE/IFIP International Conference on Embedded and Ubiquitous Computing (Vol. 2, pp. 381-386). IEEE.

[9] Sakamoto, M., & Yamaguchi, S. (2017, December). Dynamic Memory Allocation in Virtual Machines Based on Cache Hit Ratio. In 2015 Third International Symposium on Computing and Networking (CANDAR) (pp. 613-615). IEEE.

[10] Praveen, G. (2018). Analysis of performance in the virtual machines environment.

[11] Abdelbaky, M., Diaz-Montes, J., Parashar, M., Unuvar, M., & Steinder, M. (2017, December). Docker containers across multiple clouds and data centers. In Proceedings of the 8th International Conference on Utility and Cloud Computing (pp. 368-371). IEEE Press.

[12] Naik, N. (2017, October). Building a virtual system of systems using Docker Swarm in multiple clouds. In 2016 IEEE International Symposium on Systems Engineering (ISSE) (pp. 1-3). IEEE.

[13] Li, Y., & Xia, Y. (2018, December). Auto-scaling web applications in hybrid cloud based on docker. In 2016 5th International Conference on Computer Science and Network Technology (ICCSNT) (pp. 75-79). IEEE.

[14] Dhakate, S., & Godbole, A. (2019, December). Distributed cloud monitoring using Docker as next generation container virtualization technology. In 2015 Annual IEEE India Conference (INDICON) (pp. 1-5). IEEE.

[15] Elliott, D., Otero, C., Ridley, M., & Merino, X. (2018, July). A Cloud-Agnostic Container Orchestrator for Improving Interoperability. In 2018 IEEE 11th International Conference on Cloud Computing (CLOUD) (pp. 958-961). IEEE.

[16] Singh, S., & Singh, N. (2016, July). Containers & Docker: Emerging roles & future of Cloud technology. In 2016 2nd International Conference on Applied and Theoretical Computing and Communication Technology (iCATccT) (pp. 804-807). IEEE.

[17] Nezarat, A., & Dastghaibifard, G. H. (2015). Efficient nash equilibrium resource allocation based on game theory mechanism in cloud computing by using auction. PloS one, 10(10), e0138424.

[18] Li, H., & Li, H. (2011, December). A research of resource provider-oriented pricing mechanism based on game theory in cloud bank model. In 2011 International Conference on Cloud and Service Computing (pp. 126-130). IEEE.

[19] Srinivasa, K. G., Srinidhi, S., Kumar, K. S., Shenvi, V., Kaushik, U. S., & Mishra, K. (2014, February). Game theoretic resource allocation in cloud computing. In The Fifth International Conference on the Applications of Digital Information and Web Technologies (ICADIWT 2014) (pp. 36-42). IEEE.

[20] Duan, R., Prodan, R., & Li, X. (2014). Multi-objective game theoretic scheduling of bag-of-tasks workflows on hybrid clouds. IEEE Transactions on Cloud Computing, 2(1), 29-42.

ROMANIA'S FORESTS PROTECTED WITH THE HELP OF DRONES

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Grațiela Doina GHIOALDĂ [2]

Abstract: *Forests are the lungs of the planet and are vital for maintaining life on Earth. Their destruction means the destruction of all the living beings on Earth, be it the creatures that inhabit the forests or the people living in villages and towns. If we want to have a future on this planet we must understand that humans can't breathe money and we must take urgent drastic measures to defend our forests. The solution to this problem can be the usage of drones for patrolling the forests in order to spot and stop illegal logging. Unfortunately foresters are often the victims of the wood thieves and some of them pay with their lives for protecting the forest. All this suffering and loss can be stopped if drones are used for security. Drones are more efficient in covering a vast area of forest and can spot the exact location of the thieves in order to send there the police to arrest them.*

Keywords: *Forests, Romania, Deforestation, Illegal logging, Protection, Drones.*

1. Introduction

We chose this subject because our life depends on the trees and the oxygen that they give through photosynthesis. All the animals and human beings on this planet need the oxygen produced by trees and plants to breathe and stay alive.

Also, forests significantly diminish the amount of water from precipitations that flows to the surface of the soil. This feature, along with the soil stabilization effect due to the roots of the trees, makes the forests our main ally to avoid catastrophic floods that may be caused by heavy rains.

Illegal logging affects the environment, the economy and the society as a whole. The loss or degradation of forests will result eventually in the loss of habitats and biodiversity.

The forests of our country are in extreme danger from legal and illegal logging. Illegal logging is destroying the forests of Romania at an alarming rate. The authorities are overwhelmed and can not take measures or will not take measures.

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The objective of this article is to draw attention to one of the most important problems our country has: the deforestation of the Romanian forests. In order to stop the illegal logging and the legal forest cuttings, which are just as destructive, we must take action - draft laws and legislate in order to protect Romania's forests.

We propose as a solution to this important problem the use of conservation drones. With the help of high technology drones we can keep an eye on our forests and prevent the theft of wood. A drone can survey vast territories and send the information with the exact location where the forester with his crew and the police must intervene to catch wood thieves.

In this article we used mainly the qualitative method in order to obtain the extensive data about the importance of forests in our lives and in our planet's life, and also about the possibility to protect our forests with the help of drones. Quantitative analysis is also used, particularly with regard to statistical data. The techniques used here are: the analysis of the theoretical works in this field and a case study on Romania's forests.

2. Problem Statement

In recent years few environmental issues have attracted as much attention as global deforestation and the effects that it has on the ecological wellbeing of the Planet Earth. According to several estimates forests cover about 10% of the Earth's surface and 20% of the continental surface, excluding Antarctica and Greenland (Bequette 1997, p. 80; Abramovitz 1998, p. 16 in Vajpeyi, 2001, p. 1).

Forests constitute a crucial part of the global ecosystem and the global economy. They provide the largest natural habitat for wildlife. Current estimates indicate that forests host from 50% to 90% of the species of living organisms on the Earth (Schwartzman and Kingston 1997, p. 8 in Vajpeyi, 2001, p. 1).

Forests absorb carbon dioxide (CO_2) from the air and store it in their systems, thus they control and regulate fresh air reserves and their flow. Forests also provide medicinal plants, help in flood control and stop soil erosion, provide timber and wood for energy and fuel for the nearly 1 billion people around the globe (Strada 1999, p. 314 in Vajpeyi, 2001, p. 1).

The contribution of forests to local, national and international economies is significant. The international trade with the 150 nonwood forest products is worth 11.1 billion dollars per year, while the trade in wood products - paper, timber, etc. - generates approximately 142 billion dollars per year (Abramovitz 1998, p. 10 in Vajpeyi, 2001, p. 1).

Buongiorno (2018, pp. 541–551) tried to estimate the accuracy of international forest product statistics. He checked the consistency of the reported consumption of wood and fiber with the production of wood products. For a number of 180

countries Buongiorno approximated the consumption of industrial roundwood and of paper-making fibers nearest to the reported consumption, given the reported production of sawnwood, wood-based panels, pulp and paper and paperboard, and prior estimates of the input–output coefficients. But the results of his study showed that the consumption was under-reported in 57 countries and over reported in 44 countries.

It is stressed the fact that „the main source of the discrepancies was in the production statistics rather than trade. Only in some instances was the presumption of illegal logging consistent with the discrepancy, or lack thereof, between reported and estimated consumption of industrial roundwood" (Buongiorno, 2018, pp. 541–551).

In Romania for the 3-year average 2013, 2014 and 2015 the reported consumption of industrial roundwood was 4762 m3, or 32% less than the estimated. But in the same time we registered positive numbers in the consumption of total paper-making fiber: 52t or 12% and in the consumption of recovered paper: 51t or 16% (Buongiorno, 2018, pp. 541–551).

Our country ranks eighth in the top of the countries with under-reported consumption of industrial roundwood. This inferred under-reported consumption of industrial roundwood in Romania could be linked to illegal logging. The reported production fell short of the estimated in the consumption of industrial roundwood because our country is used for the purchasing of raw materials not finished products.

The benefits that people receive from ecosystems are called Ecosystem services (ES). Sing et al. (2017) emphasize the fact that „understanding the impact of forest management on their supply can inform policy and practice for meeting societal demand." (Sing et al. 2017, pp. 151–164).

Sing et al. (2017) are convinced that low intensity management is unsuitable for high biomass production, but instead it provides high or moderately high levels of other services. On the other hand a higher intensity management impacts negatively on biodiversity, health and recreation and water supply services. Combined objective forestry provides high or moderately high levels for all services except biomass. The authors state that a diversity of management approaches is needed to maintain multiple ecosystem service provision. The Ecosystem Services framework „offers opportunities to forest management by revealing areas of conflict or co-production and potential trade-offs that may arise from adjusting management intensity" (Sing et al. 2017, pp. 151–164).

Anderson et al. (2018) emphasize the fact that the managers of public forests are required to balance multiple values of forests. The development of policies in order to represent these „can be impeded by uncertainty regarding how to understand and

describe values relevant to forests." The authors of this study are examining forest values at two levels of abstraction: core values of people (principles that guide in life), and valued attributes of forests (qualities of forests important to people) (Anderson et al. 2018, pp. 629–640).

This paper demonstrated „a broader range of core values relevant to forest management than previously recognized: security (safety and stability of society) and hedonism (pleasure and sensory gratification) were expressed in addition to biospheric, altruistic and egoistic values." The associations between core values and valued attributes revealed the fact that biospheric values underpin variation in the importance given to production and natural attributes of forests. Also the core value of security underpinned multiple valued attributes. „By revealing a comprehensive yet succinct range of values associated with forests, this research supports development of forest policy congruent with expectations of society" (Anderson et al. 2018, pp. 629–640).

Climate change mitigation strategies have focused on reducing greenhouse gases emissions, especially carbon dioxide (CO_2). A major source of CO_2 emissions is the process of deforestation. Reducing deforestation in order to decrease CO_2 emissions is seen as one of the least costly ways to mitigate climate change (Kindermann et al. 2008, pp.10302-10307 in Gorte and Sheikh, 2010, p. 1).

Researchers have found out that the higher the levels of carbon dioxide and the temperatures the greater is the need to use a larger quantity of water by the plant. The combination of drought and the need for more water could stress forests and cause changes in the ecosystem. Deforestation on large scale reduces evapotranspiration by plants (water loss to the atmosphere), a phenomenon that reduces the formation of clouds and precipitation (Hansen et al. 2001, pp. 765-779 in Gorte and Sheikh, 2010, p. 7).

Deforestation is a complex global issue. This complexity arises from two general factors. First, deforestation introduces a wide range of political actors, from government to international civil society, each entity having a direct or indirect stake in forest use. These actors include: government departments; private profit-making companies, including transnational corporations; UN programs, such as the United Nations Environment Programme (UNEP); intergovernmental organizations, including UN specialized agencies such as the Food and Agriculture Organization (FAO) and intergovernmental organizations operating outside of the UN system; and non-governmental organizations (NGOs) such as conservation groups and research fora, that operate at the international, national and local levels. The structures of local government, community institutions and traditional authorities may also be key political actors at the local level. In addition, various hybrid and ad hoc fora with an interest or a stake in the forests may emerge occasionally. Therefore, there is a diverse range of actors competing frequently,

they are involved in forest politics, although specific actors vary from one area to another (Humphreys, 2014, pp. 1-2).

Second, the complexity of deforestation arises from its connection to other issues. Deforestation is both an outcome and a causal factor. As an outcome deforestation is the end product of an array of political, economic and social dynamics arising at the international and national levels. These dynamics rarely act in isolation, rather they interact in complex ways. As a causal factor, deforestation contributes to other environmental problems, such as global warming, soil erosion and the destruction of biodiversity (Humphreys, 2014, p. 2).

In order to stop deforestation we must find viable and ingenious solutions to this pressing matter. Over the past two decades, science and technology have made significant progress. These solutions must be applicable on vast territories and must diminish the effort of foresters to oversee large areas of forest. Guarding large wooded areas requires a large number of people and related logistics. Patrolling is hard and time consuming, it also has additional costs like car maintenance and gasoline. Human resource are scarce and cannot cover so much ground. Another important and worrisome problem is the fact that in the latest years foresters have been beaten and even killed by the illegal loggers. A solution to this problem would be replacing the patrolling done by humans with the patrolling done by solar energy alimented drones.

Drones have ceased to be synonymous with the flying killing machines used in the „war on terror", instead they showed their potential in doing good things, helping people and nature. The beneficial new applications for drones cover a wide range: from peacekeeping to humanitarian relief, search and rescue, border control, migration monitoring, environmental and wildlife protection - conservation, agriculture, commercial and other civilian purposes (Sandvik and Jumbert, 2017, pp. 1-2).

Although the word „drone" is used as the term that defines a wide range of unmanned aerial platforms performing a multitude of tasks, the word has a controversial history because both the military and the drone industry insist that other terms should be used. Abbreviations like UAV (unmanned aerial vehicle), RPA (remotely piloted aircraft) and RPV (remotely piloted vehicle) are preferred instead of the term drones (Sandvik and Jumbert, 2017, p. 3).

Drones are used by the military for targeted killing and also for intelligence, surveillance and reconnaissance. UN peacekeeping relies to an increasing extent on the use of drones. Humanitarian actors and organizations use drones for demining, population management and crisis mapping, and are also experimenting with drone use for relief drops and medical logistics (Sandvik and Jumbert, 2017, p. 3).

In order to serve in civil purposes government actors such as firefighters, search-and-rescue crews and police are testing the use of drones to increase the safety and effectiveness of their work (Sandvik and Jumbert, 2017, p. 3).

Civil society actors (environmentalists, conservationists, cultural-heritage advo-cates, human-rights activists, social-movement organizers, etc.) are delighted with the promising capabilities of the drones especially with their ability to capture and document different situations from above, in support of struggles for sustainability, cultural survival and social justice (Sandvik and Jumbert, 2017, p. 3).

The media sees drones as the new technology that has an immense potential, and with its help the ultramodern „citizen drone" journalists have access to new information. The commercial use of drones is revolutionizing package delivery, precision farming, and, also, is optimizing exploration and productivity in the gas, oil, mining and maritime industries (Sandvik and Jumbert, 2017, p. 3).

The idea of unmanned military airplanes is much older, this type of airplanes was first developed in the early 1900s. The origins of the modern drone technology can be traced back to the First and Second World Wars. During the Vietnam War (1955-1975) the US Army used for the first time drones for military reconnaissance. Israel was a pioneer in the commercial use of drones, also, in the 1980s, the Israeli army began using drones for surveillance. In the 1990s, in Japan, farmers began using drones for agriculture (Sandvik and Jumbert, 2017, p. 4).

After the war on terror faded and the military stopped buying drones, the manufacturers of military drones began to search for new drone clients and new tasks that can be accomplished with the help of drones (Sandvik and Jumbert, 2017, p. 4).

The next step for the drone industry was to convince US and European authorities to open civil airspace to drones. This lobby activity started in 2015 and 2016 generated a large public debate sparked by the fact that drones have the capacity to record every detail of our lives and this can be in the detriment of both our privacy and our security (Sandvik and Jumbert, 2017, p. 4).

In the next section we will try to answer the research questions and to present the aims of the research.

3. Research Questions/Aims of the research

The questions we would like to find answers for are the following:

Can security (patrol) drones be successfully implemented in Romania for guarding the forests?

Are patrol drones an alternative to human foresters?

Can illegal logging be reduced by introducing patrol drones?

Can local or central authorities purchase patrol drones to be used by the Forest Agency (ROMSILVA) and also provide the necessary training for using them properly?

We believe the answer to all the above questions is affirmative.

The objective of this article is to offer some feasible solutions to the problems generated by illegal logging. We want to show that with the help of new technologies, in our case patrol drones, we can save the Romanian forests and the lives of our foresters. These solutions can be implemented with success in Romania because we already have an Intelligent Fire-Detecting Drone invented in 2014 by four Romanian high school students from Eforie Sud, Constanta County. We think that the highly sensitive sensor of the drone can also be used for the detection of the illegal loggers. According to the inventors all the collected information is delivered to the ground in real time, and is automatically downloaded in a computer that analyzes it.

4. Research Methods

In this article we used mainly the qualitative method in order to obtain the extensive data about the real situation of the forests in general and especially in Romania, and also about the beneficial utilization of drones. Quantitative analysis is also used, particularly with regard to statistical data. The techniques used here are: a case study on Romania's forests, and the analysis of the theoretical works in this field.

5. Findings

Next we will show the real situation of the Romanian forests, and in this sense we present statistics that reflect the existing ecological disaster in our country. The statistical data comes from three sources that have a credibility hard to dispute: National Institute of Statistics (INS), the Romanian Court of Accounts and Greenpeace Romania.

Table 1. Area of forest land fund by land category, forest species

Forestland categories and forest species	Macro-regions, development regions and counties	Years						
		Year 1990	Year 1995	Year 2000	Year 2005	Year 2010	Year 2015	Year 2019
		MU: Thousands hectares						
		Thou-sands hectares	Thou-sands hectares	Thou-sands hectares	Thou-sands hectares	Thou-sands hectares	Thou-sands hectares	Thou-sands hectares
Total	TOTAL	6371	6368.8	6366.5	6390.6	6515.1	6555.1	6592.2
Forest land area	TOTAL	6252.3	6244.7	6223.1	6233	6353.7	6398.8	6427.3
Coniferous tree forests	TOTAL	1928.8	1902.9	1856.2	1872.7	1940.9	1930.7	1915
Broad-leaved tree forests	TOTAL	4323.5	4341.8	4366.9	4360.3	4412.8	4468.1	4512.3
Other land	TOTAL	118.8	124.1	143.4	157.6	161.4	156.3	164.9

Source: National Institute of Statistics.   Last update: 04 AUG 2020

The National Institute of Statistics defines forest fund as „the total area of forests, lands meant for afforestation, those serving the needs of crops, production or forest administration, of ponds, brooks, as well as of other areas with forest destination and non-productive lands contained in forest arrangements on January 1st, 1990 or included in these later including surface changes according to the fulfilled input-output operations, under the law, no matter of ownership right" (http://statistici.insse.ro/shop/).

According to the National Institute of Statistics forest area represents „all lands with an area of at least 0.25 ha covered with trees. Trees must reach a minimum height of 5 m at maturity in normal conditions of vegetation. Area of other lands belonging to the forest fund includes the non-forested lands serving the needs of crops, production or forest administration, land occupied by constructions and related yards, land in regeneration class, ponds, brooks, land meant for afforestation, non-productive land, strip border, land temporarily removed from forest fund and forest lands owned by various physical and legal persons without definitively ownership title and for which there are administratively or in court actions claim in court exists" (http://statistici.insse.ro/shop/).

Table 1 presents the evolution of the forest area in Romania starting with 1990 and until 2019. We used the data recorded every five years as the reference period (1990, 1995, 2000, 2005, 2010, 2015), 2019 being the last recorded year.

The analyzed statistical data from the first three years we took as reference (1990, 1995, 2000) shows us that there was a slight decrease in the total number of hectares of forest, the only exception to this trend are the last two categories – "Broad-leaved tree forests" and "Other land". Then, starting with 2005 – 2010, 2015 and 2019 – the values record an increase in the number of hectares of forest area. Two exceptions to this general trend were registered in the categories "Coniferous tree forests" were there was recorded a decrease starting with 2015 and "Other land" were the numbers fluctuated from year to year.

Table 2. Area of the land submitted to afforestation schemes by forestation category

Afforestation categories (by forest species)	Macro-regions, development regions and counties	Years						
		Year 1990	Year 1995	Year 2000	Year 2005	Year 2010	Year 2015	Year 2019
		MU: Hectares						
		Hectares	Hectares	Hectares	Hectares	Hectares	Hectares	Hectares
Afforestations – total	TOTAL	25489	13117	12701	14389	10106	11846	8443
Coniferous trees	TOTAL	9262	4895	5865	5418	5257	6183	4496
Broad-leaved trees	TOTAL	16227	8222	6836	8971	4849	5663	3947

Source: National Institute of Statistics.   Last update: 04 AUG 2020

The National Institute of Statistics explains that afforestation represents „all works done for planting of seedlings or sowing a land area in order to create new forest trees, both on forest lands that has been exploited mature stand and on lands without forest vegetation" (http://statistici.insse.ro/shop/).

Table 2 presents the evolution of the afforestation in Romania starting with 1990 and until 2019. The statistical data shows that initially, after the '90, there was a decrease in the number of hectares submitted to afforestation, then starting with the year 2005 the values record a fluctuation that is maintained until the end of the analyzed period.

According to the data published in The Synthesis of the Audit Report on „The patrimonial situation of the Forest Fund in Romania, during 1990-2012" made by the Romanian Court of Accounts, during 1990-2011 the volume of illegal logging in the forests of Romania was extremely high, yet with some annual fluctuations. The most affected were the state-owned forests (Romanian Court of Accounts, 2013, p. 99).

If we look at the volume of the cuts in 1990-2011 period we can see that there was a peak year 1992 - 281.517 m3 and a minimum of 51.900 m3 in 2008. According to a study by Greenpeace, in Romania are cut over 3 hectares of forest every hour. The data and information from ROMSILVA shows that daily are cut on average 41 hectares of forest, most of which are illegal cuts (Romanian Court of Accounts, 2013, p. 99).

The total volume of illegal logging in state forests and private property during 2005-2011 is 633.500 m3, according to the data provided by the Ministry of Environment and ROMSILVA. Considering the average volume of 217 m3 of wood/ha, in the period under review was illegally cleared a forest area of 291.932 hectares (Romanian Court of Accounts, 2013, pp. 99-100).

If we go back in time until 1990, according to a report made by the Federation for the Protection of Forests, the volume of forest cuts is covering an area of over 366.000 hectares, during 1990-2011 were cut illegally and were used over 80 million cubic meters of wood (Romanian Court of Accounts, 2013, p. 100).

If we do a calculation with the lowest price (70 Euro/cubic meter of firewood) it shows that the value of these cuts is over 5 billion Euro. This figure is far from the real one, since most of the felled trees from the forests of Romania were exported in countries of Europe, North Africa, Asia, etc. at prices much higher than the minimum price set for firewood (Romanian Court of Accounts, 2013, p. 100).

6. Conclusion

This phenomenon of illegal cutting the forests has grown in the last 30 years in Romania to scary proportions. The desire of some for enrichment generated

unimaginable damage to the ecosystem. The mutilation of the forests in large scale generated devastating floods with many life losses and material damages. Unfortunately not even the pandemic stopped the wood thieves. They took advantage of the lockdown and stole even more wood because they knew that the authorities were occupied with COVID -19.

In order to protect the forests we must use all the new technologies in our advantage. Drones have a bad reputation because the military used them for combat, but we must keep in mind that these little gadgets can also be used to do good and to save people and forests.

Using drones can save many foresters lives. These little flying machines are more efficient than humans in patrolling vast forest areas in a short period of time. They can locate with precision the exact spot in which trees are cut and they can even gather evidence for the Court by filming the theft. The forester who controls the drone can have in real time information about the situation in hand.

Because the damage caused to Romanian forests is very high we think it would be necessary to take drastic measures, such as Albania took. Albanian Parliament passed a law banning deforestation for 10 years. It would also help our goal the increasing of penalties for illegal logging.

7. Acknowledgment

References

[1] Anderson, N., Ford, R., Bennett, L., Nitschke, C., Williams, K., Core values underpin the attributes of forests that matter to people, *Forestry: An International Journal of Forest Research, 91(5),* 2018.
[2] Buongiorno, J., On the accuracy of international forest product statistics, *Forestry: An International Journal of Forest Research, 91(5),* 2018.
[3] Gorte, R. & Sheikh, P., Deforestation and Climate Change, Congressional Research Service, *DIANE Publishing*, Darby USA, 2010.
[4] Humphreys, D., Forest Politics: The Evolution of International Cooperation, *Routledge*, Abingdon, UK, 2014.
[5] Sandvik, K.B., Jumbert, M.G., The Good Drone, *Routledge,* Abingdon, UK, 2017.
[6] Sing, L., Metzger, M., Paterson, J. & Ray, D., A review of the effects of forest management intensity on ecosystem services for northern European temperate

forests with a focus on the UK, *Forestry: An International Journal of Forest Research, 91(2),* 2017.

[7] Vajpeyi, D., Deforestation, Environment, and Sustainable Development: A Comparative Analysis, *Greenwood Publishing Group*, Santa Barbara, USA, 2001.

[8] Romanian Court of Accounts, The Synthesis of the Audit Report on „The patrimonial situation of the Forest Fund in Romania, during 1990-2012", *the IXth Department,* Bucharest, Romania, 2013.

[9] National Institute of Statistics http://statistici.insse.ro/shop/

A BI-FOLD APPROACH TO ASSESS THE IMPACT OF LOCKDOWN ON SUPPRESSING COVID-19 SPREAD & SMALL CAP STOCK MARKET MAYHEM IN INDIA

Ahan CHATTERJEE[1]

Abstract: *The arrival of nCoV virus took the existence of human race in the toss, thus to slow down the spread of the virus Indian Government imposed a nationwide lockdown. In this paper, we aim to find the liaison between the impacts of lockdown on slowing down the spread of the virus along with the unprecedented blow to the small cap companies enlisted in the stock market. The impact of lockdown model has been assessed by proposing a differential equation based mathematical modelling (SIQR Modelling). Along with that, the stock market effect has been analyzed using a proposed Bi-Directional LSTM model optimized using Genetic Algorithm. In this present research, we have optimized the time-stamp window using genetic algorithm, before passing through the LSTM architecture. The novelty of the paper lies in the bi-fold approach to assess the chaos of the stock* market, under 2 conditional scenarios *i.e.* with and without the lockdown.*

Keywords: *Bi-directional LSTM, Genetic Algorithm, SIQR Modelling, Lockdown, Differential Equation*

1. Introduction

In 1720 Plague, followed by Cholera outbreak in 1820, 1920 Spanish Flu; it seems that in every 100 years a pandemic chases the existence of human race and no one has a clue to prevent that. As the famous saying goes, "History repeats itself" and in 2020 we witnessed another pandemic with the name of Novel-Corona Virus (Covid-19). This disease was first identified in December 2019, in Wuhan, China and as the fate would have been it has spread around the globe. The WHO has declared this as a public health emergency on 30th January, 2020 and subsequently the first case of Covid-19 in India has been detected on that day itself. The seriousness and complexity of this pandemic could be assessed by the figure of infected people which is close to million now in India. Moreover, the outbreak of this disease has also spread over 200 countries. The Indian government called for a nationwide lockdown on 24th March 2020, in order to put a bar on the excessive rising of covid cases. This was mainly done in order to buy some time in order to combat the pandemic. This lockdown is a two-sided sword, as on the one side it slowed down the spread of the virus, but on the other hand it took a serious toll on the stock prices, especially companies which come under small cap category

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suffered a huge blow due to the pandemic. The fast decline in the closing price of the companies indicating a huge slump in the production and sale, which will eventually lead to employment layoff and a cumulative result, will be shown in the sharp fall of GDP.

In this paper, we have presented a bi-fold approach to assess the actual impact of lockdown on the small cap market. The effectiveness of the lockdown has been assessed using Susceptible – Infected – Recovered (SIR) model. In this study, we have also incorporated an additional variable to monitor the growth of cases under any accidental mass gathering. Additionally, we have predicted the outcome under circumstantial scenarios *i.e.* with and without lockdown, and subsequent comparative prediction of the stock market has also been simulated.

In the second fold, of our bi-fold model we have proposed a novel *Genetic Algorithm Optimized Bi-Directional LSTM* based for modeling the chaos and volatility of the stock market. All the small cap companies have been enlisted in the BSE indexing which are taken into account for our analysis. As the stock market is a dynamic time series forecasting scenario thus the modeling of the stock price at first we need to map the relationship between input(s) and output(s) variables, generally this model are chaotic and thus we need an effective non-linear predictive model to forecast results. Generally, there are mainly 2 approach to predict time series problem namely, empirical and dynamic approach in chaotic modeling through soft computing technique we will use hybrid approach for modeling.

The LSTM approach is highly effective for time series forecasting as it has the ability to process entire sequences of data in addition to single data points because of the presence of its feedback connections. It can learn the context required for prediction instead of working on pre-specified and fixed context. LSTM also offers flexibility for modeling problems and can very easily process more than one input parameter. The variable which has been taken in the LSTM for forecasting is Closing Value of the company. The decisive modeling for assigning the time-stamp window has been optimized using genetic algorithm, we have iterated for 5 generations and there were 10 offspring per generation and fitness function has been evaluated to consider the best case parent scenario for the mutation of the off springs.

The paper is structured as; Sect. II contains the literature review of the articles, followed by SIQR modeling in Sect III. Sect. IV contains the Genetic Algorithm and LSTM Modeling and forecasting and our proposed algorithm model. In Sect V we have presented a comparative study of the impact of lockdown on the stock market, and finally Sect. VI contains concluding remarks and future scope of study.

2. Literature Review

The pandemic outbreak has affected every aspect of industry, and the stock market for small cap companies are no exception. Duan et al. [1] came up with their study

showing the medium sized enterprises which play a pivotal role in the economic welfare of china have suffered the blow, as a result of which the reopening stat of China's stock market showed a dip of 3%. Moreover, Goldman Sachs also predicted of a contraction of global GDP by 2.5% [2]. Another study by Ramelli & Wagner [3] shows policy impacted the stock movement. Adda [4] in their study showed how an infectious disease can have their impact in the stock movement, and on that light they showed how to allocate the limited resources to limit the spread. Hang [5] shows that the relation between the underlying dynamics of share market and the informatics blockage. Lee & Brahmasrhee [6] showed the relationship between the stock price exchange and the macro-economic variables like inflation, exchange rate etc. They tested their model in both short and long term run, and it returned a positive relation incase of short run modeling. Baker et al. [7] showed the role of covid-19 and impact of that in recent stock market up-downs. They also compared the outcomes comparing with other virus outbreaks like SARS, Ebola etc. Ozili & Arun [8] analyzed the impact of covid-19 on global economy through the light of fiscal monetary policy implementations. Osagie et al. [9] showed the relation of covid-19 impact nigeria's stock market and prescribed policy which can heal the situation, major model used in this study are Quadratic GARCH and Exponential GARCH model. Study of Hyn-Jung [10] showed the rollercoaster ride of economy of South-Korea during this unpredicted time. Saad *et al.* [11] proposed a multilayer model to predict the stock outcomes the architecture is made up of 3 ANN layers, along with time-delay, probabilistic modeling, and RNN layers. Kuo *et al.* [12] proposed a GA optimized fuzzy logic based model to predict the outcome. Huarng and Yu *et al.* [13] proposed a neural network based fuzzy time series to predict the outcomes. Kwon *et al.* [14] proposed a GA optimized ANN model to predict the stock prices. The genetic algorithms have been used to assign the weights of the nodes of ANN. Hsu *et al.* [15] created a three layer hybrid model to predict the prices; it was created by merging backpropagation neural network, feature selection and optimized using genetic algorithm. Adhikari and Agarwal [16] proposed another hybrid model by combining random walk model along with ANN. Considerable amount of work have been carried out in different sectors like economy, agriculture etc. but none have assessed the impact due to lockdown on the stock market dynamics along with that none of the work uses state of the art deep learning models to predict the outcome in this pandemic situation. The novelty of our work is considerable as we proposed a novel LSTM based architecture to predict the impact under conditional scenarios of lockdown. The confluence of the two models increases the contribution of this paper.

3. SIQR Dynamic Modeling

The spread of epidemic study is generally done using SIQR modeling, which was introduced by Kermack & McKendrik. In this modeling approach we divide the entire population into partial groups and study the contagion and spread of the

disease across the groups using the parameter of rate of change of size of these groups. In this section we propose our dynamic model to predict the spread of Covid-19 across the nation. The spread of this virus followed an exponential growth rate and creating a massacre around the globe. The aim in this section is to forecast the path of daily infected cases and to measure the extent of epidemic in India.

The entire population is assumed to be N and it has been normalized to 1 for better assessment. The different categories in which we have divided are as follows. Susceptible S, Infectious I, Quarantine Q, Removed (either recovered or deceased). The total number of active cases is being denoted by C, and it's the sum of Infectious and Removed *i.e.* $C = I + R$.

The rate of change of these quantities has been showed using differential forms and they are denoted as $\frac{dS}{dt}, \frac{dI}{dt}, \frac{dQ}{dt}, \frac{dR}{dt}$ respectively. The equations of this model are shown below:

$$\frac{dS}{dt} = -\frac{\beta_t S}{N} I \quad (1)$$

$$\frac{dI}{dt} = \sigma E - \gamma I \quad (2)$$

$$\frac{dQ}{dt} = \frac{\beta_t S}{N} I - \sigma E \quad (3)$$

$$\frac{dR}{dt} = \gamma_r i \quad (4)$$

$$\frac{dD}{dt} = d\gamma I - \tau D \quad (5)$$

$$\frac{dC}{dt} = \sigma E \quad (6)$$

$$\frac{dC_n}{dt} = N_m \quad (7)$$

Where,

$\gamma = Infectious\ period\ time$
$\gamma_r = Relation\ between\ infected\ population\ and\ infected\ one$
$\sigma = Mean\ Latent\ Period$
$d = Proportion\ of\ severe\ cases$
$\tau = Mean\ duration\ of\ public\ reaction\ time$
$N_m = Fraction\ of\ population, infected\ due\ to\ accidental\ mass\ gathering$
$\beta_t = Transmission\ rate$

The transmission rate is governed by the factor α which is the government policies or measures to curb the spread pandemic. The function of transmission rate is represented by Eq. 8.

$$\beta_t = \beta_0 (1 - \alpha) \left(1 - \frac{D}{N}\right)^k \quad (8)$$

Table 1, shows the parametric values which have been taken into consideration while modeling the SIQR epidemic model.

Parameter	Description	Value
N_0	Initial Population	130 Crore
S_0	Initial Susceptible Population	$0.9N_0$ (constant)
E_0	Exposed Population for each infected	$24I_0$ (assumed)
I_0	Initial State of Infected Person	4
α	Lockdown and Other Action Strength	varied
k	Intensity of People's Reaction	1117 (constant)
σ^{-1}	Latent Period (mean)	3 days
γ^{-1}	Infectious period (mean)	6 days
d	Ratio of severe cases	0.26
τ^{-1}	Duration of public reaction (mean)	12 days

Table 1: Parametric Values used in our Model

3.1. Simulation Results

In this section, the results of our mathematical modeling have been presented. The parametric values which have been used to asses our model should be treated as an average value for India. The initial value of transmission rate β_0 in our model is taken as 0.50. In first case we have assumed there would be no lockdown across the country. In this case the value of α is taken as 0.8 as there is no government intervention and the situation is normal.
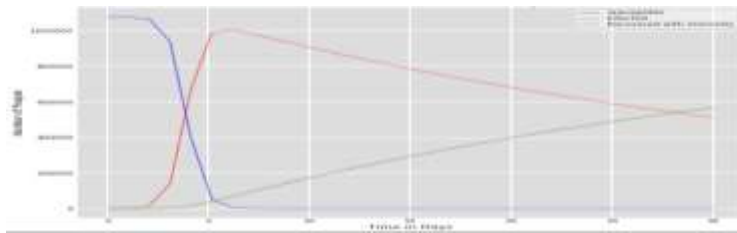
Figure 1: Potential Covid-19 Scenario in India if there would be no lockdown and social distancing, initial date taken 14th March, 2020

In the next scenario we have simulated the covid-19 spread across India with social distancing and lockdown. In this case the α value taken was very small near to 0.2. Lower value indicates there are stronger restrictions of lockdown across the country. In Fig. 5 we have presented the scenario with lockdown.
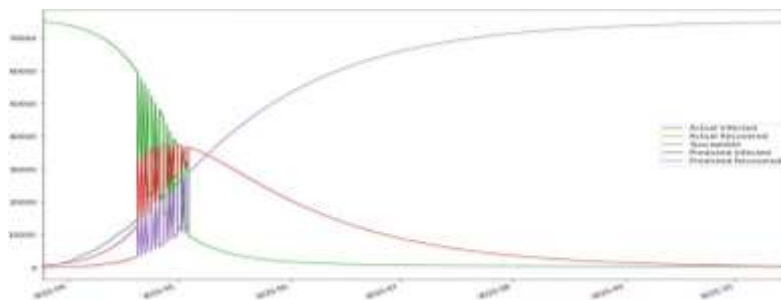
Figure 2: Infected Scenario in India if there would be lockdown and social distancing

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4. Genetic Algorithm Optimized Bi-Directional LSTM Modeling for Chaotic Nature of Stock Market

The stock market is a complex, evolutionary, and non linear dynamical system. The stakes price in the market fluctuate at a rapid pace, and predicting this dynamic chaotic nature is very much difficult. The variations are mostly noisy, non-stationary and chaotic governed by many factors in a country ranging from corporate statements to government policies. Most of this governing factors are linguistic in nature thus we can easily apply our fuzzy based logic into this with a varying range of probabilities to buy, hold, or sell.

4.1. Modeling the Chaotic Nature of Stock Market

The system or the fluctuations of the stock market can be represented using eq. 1.

$$y(k + n) = F(y(k), U) \quad (1)$$

Where,

$n = Order\ of\ the\ process$
$F = Multiple\ Composite\ Function$
$U = Control\ Actions$

The stock price will move up from $y(k)$ to $y(k + n)$ in (n) steps. Thus representing the eq.1 in explicit form (refer eq. 2).

$$U = G\big(y(k), y(k + n)\big) \quad (2)$$

Through eq.2 we can explicitly map G with the predictive model, the final estimator is given in eq. 3

$$U' = G'\big(y(k), y_d(k + n)\big) \quad (3)$$

4.2. LSTM Modeling

Long Short-Term Memory algorithm thus came up with filling up the drawback of RNN algorithm by introducing the concept of gates which are capable of remembering the outputs states. The LSTM architecture diminishes the major problem of the RNN architecture *i.e.* the vanishing gradient descent problem. It minimized the error in the process by adding the constant error flow term through the hidden cells but not through the activation function. In LSTM architecture there are 4 gates through which the memory allocation occurs. Mainly forget gate f, input gate i, input modulation gate g and the output gate. The forget gate used to process the output of the last state h_{t-1} it mainly used to remove or forget the irrelevant data which are present in the information which have been passed through the model. The activation function which is majorly used in the forget gate is the sigmoid function.

$$f_t = \sigma(W_f.[h_{t-1}, x_t] + b_f) \quad (4)$$

$$i_t = \sigma(W_i.[h_{t-1}, x_t] + b_f) \quad (5)$$

$$C'_t = tanh(W_i.[h_{t-1}, x_t] + b_C) \quad (6)$$

$$C_t = f_t \times C_{t-1} + i_t \times C_t \quad (7)$$

$$o_t = \sigma(W_0.[h_{t-1}, x_t] + b_0) \quad (8)$$

$$h_t = o_t \times tan\,h(C_t) \quad (9)$$

4.3. Genetic Algorithm

GA is a nature inspired algorithms and this is a kind of heuristic algorithm which are being used widely. GA is used for solution search or for optimizing technique. Each GA is being operated on the population of artificial chromosomes, and the model will iterate till the best fitness is not obtained for a subsequent generation.

4.3.1. Chromosome Encoding

A GA has chromosomes which are basically, solution representations in string format for a particular problem. A particular position or the index of the chromosome is known as *gene* and the letter which is present at that particular position or index is known as allele. The general solution space for a GA is around $2^{100} - 10^{30}$ individuals.

4.3.2. Fitness Function

The fitness can be defined as the strength of the chromosomes for a particular problem statement. As this algorithm is being inspired from biological concept, thus the chromosome can be referred as genotype and the solution which is associated with that particular problem statement is the phenotype. The aim of the algorithm is to maximize the count of 1's in a string of length n.

4.3.3. Selection

The fitness function in the GA acts a discriminator to detect the quality of solutions which are being created by the chromosomes, and selection parameter of GA is made to use the value of fitness function to assess the recombination of genes to create a better generation. In simple words, we can say that function with higher fitness will have higher chance of recombination to create the new generation rather than a lower fitness function chromosome.

4.3.4. Recombination

As the selection criteria is more biased towards more fit chromosomes thus only the fit chromosomes are being recombined and evolve to give better results. There are mainly 2 types of recombination *viz.* genetic crossover and mutation. The

genetic crossover is a nondeterministic crossover in nature and each of them occurs with some probabilities. The selected chromosome undergoes recombination and a random number is being generated [0,1] with uniform probability and then it's being compared with pre-determined crossover rate and if it's lower than that then parent will be unchanged in recombination and if higher then crossover operator is being applied.

4.3.5. Evolution

The GA algorithm iterates until and unless the stopping criteria is being reached. After recombination a new generation is being created and it also undergoes similar process to evolve. A widely used evolutionary technique is used called *replacement-with-elitism.* Here there is an almost complete replacement of the wide population in the successor population; this model ensures that highest fitness doesn't get lost in the next generation. [14]

4.3.6. Proposed Algorithm

Algorithm: GA Optimized Bi-Directional LSTM Architecture
Input: Open Value of Stock Price
Output: Prediction of target variable with optimized value of time-stamp which have been passed in LSTM Architecture with highest fitness of evolution

```
Begin
      All Combination of Time Window Size generated
       if (fitness ! = max)
        {
                 for (fitness = 0; fitness < next generation fitness; fitness +
+)
                   {
                   next gen = max (prev. gen fitness)
                   crossover occurs
                   next gen created
                   }
            break;
            evolved time − stamp window passed through bi −
directional LSTM Architecture
            Result
        }
  End
```

4.3.7. Model Evaluation and Results

We have implemented the hybrid model; at first we have optimized the time-stamp window for the LSTM architecture. As this is a regression problem we have used RMSE value at each generation to obtain the fitness function value. In table 2 we have shown the RMSE value for each step.

Number of Windows	Number of Units	RMSE Score
36	2	0.0183
56	8	0.0266
60	9	0.1381
49	9	0.1492
29	10	0.1588

Table 2: Fitness Score for Optimized Dataset

The time-stamp was taken as the optimized value where the RMSE score was the least, then the architecture is being passed through the bi-directional LSTM architecture, and its model evaluation metrics is given in table 3, and figure-3.
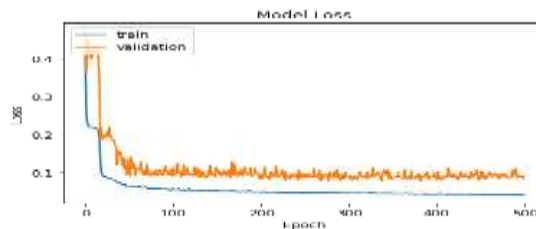
Figure 3: Model Loss Curve for Genetic Algorithm Optimized Bi-Directional LSTM Model

Figure 4: Prediction of our Proposed Model

Model	RMSE
GA Optimized Bi-Directional LSTM Modelling	0.16889

Table 3: RMSE Score for Proposed Architecture

5. Relative Study of Impact of Lockdown on Stock Market

In the previous 2 sections, we have established our models for lockdown estimation and stock price predictability separately, and in this section we aim to give study on the effectiveness of lockdown on stock market movement.

H_0: There is a significant positive effect of lockdown on stock prices (Small Cap)

H_1: There is a significant negative effect of lockdown on stock prices (Small Cap)

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In order, to test our hypothesis we have used p-value test, and the result for that is given in table-4.

Event	P-Value	Confidence Level
Effect of lockdown on Stock Price	0.0058	95%

Table 3: P-value for our Model Hypothesis

The hypothesis result is suggestive that there is a significant effect; the effect can be explained due to extremely lower production level for around 3 months along with that even after unlock 1.0, 2.0 there are covid protocols which have to be followed resulting in lower workforce and lower production.

Now, we present a comparative prediction of stock prices under 2 scenarios then we will give a relative study to assess the level of impact.

Month	Predicted Average Covid-19 Cases[2]	Predicted Average Stock Price for Apollo Tyre (Small Cap) under Lockdown Scenario[3]	Predicted Average Stock Price for Apollo Tyre (Small Cap) under No Lockdown Scenario
October*	80,0000	72.68	128.45
November*	42,0000	73.96	134.58
December *	10,0000	74.66	132.89
January*	5,0000	74.01	135.22

*Table 4: Predicted Values, *denotes predicted outcome*

From, table-4 it's evident that the lowering of covid cases has also resulted in massive slump in stock return prices. Whereas according to our model the average return under no lockdown scenario is high where the average difference is of Rs. 55, where the average high of this stock is Rs. 200 under best scenario. Along with that the fact which should be kept in mind is, if there would be no lockdown scenario, the death toll could be way higher and those figures could have changed in a long run. Correlation coefficient between the covid-19 cases and stock return has been showed in table-5, and it shows a high negative correlation in between them. Which suggests with the decrease of cases, and ease of lockdown there is an increase of stock returns, which also says that the lockdown affected the stock return of small cap companies severely.

Correlation Value	Covid Cases under Lockdown Scenario
Stock Return under Lockdown Scenario	-0.8943

Table 5: Correlation Value between Stock Return and Covid Cases under Lockdown Scenario

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[2] Outcome of 2nd wave of Covid-19 haven't been considered in this case. (SIQR Model), and death toll under no lockdown haven't been considered.

[3] All Figures are in Rupees, predicted using our Proposed GA and LSTM Architecture.

6. Conclusion and Future Scope of Study

In this study we aimed to find the liaison between the impact of lockdown on restraining covid-19 cases and the blow it gave to the small cap stock markets. We have proposed a bi-fold model in this study where in the first section we have estimated the growth of covid-19 cases under lockdown and no lockdown scenario and in the second stage we have proposed a hybrid genetic algorithm based bi-directional LSTM architecture which will predict the outcome of stock prices. Through the model evaluation metrics we can clearly see the performance of our proposed model is superior. Further, we have assessed the relative impact of lockdown on return prices along with that we saw a negative correlation among the said variables in our study, thus reaching to our concluding remark that lockdown have heavily affected the stock return, but on the other hand we also saw that if lockdown haven't been imposed then the death toll could be sky high and apparently looking good stock market would be crashed by now.

References

[1] Jha, V., Dinesh, T. A., & Nair, P. (2020). Are we Ready for Controlling Community Transmission of COVID 19 in India?. *Epidemiology International (E-ISSN: 2455- 7048)*, *5*(1), 10-13.

[2] Mittal, S. *An Exploratory Data Analysis of COVID-19 in India*. Retrieved from https://www.researchgate.net/publication/340965511_An_Exploratory_ Data_Analysis_of _COVID-19_in_India

[3] Arti, M. K., & Bhatnagar, K. Modeling and Predictions for COVID 19 Spread in India. *ResearchGate, DOI: DOI*, *10*.

[4] Roy, S. (2020). Spread of COVID-19 in India: A Simple Algebraic Study. *Available at SSRN 3597973*.

[5] Ghosh, P., Ghosh, R., & Chakraborty, B. (2020). COVID-19 in India: State-wise Analysis and Prediction. *medRxiv*.

[6] El Deeba, O., & Jalloulc, M. (2020). The Dynamics of COVID-19 spread in Lebanon. *arXiv*, arXiv-2005.

[7] Gopal, R., Chandrasekar, V. K., & Lakshmanan, M. (2020). Dynamical modelling and analysis of COVID-19 in India. *arXiv preprint arXiv: 2005.08255*.

[8] Roy, S., & Roy Bhattacharya, K. (2020). Spread of COVID-19 in India: A Mathematical Model. *Available at SSRN 3587212*.

[9] Sharma, V. K., & Nigam, U. (2020). Modelling of Covid-19 cases in India using Regression and Time Series models. *medRxiv*.

[10] Gupta, S., Raghuwanshi, G. S., & Chanda, A. (2020). Effect of weather on COVID-19 spread in the US: A prediction model for India in 2020. *Science of The Total Environment*, 138860.

[11] Singh, B. P., & Singh, G. (2020). Modeling Tempo of COVID-19 Pandemic in India and Significance of Lockdown. *medRxiv*.

[12] Sharma, V. K., & Nigam, U. (2020). Modeling and Forecasting for Covid-19 growth curve in India. *medRxiv*.

[13] Gupta, S. (2020). Epidemic parameters for COVID-19 in several regions of India. *arXiv   preprint arXiv:2005.08499*.

[14] Shekhar, H. (2020). Prediction of Spreads of COVID-19 in India from Current Trend. *medRxiv*.

[15] Kermack, W. O., & McKendrick, A. G. (1927). A contribution to the mathematical theory of epidemics. *Proceedings of the royal society of london. Series A, Containing papers of a mathematical and physical character*, 115(772), 700-721.

[16] Chatterjee, Ahan & Mukherjee, Sovik. (2020). The Impact of Lockdown on GDP Growth & COVID-19 Spread: Insights from a Mathematical Simulation Exercise for India. (ISBN: 978-81-947149-0-3)

EMPATHY AND SYMPATHY IN SYNC WITH TECHNOLOGY DURING THE COVID-19 PANDEMIC – FACILITATING THE LINGUISTIC DEVELOPMENT IN UNDERGRADUATE STUDENTS

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Abstract: *In times of crisis, it is paramount that higher education institutions build a community of shared values to keep the leverage in their hands. Ever since the outbreak of the Covid-19 pandemic, the rapid adoption of the proper technologies worldwide has become a sine qua non for online education. Professors (the organizers of classes and meetings) and their students (the guests) have embraced connectedness and change in a sustainable manner. The paper highlights the benefits of using innovative ubiquitous tools for online learning, discusses the challenges faced by language professors during the pandemic and evaluates roughly, how close or how far we are from implementing a unitary and effective system of online language education in Romania. In addition, it places empathy & sympathy at the core of online teaching and presents strategies that hone professors' virtual teaching skills to facilitate the linguistic development in undergraduate students.*

Keywords: *pandemic, empathy, sympathy, technology, connectedness, linguistic development*

1. Introduction

In today's times of crisis, ICT is used in education and training globally and has become a facilitator of connectedness between language educators and students. However, there are gaps in digital skills and learning resources across Europe as shown by the public consultation launched by the European Commission. More than half of the interviewees had not used distance and online learning before the pandemic while half of them want to achieve more through relevant and user-friendly online learning resources.

Language teachers need to have digital skills to meet the challenges of the information age. At present, at the end of initial training, teachers have a certain level of digital skills linked to their curricula and their informal and non-formal education. On the other hand, many language educators completed their initial

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education long ago, when many tools and information technologies were not available. At the same time, the field of ICT is very dynamic, the rate of development of new tools and opportunities is growing exponentially, and the range and complexity of skills needed to be a language teacher in the 21st century is so great that it is unlikely a teacher will possess them fully.

It is imperative that teachers grab professional development opportunities to become familiar with the new trends in the 21st-century educational technology and to acquire a new set of skills. Moreover, educational transformation should focus "on nine dimensions of practice: roles, relationships, curriculum, discipline, theoretical stance, motivation, focus, perspective and stance" (Twining, 2010). Modern teachers need to be flexible and able to adapt to new critical contexts. The models of professional development (see Figure 1) have been tailored to support the integration of ICT technologies in the teaching practice. Professional development sessions for digital education aim to make language teachers apply their knowledge of the subject matter in a synchronous or asynchronous approach. Furthermore, language teachers need to test whether a synchronous event is essential in their work, how to plan for active learning and participation and how to overcome the barriers caused by this approach.

Figure 1. Key models of Professional Development in the Digital Age (Adapted from teachhub.com)

2. Using the proper video conferencing software solution to benefit various learning styles

Throughout this year, Romania ranked between third and fifth place in the top of Internet speed globally. The pandemic has not affected the speed of the Internet in our country too much, according to Speedtest data. More precisely, in January 2020, Romania ranked in the 4th place, with 148.98 Mbps, in February 2020, it ranked in the 3rd place, with 155.78 Mbps, in March 2020, it ranked in the 3rd place, with 151.55 Mbps and in April 2020, it ranked in the 5th place, with 151.87 Mbps. However, in March, the month in which quarantine began and people worked harder from home and children went to online school, there was an increase in latency and interference compared to the previous month (Speedtest data, 2020). Despite this great advantage for digital education, many public schools in rural areas could not provide the proper devices to students to be able to attend online classes and they could not catch up with colleagues who study in urban areas.

In this extraordinary period, for other academics, teaching online has been a partnership between them and their students and a driver of research outputs concerning the benefits and drawbacks of digital education in a global pandemic. It is widely acknowledged that interactive teaching and learning of a foreign language is "based on the adoption of technologies such as mobile devices, augmented reality, Web 2.0, and so on." (Twining et alii., 2013). The application of ICT in language learning has become a norm around the world. Motivated students who attend online classes will adapt more easily to unforeseen situations. However, a recent study found that "among the elements that are lost in online classes, the most striking is the richness of the non-verbal cues." (Mărginean, 2020:118). Our institution was prepared to make ICT integral to the work of teachers and learners due to the outbreak of the pandemic therefore it moved its classes and lectures on Microsoft Teams. At the pandemic outbreak, young teachers were apprehensive and did their best to revamp how they deliver curriculum while older teachers had to overcome the fear to embrace technology to teach remotely. Luckily, the institutional support played an important role in this regard by offering training sessions and guides for online teaching and online examination.

Even if we were connected – language teachers and students – we had to learn to adapt and adjust. We thought it would be easier because we use the proper tools and our students are digital natives (Prensky, 2001). These youngsters have spent their entire lives surrounded by computers, video games, digital music, video cameras, mobile phones and any other tools from the digital age. So digital natives see the Internet as interaction and participation and not as a passive or one-way form of communication and meet frequently and constantly, getting to know each other and developing relationships, even if they have never met face-to-face. They prefer to connect with others through text, chat, Facebook, online games, etc. Most importantly, they solve problems intuitively, engaging in quick trial-error actions, to discover things through action, experiments and interaction, rather than through

reflection, to receive information quickly and simultaneously through different multimedia sources, parallel information processing, multiple tasks and continuous task change, and to interact with pictures, graphics, sounds and videos before writing texts (Prensky, 2001).

Surprisingly, while collaborating with digital natives, we learned that it is more challenging to teach 1st year undergraduates than 2nd or 3rd year undergraduates. The main reasons for 1st year students derive from the fact they have been part of a mandatory system focused on face-to-face education. In addition, their impossibility, due to pandemic restrictions, to connect with their teacher and colleagues in face-to-face classes to reach a certain level of comfort, shyness, fear to turn on the camera during presentations, online misbehavior and poor Internet connection have hindered their adaptation to online learning. Other colleagues had to adjust to students enrolled in distant programs, who have a digital immigrant behavior. Digital immigrants think of the Internet in passive terms as a virtual world that is not part of real life, as an environment that helps them identify what to read, review, or learn. They like written instructions, with clear steps to follow and a logical and linear model of discovery. Furthermore, they prefer to read texts instead of browsing material in audio or video format. Thus learning online is a necessity and often an inevitable chore for them (Prensky, 2001).

 In the table below we present the components and benefits of the English Class organized on Microsoft Teams.

Table 1. Components and benefits of the English class on Microsoft Teams

Video – students can see the teacher and teachers can see each participant in the meeting
Audio – teachers can hear each participant and vice versa, the teacher can assign students to groups, different groups can meet and collaborate simultaneously and the teacher can move from group to group, join their discussion and monitor their progress
Text chat – students can ask and answer questions, do translations, teachers reply to their questions, check the translations (see Figure 2), correct students' mistakes, explain to them the new vocabulary or grammar rules and share links with multiple choice questions for vocabulary and grammar practice
Posts – students can post their queries and questions because they might need further clarification of the topic debated in class, the examination procedure, the elaboration of projects, deadlines for project submission, etc.
Screen sharing – it is very useful for lecture delivery with slides, students' project presentation, the use of visuals and educational videos to ensure the understanding of grammar and English terminology for a specific technological process, product descriptions, business scenarios, etc.
Sharing and uploading files – teachers can upload files for class activities: reading texts and reading comprehension exercises, mistake finding exercises, etc. and students can upload their projects, homework, for or against essays and case-study written analysis.
Class Materials – students can review all the materials used in class and the students who could not attend the meetings can study the materials to catch up with their colleagues
Recording – the teacher is permitted to record the class but always by asking for consent to record a conversation: notifying the students of the intent to record, getting the consent off-the-record, starting the recording and ultimately asking the students to confirm on the record that they consent to the recording.

Whiteboard – it is catchy because it allows participants to write together the missing letters in business words and words belonging to the same family on a shared digital canvas
Class Notebook – OneNote Class Notebook was integrated into Teams to provide a workspace for every student, a content library for handouts and collaboration space for classes and other creative activities for language learning and to assist teachers to quickly review student work and be more efficient with their class notebooks.
Assignments – language teachers can create assignments within the Teams class
Grades – language teachers can view assignments at a glance as well as track student progress in the Grades tab.

It is increasingly clear that our mental health is linked to social connectedness. In an online language class both teacher and students can foster social connectedness in several ways. For example, an open and a positive teacher confers social connection among students based on intensive communication and collaboration. Even in this period of social and economic instability, there are teachers who encourage students to stay safe and see the move into digital education as an opportunity for sharing and collaboration. Through seemingly minor but very significant actions to create a close relationship based on trust, openness and honest communication, caring teachers see and are aware of students' needs and the technological world in which they live as adults, can increases openness, creativity and harmony within the team.

Figure 2. Translation activity in the Meeting chat

The major attribute of the language teacher is to be well organized. Organizational skills are at the core of digital education since they encompass a set of abilities that

help a language teacher adopt the proper technology, plan and prioritize. This process ensures a smooth teaching and an enjoyable experience for the members of a virtual team who are encouraged by the organizer (the language teacher) to participate actively in decision-making and send their feedback instantly. Even when problems arise, the organizer and his/her team will do their best to overcome barriers together and achieve teaching and learning results consistently. An organized teacher designs a well-structured lesson plan reducing the chance of developing poor learning habits such as miscommunication, inefficiency and procrastination.

Synchronous language teaching contributes to the improvement of students' language skills because conversation takes place in real time, students are encouraged to ask questions and teachers can gauge students' understanding straight away. When outlining the online class objectives, any language teacher should consider that second language learners have each of these learning styles as preferential (Reid, 1995: 205-207):
• *The visual style*: students can learn well by reading either in books or on the blackboard. They remember and understand better the information and instructions if you read them. They do not need as much oral explanation as an auditory student, and they can often learn only with a book. They need to take notes of the oral explanations to remember the information.
• *The auditory style*: students learn better through oral explanations. They can remember the information by reading aloud. It benefits them to listen to audios, debates and conversations with the teacher and the classmates.
• *The kinesthetic style*: students learn better if they are physically involved in classroom experiences. They remember the information well when they participate actively in activities and roleplaying games. It benefits them to have different types of stimuli: audio combined with an activity.
• *The tactile style*: students learn better, when they have the opportunity to do practical activities (experiments in a laboratory, build models, etc.). Participating in activities and taking notes can be beneficial to understand the new information and remember it.
• *The group style*: students learn more easily when working with other classmates. They like group interaction and remember information better when working with two or three colleagues. The stimulation they get from group work helps them learn and understand new information.
• *The individual style*: students understand the new material, remember it and progress better when working alone.
Given the pandemic context and the focus on digital education, we can add another relevant style to the list – *the accommodation style* when students accept and understand the transition from face to face education to digital education. They feel investment and ownership and become more engaged in this transition (through connectedness) with the organizing teacher.

We should note that language teachers' andragogy in tandem with digital skills lead to effective organization of the class and proper accommodation of guests (learners) to the digital learning environment through constant dialogue, sympathy and empathy, mainly targeted at 1st year students. For example, by asking them about how they are feeling, what good online learning experiences they have had and if they want to collaborate with us (the teachers) during the transition, we can work together fruitfully.

Using an institution-supported video-conferencing system such as Microsoft Teams from the desktop made the transition from face to face to online easier as we had a certain level of direct interaction with the students and direct audio and video communication due to a small number of students in a meeting (below 30).

Many factors influence the success of online language learning such as language skills, motivation, personality, age, learning styles and learning strategies. Regardless of the way of learning, in the classroom, "face to face" or on Microsoft Teams, in virtual classes, these factors are paramount as they help learners broaden their knowledge. Teaching experience and especially teaching online in a pandemic have shown us that each student has a preferred way of presenting, processing and acquiring information. Based on the preferences and the learning style, students implement various learning strategies with a hands-on technology approach. From our standpoint, online language classes reinforce teachers' digital competences and students' ability to reshape their learning style, be it auditory, visual or practical. Microsoft Teams includes multiple options and achieves a balanced mix between visual learning (video, virtual background, multimedia, nonverbal feedback - all posted by the teacher in real time), auditory learning (videos, audio) and kinesthetic learning (practical activities can be done and shared directly and the whiteboard can be used simultaneously with the teacher and the other colleagues in the group).

This period has triggered new feelings which sometimes made teachers and students vulnerable alike. However, we managed to find solutions, to reinvent ourselves and to adapt to an online collaborative environment. Even if the continuation of online teaching is viewed with fear and skepticism regarding the impact of online teaching over a long period, we could say that we have to accept we are all part of the new normal when we look at the context through global lens. These days, patience, empathy and sympathy should be the prevalent traits of human behavior.

Therefore, learner support should focus on forms of assistance to learners beyond the delivery of content, skills development, or formal assessment (Bates, 2019). I would like to pinpoint why empathy and sympathy are essential elements of an effective online learning environment in this pandemic, and how they can be integrated in the main sub-components of learner support. I use the term

pedagogical empathy & sympathy to cover the situations when language teachers respond to learners' difficulties, including:
• helping students to interact in an expanded warming-up;
• helping shy students to get involved in class activities;
• dedicating time to praise their contribution with laudatory remarks;
• helping students to integrate first in a small group and later on in a large group;

Not long ago I received this email from a 1st year student:

"*Good evening! Sorry for bothering you, I was informed that the activity in class is also scored. I am a very nervous person and I tremble and get lost when I have to speak in front of many people. I wanted to get involved in the seminar many times, only I was too ashamed and afraid to do it. I just want to let you know because when you invite us to express our opinions, I will be too scared to interfere, but when I am required to answer, I will answer. Thank you for your understanding!*"

After analyzing this particular case and after learning that my student lives in an orphanage, I considered it was appropriate for me to adjust to her needs based on her confession in the email. I did my best to provide her the necessary support to be active during the class through constant encouragement to read text, to pronounce unknown words, to ask her colleagues questions related to the topic and to reply to her colleagues' questions.

All students are unique. Getting to know students whom I have never met face-to-face requires an expanded warming-up as it is a very useful starting point for building strong relationships. It is ideal to identify their concerns then settle together an adjustment plan to ensure an effective learning environment for their needs. By following the principles of effective communication, responsiveness, active listening and ethics, we could empathize and sympathize with the students' condition and managed to build trust and rapport. In an online class, it is difficult to understand how students feel but it is highly recommended by experts to ask them open-ended questions. Vulnerable learners reacted differently than confident learners. They expressed their worries and needs in rambling sentences while confident learners provided accurate and insightful answers. For example, I could elicit information about their emotional state, by simply asking, "Is there something that's been troubling you?" and by listening carefully to students' words and pitch. It has been equally important for me to respect their feelings and point of view by confirming what they have told me and validating their feelings.

3. Online pedagogical empathy & sympathy through Microsoft Teams

In this section, I analyze how students perceive remote learner support and online pedagogical empathy & sympathy. I checked this by composing questions related to the observations above and by asking 50 undergraduate learners to complete a short questionnaire with only a Yes or No to each question. The questionnaire was sent by email to 1st year undergraduate students from the School of Computer science for Business Management. We see this questionnaire as a surface exploration, more precisely as a starting point for an in depth analysis, which will be included in a project proposal.

a. Has the language teacher provided good learner support remotely? (Yes/No)

b. Do you feel like you are part of an empathetic & sympathetic online learning environment? (Yes/No)

c. Has student or teacher ethical misbehavior occurred in the online English class? (Yes/No)

d. Would you attend a face-to-face class knowing the risks of contracting Covid-19? (Yes/No)

Out of the 50 students, 1 student didn't complete the questionnaire, 24 students answered Yes to the first question, 12 students answered Yes to the second question, 5 students answered Yes to the third question and 4 students answered Yes to the fourth question. The results are shown by the table and chart below:

Table 2. Students' answers for the analysis of remote learner support

	Number of students saying Yes	Percentages of students saying Yes
Question a	24	58%
Question b	12	24%
Question c	5	10%
Question d	4	8%

The current learning environment respects the state regulations enforced to diminish the spread of the Covid-19. Students must continue to learn and it is up to us to create conditions for practice within an environment that favors second language acquisition. Moreover, even if each class is conducted with empathy and sympathy for students' various conditions (e.g. poor internet connection, nervousness, delays in joining the team, health problems, lack of academic skill, etc.), emotional, technical and institutional barriers to online teaching and learning exist. For example, a barrier that causes lamentation on students' side is the preservation of the traditional teaching slot. Measures to diminish the teaching slot and increase the teach-load for online education have not been discussed although researchers argue that the proper teaching slot for online education is less than one hour to keep the students focused on tasks.

Microsoft teams is my favorite tool for my entire remote teaching. Its collaboration communication and translation tools are easily accessible for a collaborative learning environment, which fits into this pandemic context. However, even if education in Romania is based mainly on face-to-face education, language teachers should take advantage of this online experience and should focus more on adopting cutting-edge and user-friendly tools to ensure an effective learner support for developing soft skills that meet the actual requirements of employers.

Analysis of remote learner support
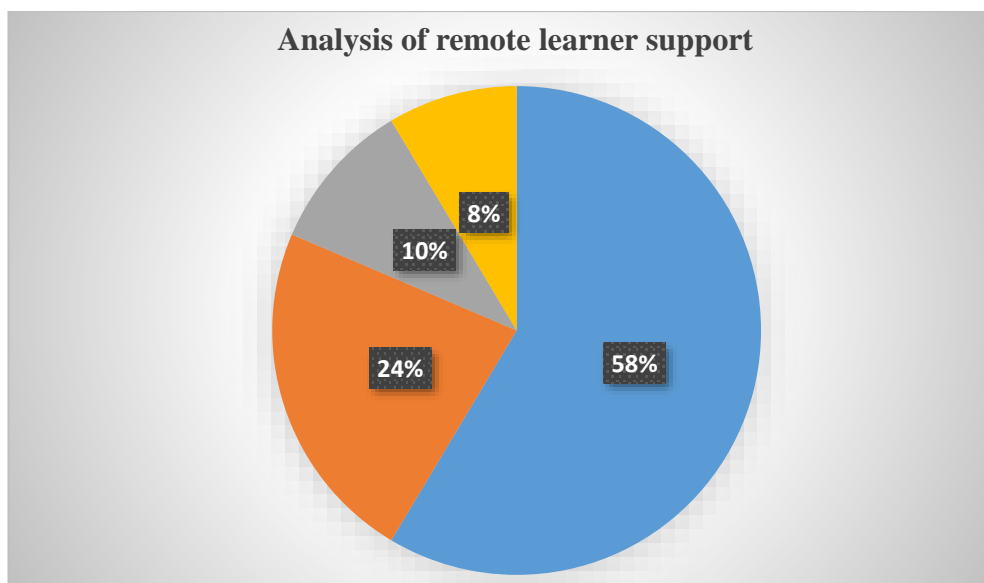
4. Conclusions

The experience of organizing meetings on Microsoft Teams has made us realize that behind the social behavior associated with the use of technology, in fact, there are also factors, which help learners to adapt online such as their relationship with family, teachers, colleagues, and with their digital selves in this moment of global uncertainty.

The need for a curriculum based on state-of-the-art technologies, such as interactive whiteboards, 3D / VR glasses and multiple online resources, in order to create lessons that are as engaging and interactive as possible, is imperative. This covers all learning styles and uses various teaching and learning strategies, precisely to meet the needs of all students, regardless of their prevalent learning style. Not many language teachers apply a multi-sensory approach because it involves a sustained effort to collect resources and educational materials appropriate to each learning style.

Finally yet importantly, each foreign language department within universities must dedicate time to identify the learning styles specific to each student to place them in a compatible group in terms of age, level of English and learning style. In this way, teachers will apply a multi-modal approach to expose their students to English in a way that is best suited to their future job role; thus, second language acquisition will unfold naturally and effectively.

References

[1] Bates, A.W. (2019). *Teaching in a Digital Age – Second Edition*. Vancouver, B.C.: Tony Bates Associates Ltd. Retrieved from https://pressbooks.bccampus.ca/teachinginadigitalagev2/

[2] Mărginean Alexandra. (2020). *Empirical Aspects in the Psychology of Online Teaching of Foreign Languages,* Journal of Information Systems & Operations Management (JISOM), vol. 14, no. 1, pp. 107-120, ISSN: 1843-471, Editura Universitară, Bucharest;

[3] Prensky, M. (2001), "Digital Natives, Digital Immigrants Part 1", *On the Horizon*, Vol.9 No. 5, pp. 1-6. https://doi.org/10.1108/10748120110424816;

[4] Reid Joy. (1965). *Learning Styles in the ESL/EFL Classroom*, Heinle & Heinle;

[5] Speedtest Data (2020). *Ce viteză de internet are România în 2020 şi ce s-a schimbat de la începutul anului*, playtech.ro

[6] Twining, P. et ali. (2013). "Moving education into the digital age: the contribution of teachers' professional development", *Journal of Computer Assisted Learning*, Wiley

[7] Twining, P. (2010). When educational worlds collide. In K. Sheehy, R. Ferguson, & G. Clough (Eds.), Virtual worlds: Controversies at the frontier of education (Education in a competitive and globalising world) (pp. 125– 142). New York, NY: Nova Science Publishers;

Electronic sources

https://ec.europa.eu/education/education-in-the-eu/digital-education-action-plan_en

https://playtech.ro/2020/viteza-internet-romania-2020/

teachhub.com

AN EFFICIENT SOLUTION FOR PEOPLE DETECTION, TRACKING AND COUNTING USING CONVOLUTIONAL NEURAL NETWORKS

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Abstract: *The number of unique persons walking near a shop or inside a mall is relevant since it can indicate the possible extension margin of a certain business. Also, being able to extract statistics regarding gender, age group and so on, can offer key insights regarding how to better manage and stock a business. In this paper we present a system which detects, tracks and counts the number of people in a video stream. The results obtained can be visualised in a GUI interface which allows for customizing multiple visualization tools. We use YOLOv3, a Convolutional Neural Network model, for object detection and Deep SORT for tracking. We describe how the system works on different hardware architectures: on a server with two high-end GPUs and on various edge devices, such as Raspberry Pi 3, Raspberry Pi 4 and NVidia Jetson TX2.*

Keywords: *People flow analysis, CNN, Object Detection, Object Tracking, Computer Vision, Deep Learning*

1. Introduction

In the recent years, the rapid growth of the Computer Vision field made it possible for the video camera surveillance process to be semi-automated or fully automated, instead of a person manually reviewing the stream. This is possible thanks to great leaps forward in solutions for visual problems, especially Object Detection and Object Tracking. The models used for such problems were initially heuristic models or simple Artificial Neural Networks using manually extracted features from images as input. In the last decade, the approach has shifted, being centred around Convolutional Neural Networks (CNNs). The new architectures coupled with significant improvements in computational power of the hardware, boasting high-end GPUs, has enabled models to achieve great speed and performance. Thus, they can be used in the real world with success, not only in heavily controlled environments.

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There are many scenarios where the ability to extract relevant information from video streams can be very useful for increasing profit, increasing security, better knowledge of a business and so on. Shopping malls can benefit from such a system, which can offer information regarding the total number of unique customers and some statistics such as gender, age group, height and weight distributions. All these data can be used by the shops to have relevant stocks and increase their profit. Also, such a system can be extended for security reasons. It could detect visual anomalies in crowded place, such as a person falling on the subway lines, violent behaviour in crowds, luggage left unattended and so on.

Thus, the advancements in Computer Vision

2. Related work

2.1. Convolutional Neural Networks

CNNs are a class of Neural Networks which have the distinct features where the neurons are displayed in a multidimensional array fashion, each neuron receiving input from a certain window of neurons from the previous layer, in contrast with the fully connected layers where each neuron in a layer is connected with each neuron from the previous layer. Also, the weights for the connections between a neuron and the neurons in the previous layer are shared, acting as a filter. Usually, between convolutional layers there are pooling layers which reduce the dimensions of the data.

Despite human performance in Object Detection and Tracking, it is significantly harder to explain why an object belongs to a certain class or to generate a mathematical description of an object. Thus, instead of manually extracting features from images, the automatic feature extraction capability of CNNs enables it to learn representations of objects, simply by analysing a big number of labelled images. This, correlated with the capability of processing whole images as they are and the shared weights, make CNNs the go to solution for image processing.

Even though the concept of CNN existed before, it started to dominate the Computer Vision field since 2012, when AlexNet [1] won the ImageNet Large Scale Visual Recognition Competition by a large margin, using a CNN architecture. Since then, there has been exponential growth of CNN models, offering increasingly faster and more performant solutions for processing images and video streams.

2.2 Object detection

Object Detection is a Computer Vision problem which requires identifying multiple objects in an image, localizing and classifying them. Also, it is important to be able to distinguishing between multiple objects belonging to the same class. Thus, it is a central problem when processing images and video streams.

Early approaches for Object Detection implied manually extracting features from images and then using simple classifiers, while modern approaches use CNNs.

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One modern approach is extracting regions of interest from an image, which are the most likely candidates to contain a single dominant object. After these regions are identified, a classifier is run over each one of them. Region based Convolutional Neural Network (RCNN) [2], Fast RCNN [3], Faster RCNN [4] and Mask RCNN [5] represent successive iterations of this approach, each improving upon the performance and speed of the previous. The main disadvantage of this approach is the fact that a classifier is used for each region of interest, making inference thousands of times per image, which slows down significantly the speed of the model.

Another modern approach is to split an image into a grid of cells, each being responsible for a limited number of objects. Thus, the image is traversed a single time, which allows the models using this approach to be very fast. The YOLO (You Only Look Once) family is representative in this case, with the successive models YOLO [6], YOLO9000 [7], YOLOv3 [8], YOLOv4 [9]. These models are very fast, while keeping high performance at the same time. Also, there are a series of light versions of these models, generally known as Tiny YOLO [10], which can be used when high computational power is not available, such as in the case of edge devices.

Objects as Points

2.3 Object Tracking

Object Tracking represent a Computer Vision problem where it is necessary to identify if two objects in successive frames are one and the same object. There are two main classes of Object Tracking: Single Object Tracking and Multiple Objects Tracking. The first class requires tracking a single object through a video stream, representing the simple case. The second class has many more real world applications, but is significantly harder.

One approach to solve Object Tracking is to use the Euclidian distance between objects positions in successive frames and pairing the objects with the smallest distance, considering them to be the same object. This approach works well when tracking a single object, but when multiple objects are involved, it falls short, offering a high error rate, especially when the objects are clustered or occluded.

Simple Online and Realtime Tracking (SORT) [11] represents an improvement to this approach, by using a Kalman filter alongside the Euclidian distance, in order to predict the trajectory of objects, which will make it easier to track the objects.

A further improvement is presented in Deep SORT [12], where besides using the Euclidian distance and a Kalman filter, a deep metric is used for visual recognition. Thus, in order for an object to be considered the same in successive frames, it not only needs to be in the same vicinity and following roughly the projected trajectory, but it also must have similar appearances. This metric represents an

array with 128 values, learned by a CNN trained on a big dataset of pedestrians [13]. Thus, this array encodes some visual features of an object, and it will successfully identify the same object in successive frames if the detections are candidates (they are considered the same object by the Euclidian distance and the Kalman filter) and if the cosine distance between the projection of the two 128th dimensional points (the two feature arrays) on the unit hypersphere is smaller than an empirically identified threshold.

3. System overview

An end to end system which acquires frames from a video stream and identifies, tracks and counts the people has many real world applications, but can differ based on the exact use, the required performance, available hardware and budget. Thus, we explore two different approaches: server processing and edge processing, with a third approach being possible as a combination of the first two.

3.1 Server processing

Server processing represents the approach where the data acquisition and the processing are separate. Usually the latter is done on a server with high computational power available, thus enabling us to use the models with the highest performance, while being able to run at realtime speed (30 frames per second).

This approach allows for the best performance and speed, but has some drawbacks as well: it is significantly more expensive, it will have an overhead caused by the data transmission and will depend on a secure and fast connection to the data acquisition module.

Thus, in this context, we used YOLOv3 for object detection, filtering the objects detected such as it will detect only persons and for tracking, we used Deep SORT.

The server has two GTX 1080 Ti GPUs and 64GB of RAM and the data acquisition is realised by an IP camera, sending the video stream to the server via a wireless or wired connection.

3.2 Edge processing

Edge processing represents the approach where the video stream is processed on a small embedded device directly connected to the data acquisition module. Thus, it is a self-contained system which can be easily used anywhere. Another advantage is that it is nor relying on a fast and secure connection, the video stream being directly transmitted via cable. Also, it has significantly lower prices than the server approach. The biggest disadvantage consists of its lower computational power available, meaning that lighter models have to be used, which in turn represent a drop in performance.

Thus, for Object Detection, we use Tiny YOLOv3 and for Object Tracking we use Deep SORT.

As hardware, we used the following edge devices: Raspberry Pi 3, Raspberry Pi 4, Intel NCS, Intel NCS 2 and Nvidia Jetson TX2.

3.3 Central platform

After the data from the video streams is processed either by the server, edge devices or a hybrid approach, the results are sent to a web application offering a GUI interface. Thus, the results can be visualised and further processed by using multiple visualisation and formatting tools. In Figure 1 we present a chart showing the total number of people detected, which also has filters based on age or sex and the requested time period.

Figure 1 – Chart containing the total number of people detected. The bucket size is equal to one day.

In Figure 2, we present a pie chart which shows the distribution of people by age or sex. It is worth noting that the models that identify gender and age group are still work in progress, and the data regarding age and gender used in these charts is generated.

Figure 2 – Pie chart representing the distribution of people.

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4. Results

In this section we present a comparison between the results obtained on the dedicated server and the edge devices available.

Cojocea, Hornea & Rebedea [14] make a comparison between some edge devices and we extend this by adding some new devices, thus enriching the general overview. For our experiments we used the dataset provided by the Multi Object Tracking Challenge 2017 [15], which contains 14 videos with crowds of people, with durations of tens of seconds.

4.1 Object Detection

In Table 1 we present a comparison regarding performance and speed between the available edge devices and the dedicated server. We can observe that most edge devices are still lacking in speed, even though we used light models. But, it is worth noting that Nvidia Jetson TX2 is capable of running both light and deep models, the first in real time and the second at a reasonable speed of more than 3 frames per second. Also, when comparing the performance of the light and deep models, we can observer that the latter is twice as performant than the first, which can have an impact in how well the system will work.

Device	Model	Frames per second	mAP
Raspberry Pi 3	Tiny YOLOv3	0.33	29.8
Raspberry Pi 3 + Intel NCS	Tiny YOLOv3	2.90	
Raspberry Pi 4	Tiny YOLOv3	0.87	
Raspberry Pi 4 + Intel NCS2	Tiny YOLOv3	7.86	
Nvidia Jetson TX2	Tiny YOLOv3	37.8	29.8
	YOLOv3	3.1	53.2
Dedicated server	Tiny YOLOv3	343	29.8
	YOLOv3	47.44	53.2

Table 1 – Results for Object detection

4.2 Object Tracking

In Table 2 we present the results obtained for Object Tracking (we track only people), using multiple object tracking accuracy (MOTA) and multiple object tracking precision (MOTP) [16] as metrics. We can see a twofold difference in speed between SORT and Deep SORT algorithms across all three devices we used. It is worth noting that while Raspberry Pi 4 is still farm from realtime speed and the dedicated server surpasses this speed for both algorithms, Nvidia Jetson TX2 is on the verge of realtime performance. When talking about MOTA we see a twofold

difference in performance, which is not visible regarding the MOTP metric, where the results are tighter.

Device	Algorithm	FPS	MOTA	MOTP
Raspberry Pi 4	SORT	2.89	29.8	65.4
	Deep SORT	1.23	57.4	77.5
Nvidia Jetson TX2	SORT	24.78	29.8	65.4
	Deep SORT	11.69	57.4	77.5
Dedicated server	SORT	67.45	29.8	65.4
	Deep SORT	35.48	57.4	77.5

Table 2 – Results for object tracking

5. Conclusions

The system that we described in this paper is meant to be used in the real world in shopping malls, concerts and other crowded events, in order to extract relevant information regarding people. It is an ongoing discussion regarding the pros and cons of using server processing, edge processing or hybrid processing. The results presented in the previous section show that all approaches are possible from a technical point of view, with the afferent trade offs regarding performance and speed, flexibility, size and price. Also, we can see a great evolution of edge devices regarding computational power, which encourages us to consider the edge processing approach in the future, when such devices will be able to run deep models in realtime or near realtime.

References
[1] Krizhevsky, Alex, Ilya Sutskever, and Geoffrey E. Hinton. "Imagenet classification with deep convolutional neural networks." Advances in neural information processing systems. 2012.
[2] Girshick, Ross, et al. "Rich feature hierarchies for accurate object detection and semantic segmentation." Proceedings of the IEEE conference on computer vision and pattern recognition. 2014.
[3] Girshick, Ross. "Fast r-cnn." Proceedings of the IEEE international conference on computer vision. 2015.
[4] Girshick, Ross. "Fast r-cnn." Proceedings of the IEEE international conference on computer vision. 2015.

[5] He, Kaiming, et al. "Mask r-cnn." Proceedings of the IEEE international conference on computer vision. 2017.

[6] Redmon, Joseph, et al. "You only look once: Unified, real-time object detection." Proceedings of the IEEE conference on computer vision and pattern recognition. 2016.

[7] Redmon, Joseph, and Ali Farhadi. "YOLO9000: better, faster, stronger." Proceedings of the IEEE conference on computer vision and pattern recognition. 2017.

[8] Redmon, Joseph, and Ali Farhadi. "Yolov3: An incremental improvement." arXiv preprint arXiv:1804.02767 (2018).

[9] Bochkovskiy, Alexey, Chien-Yao Wang, and Hong-Yuan Mark Liao. "YOLOv4: Optimal Speed and Accuracy of Object Detection." arXiv preprint arXiv:2004.10934 (2020).

[10] Huang, Rachel, Jonathan Pedoeem, and Cuixian Chen. "YOLO-LITE: a real-time object detection algorithm optimized for non-GPU computers." 2018 IEEE International Conference on Big Data (Big Data). IEEE, 2018.

[11] Bewley, Alex, et al. "Simple online and realtime tracking." 2016 IEEE International Conference on Image Processing (ICIP). IEEE, 2016.

[12] Wojke, Nicolai, Alex Bewley, and Dietrich Paulus. "Simple online and realtime tracking with a deep association metric." 2017 IEEE international conference on image processing (ICIP). IEEE, 2017.

[13] Zheng, Liang, et al. "Mars: A video benchmark for large-scale person re-identification." European Conference on Computer Vision. Springer, Cham, 2016.

[14] Cojocea, Eduard, Stefan Hornea, and Traian Rebedea. "Balancing between centralized vs. edge processing in IoT platforms with applicability in advanced people flow analysis." 2019 18th RoEduNet Conference: Networking in Education and Research (RoEduNet). IEEE, 2019.

[15] Multiple Object Tracking Benchmark MOT17 homepage, https://motchallenge.net/data/MOT17/ , last accessed 2020/05/30

[16] Bernardin, Keni, and Rainer Stiefelhagen. "Evaluating multiple object tracking performance: the CLEAR MOT metrics." EURASIP Journal on Image and Video Processing 2008 (2008): 1-10.

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USING THE ENTERPRISE RESOURCES PLANNING SOFTWARE AS A SAAS IN THE DIGITAL ECONOMY - A CASE STUDY ON ODOO SOFTWARE

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Abstract: *In recent times the ability of a company to minimize waste and errors is increasingly important to maintain comfortable levels of market competitiveness. The article presents some elements about erp programs, in general, erp programs in the cloud environment (Software as a service). In the second part we made and described an application in Odoo software. The Odoo modules that were used and presented were: Accounting, Manufacturing and Sales.*

Key words: ERP, Odoo, database, digital economy, software

Introduction

ERP system let possible work in a unique database even if the company is a multinational with different locations and this aspect leads also with a reduction of costs. The primary goal of ERP systems is precisely to support this challenge to optimization. In fact an ERP system allows getting better decision-making and planning skills thanks to immediate access to all information and also to the ability to easily request and process company data

In deciding to purchase the software package in the market, the company will have to consider its knowledge and skills about the package to be purchased, so it is a good idea to attend to a course and thus find all the information about the ERP before buying it. It is not recommended for a company to buy the system without first having seen or heard the vendors that have already implemented it, because it is useful to have a feedback, where possible, the operation of the software in order to be able to understand its potential or any difficulties to understand if the organization is able to deal with them.

In choosing the software to be used, the company will have to consider the knowledge and skills of the staff, as they may need a series of interventions to adapt the package purchased with the system in use in the company. Also, the company must evaluate the different offers of suppliers in order to buy the product with the appropriate skills in areas of greatest need for the company. It is possible

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to purchase the modules necessary to cover the difficulties that the organization has. For this, the company searches outside that software that will allow implementing the modules that the organization requires in order to obtain a functioning ERP and get the implementation of the project decided. The purchase of the package will involve the need to perform some interventions resulting from the adaptation of this with the system in the organization, in order to modify it to make it work through the provision of interfaces.

In the choice of the software supplier, in addition to the evaluation of the supply of packages that it has, the company must also evaluate the service that this offers as a result of the implementation resulting from adaptations, updates or the possibility of adding new modules compared to those already adopted by the organization.

As in all decisions regarding the choice of a supplier, the person from the company who has the task to buy an ERP software will have to draw up a list of features or improvements that the company need to introduce in the system, contact the various suppliers in the market and request their offers and then proceed with the comparison and evaluation of these by choosing the supplier that in the quality/price ratio offers the best offer, considering with adequate attention the service they offer.

ERP can be considerate as a Software as a Service (Saas)

ERP software's help businesses to use systems that have integrated applications to manage and organize the different departments in a business also it allows businesses to automate back office functions which are related to human resources, technology and services.

An ERP software combines many different operations into one efficient software, database with a user interface. The different operations include sales and marketing, product planning, development and manufacturing. ERP systems are highly integrated with the software(s) the business is already using.

As technology advances ERP systems are becoming very critical and important to manage thousands of business of all industries and sizes. The ERP solutions have evolved and are now web-based applications the users can use remotely. ERP is like the glue which joins many computers together in an organization which allow all the departments to share information and processes with others through the entire organization. ERP simplifies the business processes because everyone can access the data at one central location. (figure 1)

The ERP systems are very carefully designed around one, defined data structure and schema that has a common database. It is ensured the information used across the organization is normalized, based on user experience and common definitions. The constructs are interconnected with the business processes across business departments connecting the people who use them and the systems.

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Figure 1. All departments connected via ERP

Rather than having several databases with disconnected spreadsheets, the ERP system brings all users from CEOS to clerks together by allowing them to create, store and use the same data which has or is going to go through common processes. With a secure and centralized data storage location everyone in the organization can be sure and confident that the data is up to date, correct and complete. (figure 2)

Figure 2. The ERP workflow processes

Software as a Service (SaaS) is the delivery model for ERP systems. The ERP software is delivered as a service to the cloud then it runs on a network of remote servers – not on the company's server. The cloud provider manages, patches and updates the software many times throughout the year, which makes it very cost efficient for the business as they do not have to get an expensive upgrade done every 5-10 years. This also reduces capital expenses (CapEx) and operational

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expenses (OpEx) as it eliminates the purchase of hardware, software and extra IT staff. The employees can focus on more valuable tasks such as growth and innovation. The business can invest the savings in new business opportunities and make sure that it is up to date with the most recent ERP.

The main benefit of the SaaS model is the software is up to date with latest functions and features. The cloud ERP providers regularly send updates to ensure all the ERP software's work efficiently. With access to new technologies and ERP software upgrades the business can improve with the evolving ERP software's.

Odoo - A Cloud ERP used as a Saas

Odoo is a Saas erp program that successfully uses the cloud environment to respond in a professional way to the needs of an organization. The odoo platform contains several applications, the user having the possibility to choose and add for a fee the necessary applications in his business activity. All user-selected modules communicate with each other, so no additional programs are required to integrate them into a single platform, giving the user the impression that they have a single integrated program that handles their business.
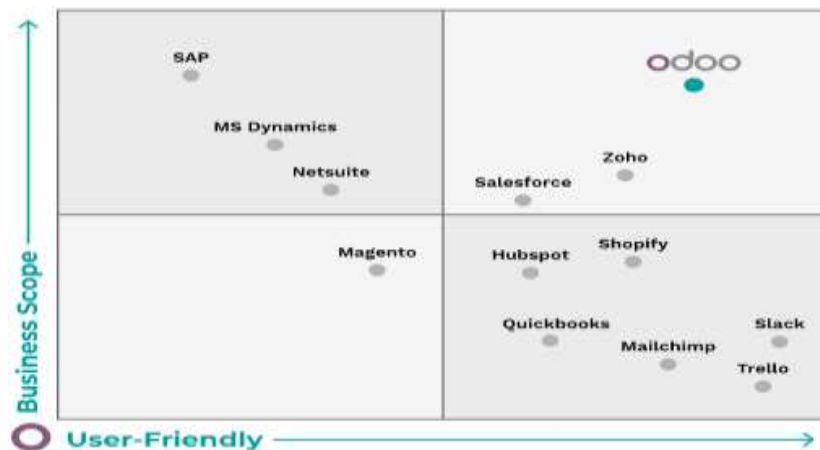

Figure 3. Odoo's place in the market

On the market of erp programs there are several applications that have different functionalities, depending on the real needs of users, as can be seen very well in Figure 3. If we look at the business purpose can be seen that SAP, MS Dynamics, Odoo and others respond best to this goal. But not all users are computer specialists. Thus, solution providers have sought to develop programs that are as intuitive as possible, so that they are as intuitive as possible and do not require prior knowledge. Such user-friendly programs are: Slack, Trello, Hubspot and others.

Not every time the user-friendly programs responded best to the real business requirements. So vendors began to develop programs that were as easy to use as possible, but to respond professionally to business flows. One such program that successfully combines business scope and user-friendliness at a high level is Odoo.

Figure 4. Few modules from Odoo Application

As we said above, Odoo is made up of modules, and the user can choose which modules to use initially, and then to purchase others as needed. We assume an application with the following modules (Figure 4): Discuss (application used for discussions with various entities - customer, suppliers, employees and others; Calendar (application used for better organization of activities in the current flow of activities); Contacts (stores information about all company contacts); CRM (Customer Relationship Management); Sales (application that deals strictly with the sales part of the company); Inventory (a strict stock record is kept); Manufacturing (production module); Accounting; Consolidation and Project (project management is performed).
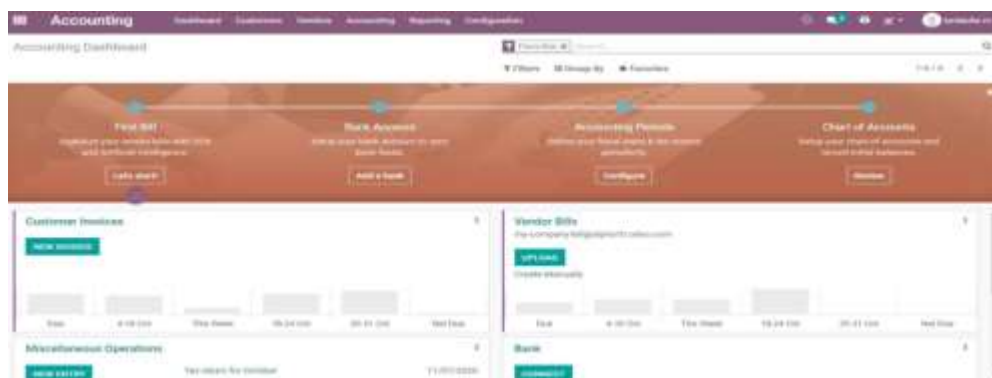

Figure 5. Accounting Module

The Accounting module keeps the accounting records of a company, making it indispensable for the activity of the economic agent that buys Odoo. When the user

enters this module he is asked for data about first bill, bank account, accounting periods, but also about chart of accounts (Figure 5). Also, data is taken from the other modules, such as: manufacturing, inventory, sales and others.

If you follow the menu in figure 5, you can enter in turn information about the invoice, bank account, accounting period or periods, but also about the chart of accounts.
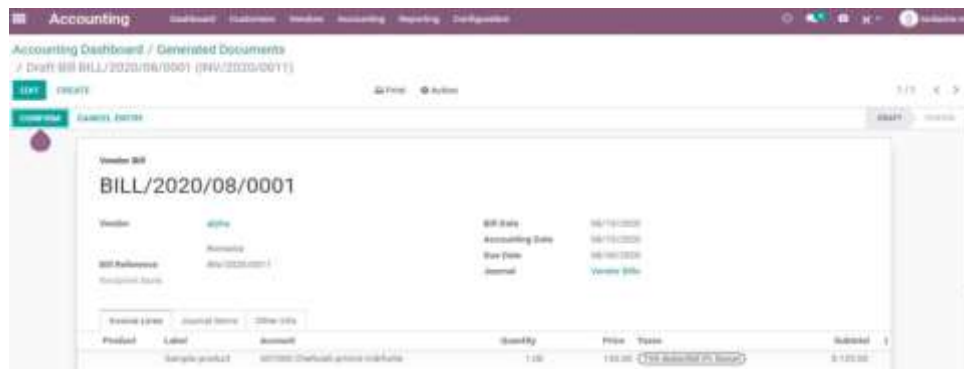

Figure 6. Generated bill from Accounting Module

After the invoice template type has been established and the document has been generated from the system, there is another button that confirms this invoice and saves it in the accounting (Figure 6). Thus, by pressing the Confirm button in figure 6, the payment of the respective invoice is further registered in the accounting.

Following the menu in figure 5, the user can create a bank account and set the accounting periods (figure 7).
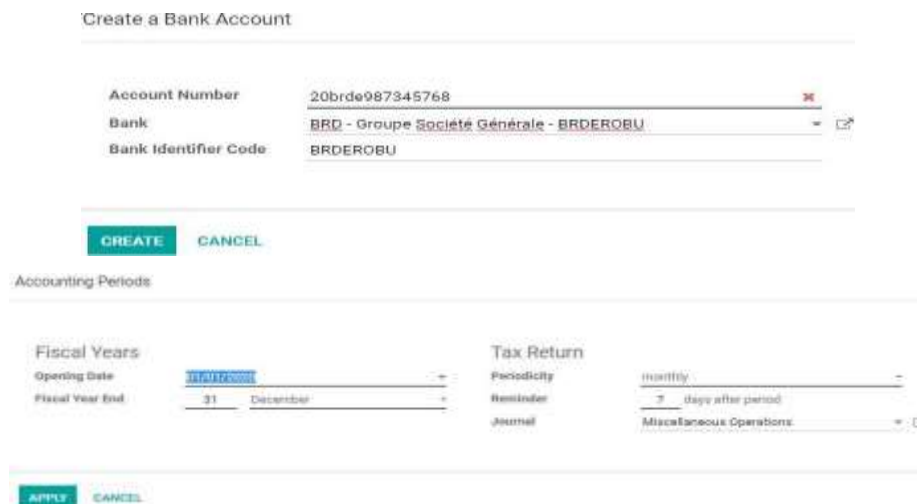

Figure 7. Create a Bank Account and Accounting Periods

Further payments from customers can be recorded in the accounting, invoices from suppliers can be uploaded and invoices can be further generated (figure 8).

Figure 8. Example of invoice generated in Accounting Module

The invoice can also be downloaded and kept in electronic format (Download button), but there is also the facility to be sent to the printer (Print button), as shown in figure 8.

The menu of this module consists of:

- Dashboard - keeps information about all accounting entries and exits
- Customers - menu containing information about: customers, products, follow-up reports, batch payments, credit memos and invoices.
- Vendors - menu containing information about: vendors, products of vendors, batch payments, payments, refunds and bills.
- Accounting - menu that provides information about: journal entries, other journals (sales, purchases, bank and cash, miscellaneous), ledgers (general ledger and partner ledger), management (automatic transfers, assets, deferred revenues, deferred expenses) and other actions like reconciliations and lock dates.
- Reporting menu contains some documents which are useful in company current activity, like: profit and loss, balance sheet, executive summary, cash flow statement, general ledger, trial balance, consolidated journals, tax report, journals audit, invoice analysis and depreciation schedule.

The Manufacturing module contains the menu:

- Operations which contains: manufacturing orders, unbuild orders and scrap
- Planning with run scheduler.
- Products which contain products and bill of materials
- Reporting where the user can see the manufacturing orders
- Settings where the user can choose another features for the software, like: work orders (Process operations at specific work centers), quality (Add quality checks to the work orders), the possibility to produce the residual products, subcontracting

(Subcontract the production of some products), lock the quantities to consume (Prevent manufacturing users to modify quantities to consume, unless a manager has unlocked the document), master production schedule (Plan manufacturing or purchase orders based on forecasts) and security lead time (Schedule manufacturing orders earlier to avoid delays).
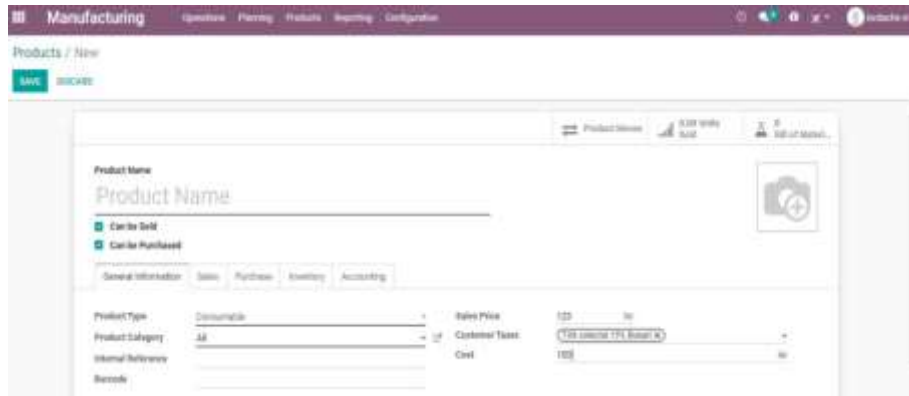

Figure 9. Create a product in Manufacturing module

In the Manufacturing Module, the company can create the products (figure 9) from its portfolio. For any product, the user should give information like:

  - general information as: product type, product category, barcode, sale price, customer taxes, unit cost and some internal references if it exists.

  - information about sales: invoicing policy (if the product is ordered or delivered quantities) and other sales description.

  - information about purchase, where the vendor taxes are established

  - information about inventory like the route of the certain product and logistics information (responsible, weight, volume and others). If the product has the manufacture route, the Odoo program presents a diagram with a report of all routes the product went.

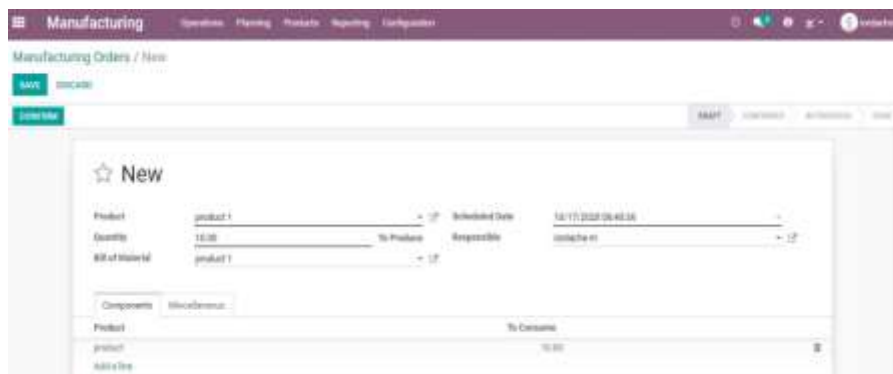 - information about the income and the expense accounts.

Figure 10. Define a new manufacturing order

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From the Operations menu, it can be defined the manufacturing order (figure 10). In this document must complete the product name, quantity, the components of the product and in the miscellaneous tab the operation type for the company. After defining, the order must be confirmed and also validated. In this way the user proceed to introduce all the orders.

From the Reporting menu the user can construct and see the needed report. There are a lot of criteria, as: backorder sequence, company (if there are more than one companies), components location, consumption, the number of created manufacturing orders for every person, deadline, end date, let/serial number, order point, priority, product location, responsible, start date, state of the order and others.

The Sales Module has the menu:

      - Orders: Quotations, Orders, Sales Teams, Customers

      - To Invoice: Orders to Invoice, Orders to Upsell

      - Products where are stored all the information about the products.

      - Reporting about sales

      - Configuration about sales teams and sales orders.

Before making any effective sale, a quotation is necessary to be made to the customers. The process of defining a quote in Odoo implies: setting the company`s data for documents header/footer, customizing the look of the quotations, choosing between electronic signature or online payments and, finally, sending the quotations (figure 11).
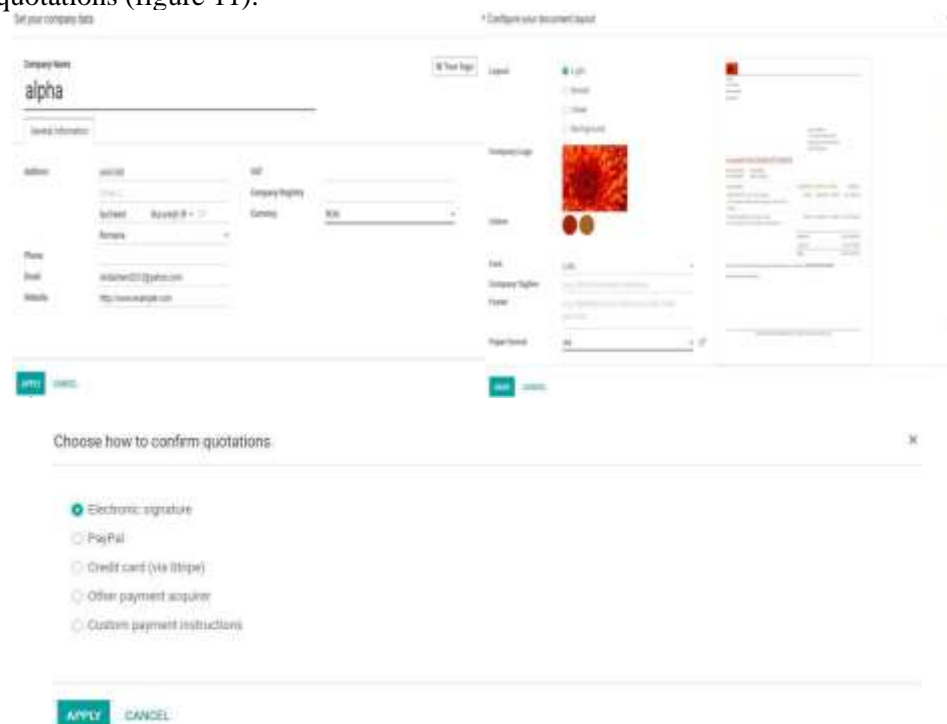

Figure 11. Collecting general data for the quotations

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After collecting all the information needed for the future quotations, Odoo offers the possibility to define some specific quotation (figure 12). In the quotation, the user has the possibility to complete with the information three tabs: order lines, optional products and other information. In the order lines tab the user will choose from the existing products of the company the product (or the products) for which the quotation is made. In optional products tab the user choose another products demanded by the client. Finally, in the other info, it is necessary to be specified information about sales, like: salesperson, sales team (if it exists), order signature, online payments (if the company allows such type of payment), delivery date and others.
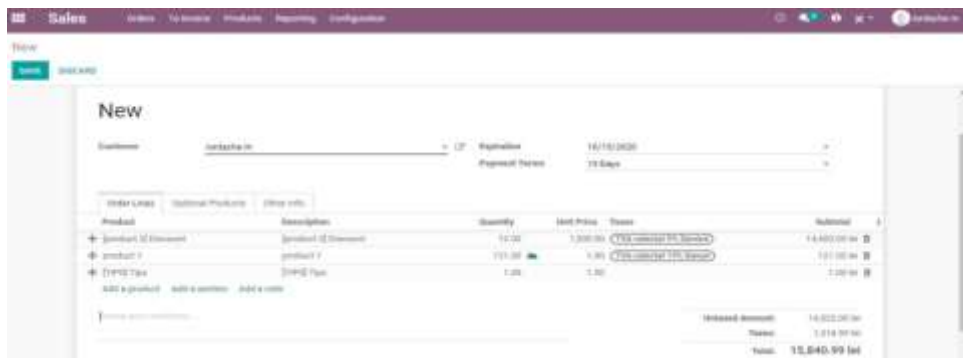

Figure 12. Define a quotation

After entering all the information needed for the quotations, the user click on save button and the quotation is done.

Further in the analysis, the Odoo program offers the possibility to create an invoice for the offer made (figure 13). If you click on the create invoice button, information regarding the invoice type is requested. There are three types of invoice predefined in Odoo: regular invoice, down payment (percentage) and down payment (fixed amount).
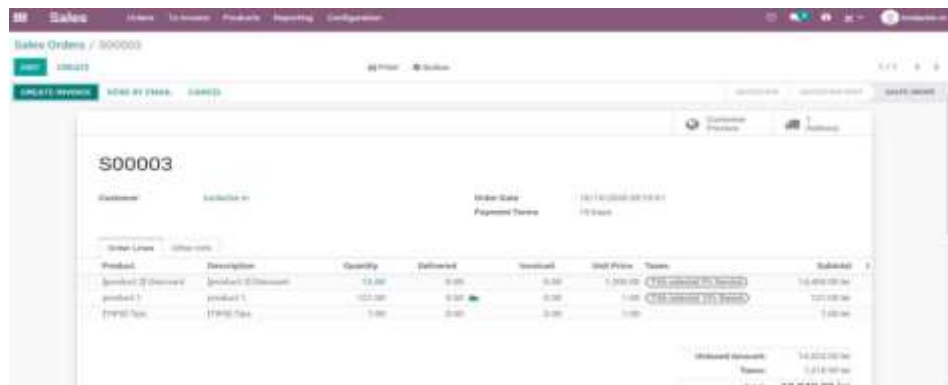

Figure 13. Creating an invoice for a quotation

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After all the steps have been taken to create a quotation and to create an invoice, after pressing the create invoice button in figure 13, the user is given the possibility to see a draft of the invoice made. After verifying the correctness of the information sent, we will proceed to the actual registration of the invoice in the accounting (figure 14).
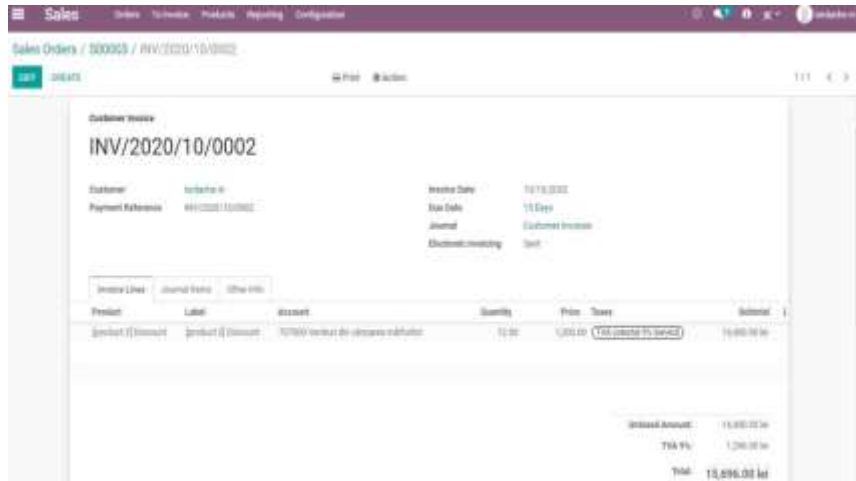

Figure 14. Example of invoice

It should be emphasized that in the business process not all quotations are transformed immediately or at a predetermined period of time into firm orders. Moreover, orders can be made without the need for a prior quotation, this being successfully implemented by the studied software.
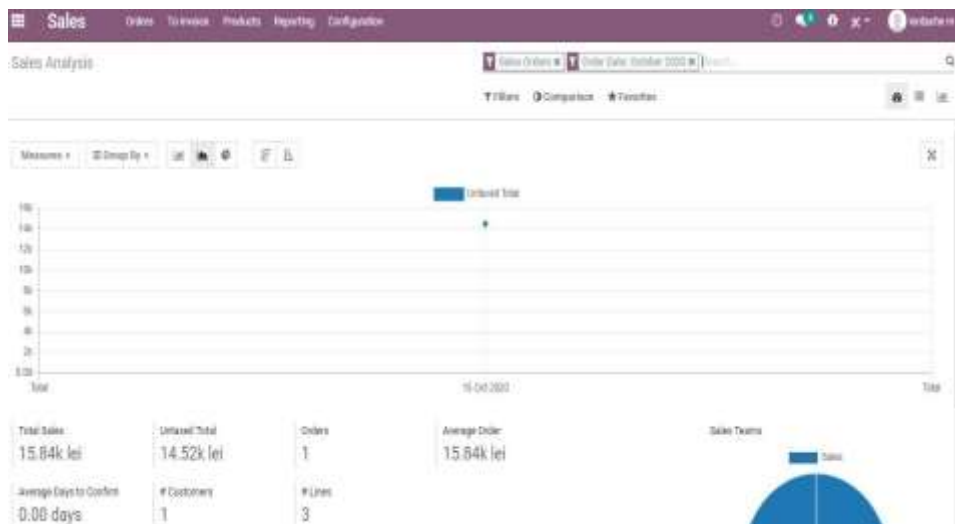

Figure 15. Sales Analysis

After quotations have been registered, respectively firm product orders, or at certain periods of time, the user can perform certain sales analyzes (Figure 15). From the Reporting menu, the Sales Analysis option provides an overview of the sales situation. Thus, information is provided about total sales, untaxed total, number of orders, average days to confirm the created quotation, number of customers, the total number of the lines (products), the average order, sales teams and other information very useful in the process of sell.

Conclusion

Today the implementation of an ERP system is fundamental for any large, medium or small company that wants to be competitive and develop its business in the best way.

The flexibility of the modular structure, the web based interfaces and the Cloud have made possible reducing the costs of the implementation of these systems. In this way even small and medium enterprises are enabled to approach to the world of ERP and increase the benefits from the advantages that these powerful implements offer even to smaller businesses.

The major contribution of business improvement systems is to changing the business culture and work habits. Having a single information system enhances employee engagement with and between businesses, because with ERP systems the focus is on tracking and finalizing processes.

Implementing a business management system is a serious investment that takes time and effort. The process is not easy, because it requires the company's work model to be optimized and consolidated - it takes time, and most of all, a desire and willingness to work. Every process reflected in the system needs to be refined; to consolidate good practices, to create a habit of work. These changes are inevitable in order to achieve effective implementation and return on investment.

References

[1] https://www.seniorsoftware.ro/en/erp/what-is-erp/
[2] https://www.youtube.com/watch?v=c9HfNg4a_Og
[3] https://www.youtube.com/watch?v=f0q2HFptRa4
[4] https://www.oracle.com/uk/applications/erp/what-is-erp.html
[5] https://www.ctnd.com/calculating-business-value-erp/
[6] https://www.investopedia.com/terms/e/erp.asp
[7] https://roboticsandautomationnews.com/2019/08/27/erp-automation-benefits-and-trends/25196/
[8] https://odoo.com

ONLINE LEARNING: A VIABLE COMPLEMENT TO THE TRADITIONAL PARADIGM OF EDUCATION

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Abstract: *The context of the most recent Coronavirus pandemic has forced universities all over the world to cancel all in-person classes and shift to the online, a step that many of the academic institutions have been toying with, but never had the courage to totally put into practice.*

The present study discusses the specific case of language teaching in an online format, focusing on the communicative aspect of language teaching, and highlighting its difficulties and the subsequent disadvantages. If CMC was in the past just a theoretical approach to teaching, it now becomes the reality and adaptation is the key aspect that both students and teachers need to learn.

The study tries to answer a couple of thorny questions related to how prepared we are for the shift, to clarify the background for the change in the mentality of foreign language teachers, and last but not least, to offer solutions for the best approach a teacher should have towards the new trend of online education.

Keywords: *Computer Mediated Communication, FLT, online teaching, synchronous versus asynchronous e-learning, coronavirus, Microsoft Teams, Zoom, Google Classroom.*

1. Introduction

After World Health Organization declared on March 11, 2020 that the outspread of the most recent Coronavirus turned into a pandemic, universities all over the world started shutting down, in the attempt to slow the spread. Mid-March found Romanian universities cancelling their in-person classes, in an effort to prevent COVID-19 from spreading to the academic population, and, thus, to local communities. All international conferences, exchange programs, Erasmus+ exchange programs were banned, students were sent back home, and it took a couple of weeks of uncertainty until specific online platforms were put into practice.

Among the most common communication platforms that are used in Romania during this period we can mention Zoom, Microsoft Teams and Google Classroom. Each of them has its advantages and disadvantages, particularly in the context of foreign language teaching, where interaction is the key element for improvement.

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Although the beginning was difficult both for the students and for the professors, who had to adjust their teaching methods, lectures and study materials, to attend webinars and ask for IT support in order to install and access the platforms, little by little things went to normal, and virtual classes completely replaced in-person ones.

The present study reviews literature with reference to synchronous and asynchronous e-learning, highlighting the importance of CMC (Computer Mediated Communication) and CALL (Computer Assisted Language Learning) as two important elements, which in a way help pave the path of the shift from in-person to online teaching of languages. Although online language teaching is not a new concept, and language schools all over the world have practiced it for many decades by now, some of them more successfully than others, professors have always been reluctant to acknowledging the efficiency and effectiveness of this type of teaching. And although online language examinations are not a new concept in the industry, we are still reluctant to using them, for fear they might affect our effectiveness as language teachers.

It is true that we, as teachers, are used to eye contact with the class, and there are situations when we develop a preference for one group or another, simply based on the empathy that we build with students at the beginning of the semester. But this whole concept of one-to-one interaction, face to face, involving stimulation from the teacher's part with the help of verbal or nonverbal communication will have to disappear, at least for a period. In this situation, we have to understand the background, rely on the present and innovate in the future, so that situations like the present one could become more bearable.

2. Social change – the trigger for online learning

The present disease outbreak was in fact the trigger for the new change in the old mentality regarding face to face classes, in real time, in a special environment, which is school. However, what we want to understand is how easy or how difficult it is to answer the following questions:

1. Are we, as language teachers, prepared for the online environment? Because generally speaking, online classes require special skills on virtual class conduct, information technology skills, sometimes special platforms, knowing how to use video conference platforms, share content, or respond to students' demands.
2. How should professors be prepared for such a life changing experience? Is an online webinar enough or should they be trained in one to one sessions?
3. Can we engage all students, or is it just a part of a class that will stay focused?
4. How easy or difficult is it for me, as a teacher, to keep focused in front of an empty screen?

All these questions stem from the need to become conscious of the challenges posed by online teaching/ learning and their proper answering will tell us how

prepared the community is for such an abrupt change. But when social distancing is called for as an immediate solution for the limitation of the disease spread, we need to merely take action and forget about the social or emotional feedback. Because school in general is a source of balance in learners' life, and the sense of engagement that the brainstorming sessions during the class, or the student-teacher, student-student dialog can produce, is extremely important for the overall development of individuals.

Higher education was prepared for this shift, even before we knew we were going to need it. Numerous conferences took place all over the world, piles of research books, articles, specialized journals have been published focusing on the importance, analyzing the theoretical backgrounds and the necessity of a change from face to face to virtual learning.

Due to technological developments, universities were able to invest in various technologies, increasing the amount of hardware and software that they made available to their staff and students, but the speed in technology was not able to keep the pace with the slow development of training programs in organizations, so teachers made the change at their own pace, with the amount of change they wanted or were able to digest, which was not enough.

According to specialists, there are a couple of factors that play an important role in the need for a shift towards online learning, as can be seen in the figure below. But unfortunately, none of them has ever thought that we will need the online as a unique solution for education during some tough medical times such as a pandemic.
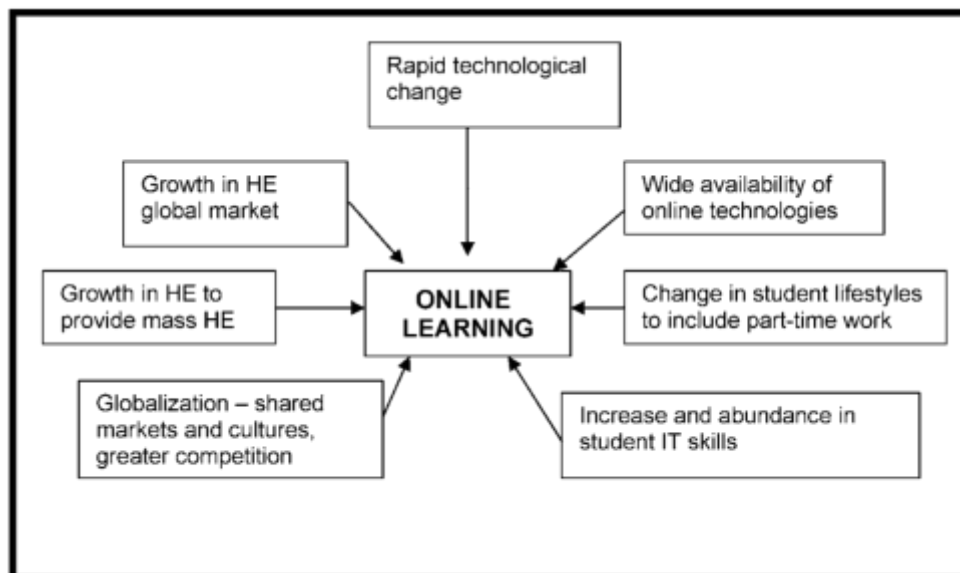

Figure 1. Determiners of online learning [1]

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In the specific case of language learning, since the 1990s computer mediated language communication became more and more important, placing greater emphasis on conversation and discourse, learner involvement in online activities and collaboration, as Hampel and Lamy suggest in their study. As the researchers indicate and highlight with the figure below, in second language acquisition the direct interaction between the learner and the teacher, as well as between learners is of great importance, having a highly stimulating effect on the acquisition of the new language. If this element does not exist, stagnation in language acquisition may appear, hampering fluency and immediate reaction. [2]

The figure below highlights the importance and cohesion between three poles: learner – teacher – peer, or input – output as the specialists call this interaction.
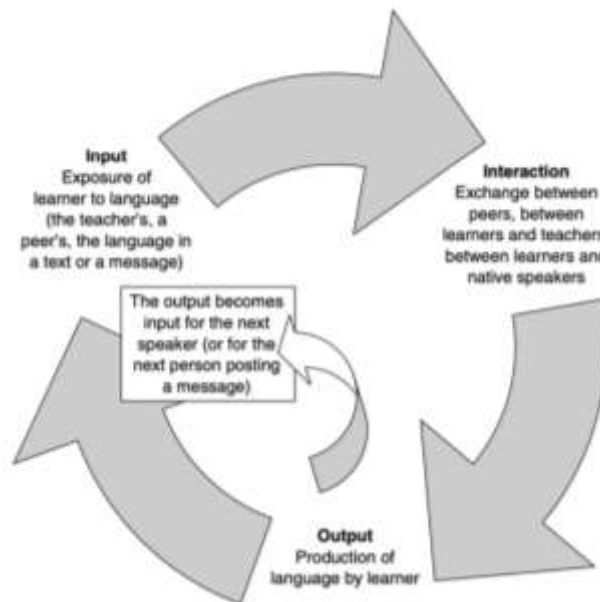

Figure 2. Model of language acquisition based on input-output

As Gass, Mackey and Pica suggest, input becomes an efficient tool for language learning only when this is done in an interactive way, allowing learners to discover meaning, in other words, focus being placed on attention to language acquisition. [3]

Later on, Swain developed a new SLA model, suggesting that the output should be also included as relevant for the learner, since it allows them to concentrate on syntactic processing, in other words, focusing on form. But the most important question is in what way can the computer improve the cognitive approach to language learning? In 2001, Chapelle suggested that CALL should be evaluated according to a set of criteria, which should include the following elements:

- Focus on form – taking into consideration learner characteristics we would be able to find engaging activities that should fit learners' profile.
- Focus on meaning – materials should be adapted to the real-world, so that they are as up to date as possible, and in tune with the students' interests.
- Positive impact – development of adequate strategies.
- Practicality – adequacy of materials to support the use of CALL activities. [4]

3. Online Teaching – challenges and achievements

Sociocultural theories consider that the teacher is more than a fountain of wisdom, s/he is a facilitator, able to move around the class, help students solve problems, answer questions and offer partial solutions, in order to fulfill the educational process. Thus the main focus is on the learner, and the question that the new modern methods of teaching pose is related to how well can the teacher maintain the level of motivation of the learner, if s/he is no longer present in the class, where competition between peers is the most relevant trigger.

As specialists suggest, we as language tutors, have to focus more on developing communication skills, apart from the technical skills required for the online interaction. Hampel and Stickler offered in 2005 a pyramid model, containing the seven mandatory skills that we need in order to perform efficiently during the language class.

Thus, at the bottom of the pyramid there are computer skills, or the technical knowledge that allows us to access online platforms, upload and download materials, connect on different communication platforms, use applications, use software technologies, adapt to the requirements or constraints of the respective applications, be able to socialize online, then be conscious of the impact of the communicative competences as a facilitator; among the most important elements are creativity and the ability to adjust your own style in the interest of the student. [5]

Figure 3. Hampel' and Stickler's *pyramid model* of skills

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"Research shows that an important part of the facilitation of learning is the skill to encourage the bonding of the online group in order 'to ensure that learning is meaningful, socially based and supportive of cognitive outcomes' (McLoughlin and Oliver, 1999: 40). This is particularly important for language learning, with its focus on communication." [1]

Thus, language learning is linked with the cooperative and collaborative method, which in turn, is directly related to the concept of the teacher as a facilitator of information and an intermediary between the two poles: learners and technology. Cooperative activities imply that the tasks are given by the teacher, but responsibility is shared among the learners, while the collaborative method implies that students have immediate and direct control over the content and are encouraged to achieve goals individually or in teams, rather that ask for the teacher's help.

There are numerous benefits of collaborative learning, which include academic, social, as well as psychological benefits for the learners. Collaborative learning can help develop critical thinking, allowing students to get involved in activities and improve their overall results. Psychologically speaking, collaborative learning helps students develop self-esteem, reducing anxiety and developing a positive attitude towards learning. Last but not least, the social benefits include the ability to develop understanding, cooperation and a positive atmosphere, creating a so-called learning community.

A different perspective on language learning in the virtual environment. It is meant to create the most appropriate environment for the unfolding of a problem-based learning, which represents a constructivist frame, encouraging the development of a problem that the learner himself can solve by asking and answering himself the matters at stake. It is particularly effective when dealing with essay writing, where the learner is by himself, allowed to express his views and deal with the matters without a time constraint, compared to the face-to-face interaction where you are under pressure because of deadlines or immediateness of answers. However, it addresses a very mature group of learners, mainly adults, requiring involvement and extensive research on their part.

In their study, Hampel and Lamy came up with the most extensive list of pros and cons for online learning, but from the learner's perspective. Among the positive aspects we could mention the fact that learners have now the possibility to participate equally during online classes, have more autonomy, as well as time available for reflection. They are no longer under the eye of the teacher, who is waiting for an immediate response during the class; we can thus talk about a lower level of anxiety among language learners, which in turn offers the background for more creative achievements.

Among the negative aspects, the two specialists mention elements such as the length of the monologues uttered by the professor, who in many situations is alone

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in the virtual class, particularly if the subject is not very interesting or interactive. This is not always the case with foreign language teaching, where the level of interaction is very high, but there may be situations where the topic is either very difficult, or too complicated for the language learners, and where learners' involvement is extremely low. Another negative aspect, as specialists consider, is the fact that learners are not totally autonomous, their autonomy being managed by the institution that provides the learning platform. There is also a level of anxiety when speaking in synchronous audio environment.

4. Online Learning – involvement and contributions of the language learner

Beginning with the year 1995 specialists used to consider that learners' involvement in online activities, be they synchronous or asynchronous, was comparable to the face-to-face one. However, recent research highlights the fact that the modern computer-assisted class discussion (CACD) has the ability to involve learners in different types of discourse, allowing learners to access a wide variety of discourses.

Unfortunately, there is a certain level of anxiety among language learners, particularly when we talk about speaking activities, where learners need to get involved in direct interaction, and their pronunciation skills will become visible, which automatically has a direct impact on listening comprehension.

According to Dörnyei, one way of overcoming language anxiety is to develop learners' confidence. Because language learning involves the use of nonverbal communication, the disappearance of these types of cues can increase the level of stress from the learners' part. Elements like kinesics, proxemics and paralanguage can help learners enhance meaning when they lack knowledge of a specific term, while they are online. At the same time, students usually wait for the nonverbal approval of their trainers/ teachers, who can suggest them visually. If all these aspects of face-to-face interaction are now missing, language learners' level of anxiety is at higher levels and this could be an explanation for their lack of involvement or decreased level of interest in online language classes. [6]

But as Pritchard himself suggests, the level of anxiety is equally visible both in the case of learners, and in that of teachers/ tutors, who were previously unfamiliar with information technologies. As can be noted from the picture below, there are a couple of factors which have the ability to level the ground between students and teachers, all the four poles being directed towards the essence of the process, that of developing a set of skills and understanding the importance of ICT in all our future endeavors. [7]
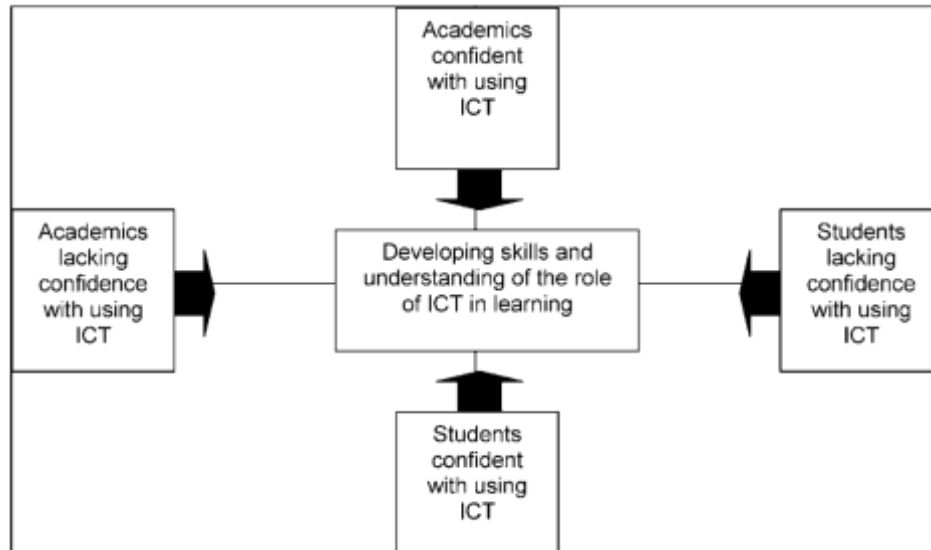
Figure 4. Pritchard's model for the leveling of ICT knowledge between learners and teachers

Another aspect that can cause anxiety among language learners is the evaluation, which is now in an online format. On the one hand learners can be less stressed, because they are in their own environment, at home, but on the other hand, it is the fear of the unknown, of the unexpected demand of information that they might not be in the possession of, which can increase the levels of anxiety among language learners. However, in language learning, which is a lifelong process, fear of unexpected is lower than in other subjects.

On the other hand, in the online environment, when we refer to the assessment methodology challenges appear not only for learners, but also for teachers. First of all, this is due to the fact that for many teachers, this year's challenges have been a novel approach to teaching in general. There are many language teachers who have never taught in the online, or had only little experience in the field, particularly with lectures, and not that much with interactive language seminars. After this challenge was overcome, a new aspect appeared related to the method of evaluation, the best approach that could be able to evaluate all linguistic aspects. Some of the language teachers decide to include all the linguistic skills (reading, writing, listening and speaking), although it is harder and more solicitating for the assessed student. For the evaluator, this stage is very demanding, as the development of online test is not extremely easy, both from a technical perspective, but also content-wise. However, there are always positive aspects, such as the fact that the review and revision of tests is easier due to the automatic answer reply, particularly with grid tests, but it can be also easier to check, due to the fact that everything is in electronic format. So, aspects related to a student's handwriting are

overcome. On the other hand, we should not forget the administrative aspects related to the registration of results. Due to the fact that the system is automatic, results are imported into an xl. file, which in turn can be automatically connected to online grade registers.

Specialists still question the reliability of online testing, as plagiarism or substitution of identity are the two important negative aspects of the online evaluation system. However, they are optimistic the new technological developments as well as the creation of new and ingenious solutions, will overcome in the future the problems that we experience today. And hopefully, we will be able to return to the class, where we are all accustomed to interacting, teaching and assessing in a specific manner.

Also connected with the teachers is the issue of the design of materials to be used in the classroom. Especially for language training, it has always been emphasized that that the use of resources found online is of paramount importance, particularly since language teaching/learning has a very strong component of direct interaction, particularly for the listening and speaking skills. Teachers have long resorted to the what the internet has to offer that can be of use in the language class, but technological and/or financial constraints have not always made it possible for all students to access the resources simultaneously during a given class.

From among the resources that can prove valuable in a language class we should mention blogs, online bibliographies, online dictionaries and thesauri, online journals, information centers etc. Teachers can engage their students in a multitude of activities through the use of these resources, with a plethora of advantages. First, there is the topicality of information – students can comment, for instance, on very hot pieces of news which helps them train their language on topics which are both actual and in keeping with their own interests. Then, it is obviously easier for the trainer to refer the students directly to the sources when the purpose is, for instance, to compare different writing genres and styles: a letter to the editor, a dictionary entry, a brief article of popularized science, a piece of news, fragments from a blog etc.

Another huge advantage is tandem learning, which is particularly useful for language acquisition. While it can occur in person, its efficiency is the same in the case of online interactions via socializing media, email, phone etc. (the online medium can even be preferable if the partners are also interested in developing their writing skills). What is interesting is that it can be done both at the student's own initiative or under supervision and guidance of the language trainer. International students who interact in this form of learning can be from countries at different poles of the Earth. This means that, apart from the language interaction per se, they also exchange cultural information, which becomes thus an integral part of the language learning process. And it has become apparent by now that efficient language use is impossible in the absence of a broader context which encompasses the culture in which a particular language is embedded.

5. Conclusions

The very recent events that have affected our entire planet have definitely shown us that the paradigm of how education is perceived and put into practice needs to change in order to answer new and not always pleasant realities. In the process, all the agents involved have to be aware that flexibility and openness to the acquisition of new skills – whether they are technical or emotional, adaptive – are paramount for the success of this new approach to education. Fortunately, the fast pace of technological advancements has already prepared us for this stage to some extent, as students, trainers, institutions and organizations involved in providing education services have had to adjust quickly to the constantly shifting requirements of reality.

Language learning ranks very high among the types of content most preferred by people all over the world. This could probably account for the fact that for some good decades, this area of training has benefited numerous tools and strategies for the inclusion of the online in the practical activity of language acquisition. It is undeniable that the online teaching/learning environment has its challenges which are both technical (students' and teachers' need to familiarize with various platforms and tools, issues connected to assessment, from test design to the implementation of ethical practices, students' access to the necessary devices etc.) and emotional (adjustment to this form of mediated interaction, students' occasional lapses, participation motivation depending on the type of class – synchronous or asynchronous or lack of direct interaction with peers). However, the latest events have demonstrated that all the parties involved are willing to and capable of making efforts to adjust to this form of education. With constant betterment which derives from the awareness that online education is here to stay, it will eventually become a good complement to face to face learning.

In this, a key role will be played by the teaching staff, as they will be the ones guiding their students through this intricate process that relies on online resources completely (from identifying the adequate information to using it accurately and appropriately). They will have to support their students in "developing new skills to effectively search, critically evaluate and assimilate information and acquire knowledge for later application. They will help students to use analytical interpretative processes (…) and abstract the meaning and relevance of this knowledge for application to specific and differentiated contexts" [1]. It is, therefore, a huge responsibility that will fall on trainers' shoulders and they will have to, as they have always done, rise to the occasion, because they are among the key factors upon which the success of this enterprise will depend.

This new landscape of education that is in full process of reshaping and redefining its strategies and approaches is also an opportunity for increased collaboration. This will have to be visible among all the parties. The collaborative effort will

probably have to be greater than before to supplement for the much-needed face to face interaction. Because, despite the numerous advantages it has and which cannot be challenged, online education should not replace in-person training, as it is not suitable for all contexts, all student age groups, all types of content etc. But it will definitely be a significant part of the future of education, as its relevance will increase with every new generation that comes with heightened technological needs, expectations and ability to use technology to its advantage and, hopefully, for the best.

References

[1] Shirley Bach, Philip Haynes, Jennifer Lewis Smith, *Online Learning and Teaching in Higher Education*, Open University Press, McGraw-Hill Education, Berkshire, England, 2007;

[2] Marie-Noelle Lamy, Regine Hampel *Online Communication in Language Learning and Teaching*, Palgrave Macmillan, [New York], [USA], 2007;

[3] Gass, Mackey and Pica

[4] Chapelle

[5] Hampel and Stickler

[6] Dörnyei, Z. (2001b) *Motivation Strategies in the Language Classroom*, Cambridge: Cambridge University Press.

[7] Pritchard, A. (2004) Introducing new students to ICT: giving a purpose to it all, Active Learning in Higher Education, 5(3): 248–62.

GENDER STEREOTYPES – A FRONTIER FOR WOMEN IN COMPUTER SCIENCE

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Daria SAVU[2]

Abstract: *Modern society is still haunted by stereotypes, particularly when we talk about the field of Computer science. The number of female specialists in Computer science is increasing, but gender stereotypes and frustration still determine many girls nowadays to consider a less masculine profession in life.*

The present study starts from a historical presentation of the term STEM- a type of education developed in the USA in the 1970s and reaching the highest level of implementation in public schools after the year 2000, as well as its implications upon modern society. This part will set the ground for an understanding of the gender stereotypes and their impact on STEM related fields. At the same time, this part will create the link between an understanding of the educational profile of young women who pursue an academic path involving the field of computer science and a career in the field.

The purpose is to understand how mentalities can be changed, in a masculine world which is extremely competitive, where women can become counterparts of their male competitors. The final aim is to develop a set of cultural awareness skills, able to overcome gender stereotypes in the field of Computer science.

Keywords: *gender studies, Computer science, STEM education, Hofstede's dimensions of culture, masculinity vs. femininity*

1. Introduction

Modern society still lacks the competence and knowledge of women, in fields like Computer Science. STEM education, whose acronym comes from science, technology, engineering and mathematics, represents that field of activity which evolved dramatically during the last twenty year.

In the United States of America, statistics say that in middle school, interest for STEM related subjects and classes is almost equal for boys and girls and diminishes by 15% percent as teenagers reach high school. The same statistics suggest the fact that at academic level the figures drop dramatically, resulting in a maximum 20% of all bachelor's degrees earned by women in Computer science.

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The sociological explanation for this issue is the fact that social barriers and gender stereotypes negatively affect girls' decisions related to applying for a bachelor's degree in computer science. There are a number of misconceptions still visible in today's modern society, where women are seen as too soft, more compromising than men, and less able to take decisions under a large amount of stress. Probably this is one of the reasons why the Dutch sociologist, Geert Hofstede, when he analyzed the IBM work environment all over the world, felt the sociological need to explain the difference between masculine and feminine societies, not in terms of the job responsibilities that should be assigned to men and women, but more related to the difference of approach of the two genders, particularly where top management positions are involved.

As Hofstede himself suggests: "A society is called masculine when emotional gender roles are clearly distinct: men are supposed to be assertive, tough, and focused on material success, whereas women are supposed to be more modest, tender, and concerned with the quality of life. A society is called feminine when emotional gender roles overlap - both men and women are supposed to be modest, tender, and concerned with the quality of life". [1]
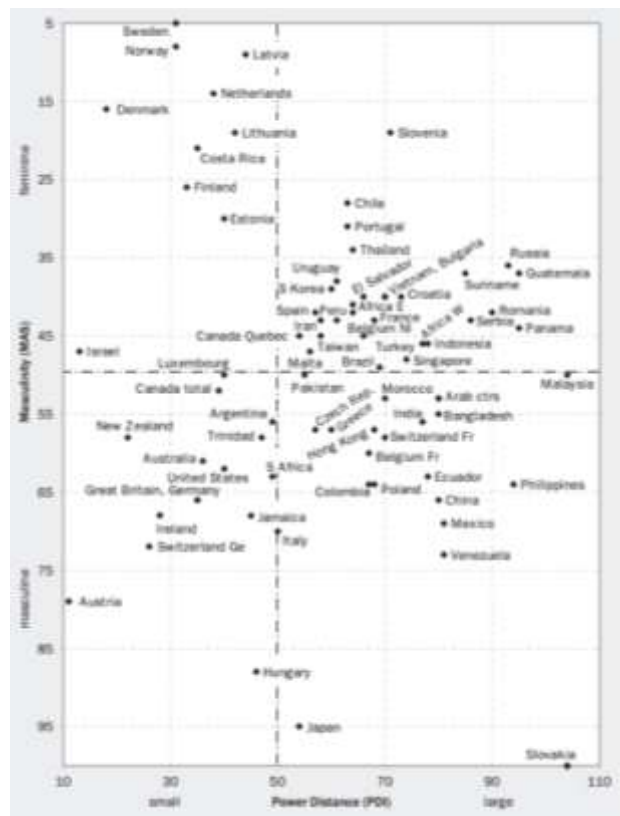

Fig. 1 Power Distance versus Masculinity Diagram

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According to the results of Hofstede's study on masculinity and femininity levels at IBM, all over the world, the most masculine occupations are sales representatives, followed by engineers and scientists and technicians and skilled craftspeople on a third position, while among the most feminine occupations he observed the office workers and semiskilled and unskilled workers. Thus, we understand that the professional differentiation on a society is determined by socialization and the level of education is the key aspect, that creates the rules.

In a society which is dominated by the masculine pole, women usually accept male dominance tacitly. Family is the first environment where these rules are learnt, and where the core gender values are transferred from one generation to another.

In the power distance versus masculinity diagram (figure 1), developed by Geert Hofstede and published in his research entitled *Cultures and Organizations. Software of the Mind*, we can observe inequality between parents and children, which can become norm in different parts of the world, and which definitely imprints the pattern to be followed by the next generation. Romania is positioned in the top right-hand quadrant, which is characterized by Hofstede in terms of inequality and tenderness, which represent the type of society in which both parents dominate the relationship with their children, share equal values of life and care for the relationships, providing equal *authority and tenderness*.

Of course, when we talk about masculine and feminine societies, we are not discussing about marginalization of women in society and their inability to access male professional careers, but we realize that a more masculine or feminine society will display a preference for certain professions. It is still a fact, that for example more than 70% of all secondary and high school teachers in Romania are women, which shows the fact that teaching is perceived by the society as a job mostly dedicated to women. But as Hofstede suggests in his study: "Which behaviors are considered feminine or masculine differs not only among traditional societies but also among modern societies. This is most evident in the distribution of men and women over certain professions. Women dominate as doctors in Russia, as dentists in Belgium, and as shop- keepers in parts of West Africa. Men dominate as typists in Pakistan and form a sizable share of nurses in the Netherlands. Female managers are virtually nonexistent in Japan but frequent in the Philippines and Thailand. In spite of the variety found, there is a common trend among most societies, both traditional and modern, as to the distribution of social sex roles".

Men are competitive, sometimes stubborn and tough, while women are supposed to be more focused on family care, thus assuming a more tender role in society. In other words, a woman in science and technology would not be rejected as a professional or specialist, but this role would somehow exclude the possibility of both a career and family life. Of course, these are the challenges and stereotypes that modern societies are trying to overcome, and this is point where the present study wants to raise the question of how mentalities can be changed and how long will it take for societies to adopt a different perspective.

A society haunted by stereotypes is more prone to marginalizing women in a men's world, as is the particular case of female specialists in the field of computer science. If we can start from a clear definition of stereotypes, an understanding of all their negative implications and a preparation of the young generation against this form of aggression, then we are on the right path towards a more modern vision of the world where men and women could share the same ideals in life.

Tintori and Palomba, in their research on stereotypes about science and scientists, entitled *Turn on the Light on Science*, offer an extremely relevant definition of stereotyping as "a fundamental process of the human mind through which our brain can easily stock a large amount of information; it involves oversimplification and overgeneralization, because you apply to all the members of a group the characteristics that you have learned to associate to that group either by meeting one or a few of its members or from parents, peers, the internet or the media".[2]

A better understanding of how mentalities can be changed should start form an understanding of the field of STEM, the one that appeared quite recently in international curricula, all over the world, which will probably be the trigger to transform the young generation, where the gap between men and women in computer science will continue to shrink.

2. History of STEM Education

Science, Technology, Engineering and Mathematics are the pillars on which the modern world was built. Throughout history, humans have asked questions about the world around them and through these four subjects, they've also found answers which eventually led to technological wonders. One cannot say when STEM was created, because these four disciplines are so tightly intertwined that people have always studied them together without consciously knowing. However, the first moment that inspired STEM education as we know it today, has been the founding of NASA in 1958. Then in the early 90' the acronym SMET is used to describe the curriculum for these disciplines, which was later changed to STEM, in 2001, by Judith Ramaley, assistant director of education and human resources at the U.S. National Science Foundation. [3], [4]

Because of traditional gender roles and societal expectations of women in the past, there were far less women involved in STEM than men. However, those who took part in it, were indeed remarkable. For example, we have, Ada Lovelace, sometimes referred to as the world's first computer programmer, even though she didn't have one to work with. She was an inspiring mathematician who created the first algorithm and made extensive notes for the Analytical Engine, a project Ada worked on with her friend, Charles Babbage. [5] Then there was Marie Curie, the first woman to win the Nobel Prize, and the first person to win the award twice. She was a polish scientist who along with her husband discovered radium and

polonium and worked on the development of X-Rays. [6] Another incredible woman who worked in STEM is Edith Clarke, who worked as a "computer", someone who performed difficult mathematical calculations at that time, at the beginning of the 20th century. She became the first professionally employed electrical engineer in the United States in 1922 and was included in 2015 in the National Inventors Hall of Fame. [7]

Since technology is evolving at an increasingly rapid pace, STEM would represent the future, from the late 20th century till today, governments have tried to encourage and develop STEM education ever since early childhood so that every high school graduate would have basic STEM skills. Notably, in 2009, President Obama launched the campaign Educate to Innovate specifically to motivate young people to excel in STEM: "Reaffirming and strengthening America's role as the world's engine of scientific discovery and technological innovation is essential to meeting the challenges of this century. That's why I am committed to making the improvement of STEM education over the next decade a national priority."- President Obama
The priority areas of the project are the following:

1. Building a CEO-led coalition to leverage the unique capacities of the private sector
2. Preparing 100,000 new and effective STEM teachers over the next decade
3. Showcasing and bolstering federal investment in STEM
4. Broadening participation to inspire a more diverse STEM talent pool

The fourth area is specifically designed to include girls and women in STEM through partnerships and mentorships programs, for example „Department of Energy's Women in STEM mentoring program" and in 2013 issued a call to tech innovators to ensure representation and inclusion of minorities and unrepresented groups. [8]

One of the milestones for including end encouraging women in STEM is the 2017 INSPIRE Women Act. The bill was introduced by Representative Barbara Comstock of Virginia and compels the director of NASA to encourage young women to pursue careers in STEM fields.

The initiatives that will be supported by the director of NASA are the following

1. NASA GIRLS AND NASA BOYS- virtual mentoring that pairs NASA mentors with young students
2. Aspire to Inspire- a program that aims to spread information about women in STEM so that young girls may fallow into their footsteps
3. Summer Institute in STEM- a program designed to inform middle school students about nontraditional careers with Goddard Space Flight Center

The act also requires a report about how NASA plans to engage professionals (e.g. retired astronauts, scientists, engineers) to determine the next generation of young women to choose STEM careers. [9]

Even though the number of women is STEM is increasing, the gender gap is still present as shown by the graph below: [10]
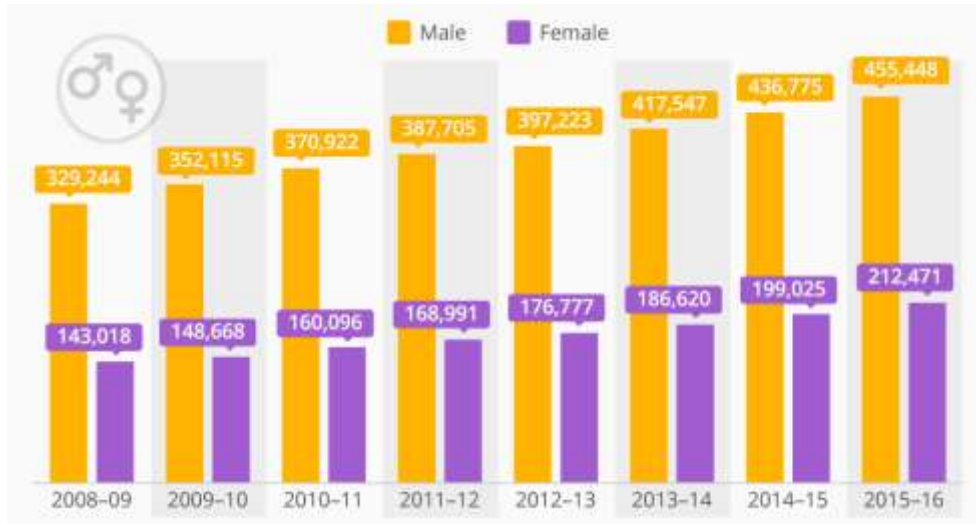

Fig. 2 Number of STEM degrees awarded in the United States, according to gender differentiation, showing a steady rise, Source NCES

However, there are more and more campaigns that promote STEM education among young girls and women such as Ada Lovelace Day, founded in 2009 and International Day of Women and Girls in Science, founded in 2015.

There is still a long way to go regarding the gender gap in STEM related study and work fields, but as we can learn from the past, women are perfectly capable and just as interested in STEM as men are. With the right role models and mindset, I strongly believe that, in the future, women will thrive in STEM just as they did before.

3. Gender stereotypes and their impact on STEM related fields – a solid link between education and women's career in computer science

The younger generation, which is extremely digitalized, due not only to technological developments, but also as a result of the shift to online learning, during the pandemic crisis, was affected by this whole trend. Thus, a new approach towards life appeared, where young people are surrounded by technology, which in

specific situations represents the only means of communication with the social group, other than the family.

As specialists suggest, the line between the information and communication technology is quite difficult to draw, and it is the role of STEM education to bridge the gap between this new technological world and the old normal.

STEM education can prepare students for this new trend, where their competences are challenged and makes them feel at ease in front of the computer or laptop and be able to fulfill the tasks required by teachers or tutors. In other words, more than never, there is now a stringent need for an immersion into virtual reality in education, lasting probably for the next couple of generations, and where men and women, boys and girls are required the same level of technical skills.

In 2017, Schwab predicted that the technological boom will be a 4th industrial revolution, developing at an exponential rate, compared to the previous ones. However, this megatrend that specialists predicted in the last couple of years was forced by a situation that the modern world had never experienced at these levels, which at the end of the day represents a mere advantage for the young generation, women included.

"Technology is not an exogenous force over which we have no control. We are not constrained by a binary choice between "accept and live with it" and "reject and live without it". Instead, take dramatic technological change as an invitation to reflect about who we are and how we see the world. The more we think about how to harness the technology revolution, the more we will examine ourselves and the underlying social models that these technologies embody and enable, and the more we will have an opportunity to shape the revolution in a manner that improves the state of the world". [11]

According to surveys on the importance of STEM education, starting from secondary school, among the values that young people appreciate in their education, we can mention achievement, relevance, practice, technology, communication and feedback. Gender differences showed some discrepancies of approach, only at the level of relevance, favoring boys at a higher rate. Thus, relevance is probably the only element of differentiation between boys and girls, men and women, and the explanation is again related to the gender stereotypes persistent in society, all over the world. They are related to the fact that mathematics is still considered a male field of activity. Nonetheless, PISA results showed no difference in mathematical literacy between boys and girls. Which represents a sign of gender equity in relation to mathematical performance. But it is also the result of the fact that boys and girls in most education systems are trained in multigender groups, as sex separated schools are a rarity in modern societies. [12]

In his study *Riding Waves of Culture*, Fons Trompenaars scrutinizes the existence of gender differences and the stereotypes that reinforce them, all over the world. It is true that women sometimes are labelled according to some misconceptions, that their role in the community is that of caregivers or caretakers, that their professional paths should not necessarily be related to technology or science, or in the rare cases when they are involved in STEM related fields they are just an exception from the rule. But it is a fact that women "need to work harder than men to show they are achieving individuals, measuring themselves by specific criteria and by universal yardsticks". [13]

6. How can mentalities be changed in a masculine society?

Monica Biernat and Diane Kobrynowitcz suggest that the gender construct is multifactorial or multidimensional in nature. That suggests the fact that gender involves a variety of elements, from stereotypes, to beliefs, identity, attitudes and perception. Along the years, there have been many different definitions of gender stereotypes, but they all have in common a different representation of men and women roles, which in very rare situations overlap. What is most disturbing for the modern society, is the fact that stereotypes can influence judgement.

Even though we are tributary to Ada Lovelace, the inventor of the first computer, and we owe Margaret Hamilton, the NASA engineer, the correct approximation of the lunar trajectory, when the Apollo 11 spaceship landed on the Moon, we have to admit that particularly the field of coding and development of computer tools in not necessarily a women's world.

Women are still underrepresented. Statistics suggest that in the United Kingdom, only 19% of the girls choose computer science as a major, versus 81% of the male high school graduates.
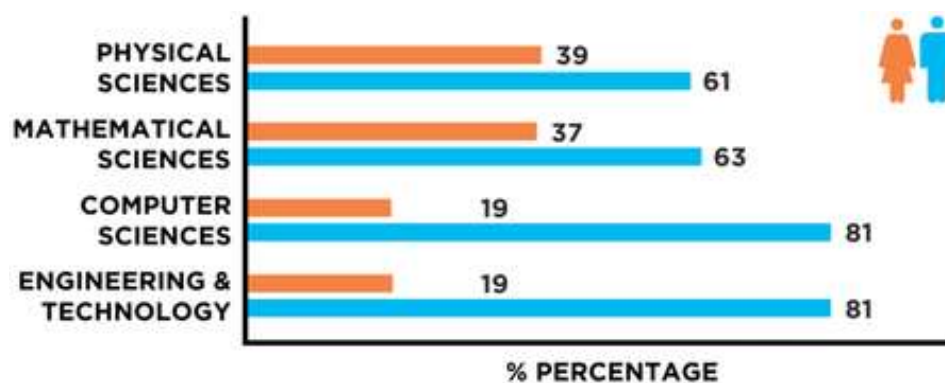

Fig. 3. Statistical data with regard to the percentage of women in STEM related fields [14]

At the same time, the development of a cultural awareness and promotion of female specialists as role models in STEM related fields, for the young generation, could develop the competitive skills much needed by modern girls who dream of pursuing a professional career in computer science. Furthermore, the creation of groups coordinated by female mentors, whose activity could be incorporated into the curriculum, could also correct the disproportions in figures between boys and girls in STEM education, at professional level. Last but not least, social media can be an efficient tool for creating awareness, for the spread of success stories and promoting successful women who could become role models for other women. "A cross-national data analysis has indicated that gender differences in math are closely related to cultural variations in opportunity structures for girls and women, in particular to gender equity in school enrollment, women's share of research jobs, and women's parliamentary representation (ibid., p. 103). Accordingly, the low proportion of women in STEM leads to the spread of a gender stereotypical image of math and science as a male domain and beliefs about male supremacy in technical and math-intensive fields. In turn, such beliefs affect young people's career choices, leading to a mutual reinforcement of gender stereotypes, and gender gaps in career related interests and choices." [15]

7. Conclusions

With a constant decrease of the number of female specialists in computer science, all over the world, with a special trend particularly during the last twenty years, governments have been forced to take some measures, as it has been realized that the trend negatively affects the societal progress.

Among the most important developments is the implementation of STEM programs in public and private schools, secondary schools and high schools, in many countries all over the world, aiming at training women so that they can enhance capabilities to get involved in science communication. Thus, school programs have raised awareness on the importance of engagement of women in STEM related fields.

Specialists consider that two other ways of potentially contributing to the development of technology skills among women is through experience and persuasion, which in turn could determine a female high school graduate to follow the computer science path at bachelor and master level. In other words, by helping women to challenge themselves and through persuasion, by offering positive feedback and promoting the important role models in the society, knowledge could be faster spread in the community. As Koenig and Eagly suggested in their 2014 study, stereotypes about women in STEM related fields, and particularly in computer science can be changed only by presenting different types of women whose professional behavior can alter the so-called *norm*, with the final aim of expanding normative social rules. [16]

On the other hand, from a financial perspective, once women achieve their bachelor's degree in computer science, the pay gap between them and men is extremely small, with women earning 94% of males' earnings. So, it becomes extremely important to encourage women to pursue a professional path in computer science, not only because it offers them an equal position with men in the society, but it also offers them the chance to compete with men, from a financial perspective.

References

[1]   Geert Hofstede, Geert Jan Hofstede, Michael Minkov, *Cultures and Organizations. Software of the Mind*, McGraw-Hill Education, 2010;

[2]   Antonio Tintori, Rossella Palomba, *Turn on the Light on Science*, Ubiquity Press, London, 2017

[3]   https://www.britannica.com/topic/STEM-education

[4]   https://www.sutori.com/story/a-history-of-stem-education-XsxYavG6btgGC6fihNfrMbYa

[5]   https://ourworld.unu.edu/en/ada-lovelace-day-6-women-who-shook-up-stem

[6]   https://www.biography.com/scientist/marie-curie

[7]   https://obamawhitehouse.archives.gov/women-in-stem

[8]   https://obamawhitehouse.archives.gov/issues/education/k-12/educate-innovate

[9]   https://en.wikipedia.org/wiki/INSPIRE_Women_Act

[10] https://www.statista.com/chart/16970/women-stem/

[11] Klaus Schwab, *The Fourth Industrial Revolution*, World Economic Forum, Geneva, 2017

[12] Tasos Barkatsas, Nicky Carr and Grant Cooper, *STEM Education. An Emerging Field of Inquiry*, Brill Sense, Leiden, The Netherlands.

[13] Fons Trompenaars, Charles Hampden-Turner, *Riding Waves of Culture*, Nicholas Brealey Publishing, London, 1997

[14] https://www.stemwomen.co.uk/blog/2019/09/women-in-stem-percentages-of-women-in-stem-statistics

[15] Elena Makarova, Belinda Aeschliman and Walter Herzog, *The Gender Gap in STEM Fields" The Impact of the Gender Stereotype of Math and Science on Secondary Students' Career Aspirations,* https://www.frontiersin.org/articles/10.3389/feduc.2019.00060/full

[16] A.M. Koenig, A.H. Eagly, *Evidence for social role theory of stereotype content: observations of groups' roles shape stereotypes*, Journal of Personality and Social Psychology, 107(3), 2014

INVESTIGATING PARALANGUAGE IN THE CONTEXT OF ONLINE TEACHING OF FOREIGN LANGUAGES

Alexandra MĂRGINEAN[3]

Abstract: *The introduction announces the background and rationale of the research, as well as the context in which I have chosen to investigate paralanguage, and the issues that I have tried to ascertain in relation to this topic. The starting point was a TedTalk video on six aspects related to the voice. On the one hand, the interest has been to determine whether and how these voice qualities really matter and influence the receivers' perception (in this case the students') in online meetings that do not use video feed. So, the first part of the study was conducted by the teacher on the students without their knowledge and conscious participation. On the other hand, in the second part of the research, the video on voice qualities is played for the students and used as a basis for discussion and a further quiz, made up of seven questions meant to determine: the students' previous awareness of paralanguage, their opinion on its usefulness, their ability to exercise critical judgment in considering and comparing paralinguistic features, the extent to which they see paralanguage practicality and relevance, how much of the information is internalized instead of merely received, and whether they are willing to implement and make use of it in their future communications. The activity then targets both informativeness, to teach students about the use of voice qualities, and to raise awareness of the importance of paralanguage, making them conscious users of it in order to improve the way in which they both communicate and perceive the others in communication.*

Keywords: *paralanguage, online teaching, foreign language teaching, survey, audio-video class materials*

1. Introduction

The *context of the ongoing pandemic caused by the Covid-19 virus* has imposed, in some fields, the exclusive transfer of all activities in the virtual environment. This is also the case of teaching, which represents the focus of this study, more specifically the teaching of foreign language acquisition online at university level.

We need to first announce the *particulars about the actual situation of online teaching*, in order to better understand the features that make up the exact context in question. The teaching analyzed in our paper takes place at the Romanian-American University, using the Microsoft Teams platform, and refers to teaching

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English for specific purposes, in our case related to a blend between interculturalism and IT terminology, to third year students in Computer Science.

The study is about *paralanguage features* and their importance in the act of teaching, as we are trying to ascertain both how aware teachers and students are and should be of matters pertaining to this variable, as well as how the conscious use of these features by the teacher actually works and influences the perception of the receivers of communication, namely the students.

The *need to take heed of paralanguage naturally arose* from the conditions under which classes take place on Microsoft Teams, namely mostly with the camera off (for rationales which I have mentioned elsewhere, but which mainly reflect the desire to have better sound quality), which leaves what one hears and, respectively, transmits through his/her voice a crucial aspect in communication. In the absence of the visual elements, which make up, according to theorists of communication, most of the information and our perception drawn from a communication activity, paralanguage remains the essential exchange to which communication is actually reduced to. According to Mehrabian's equation, out of the 93% of the non-verbal, 38% are represented by the vocal qualities and 55% of the information is conveyed by the body, which means that the paralanguage has to find a way to compensate for, in our cases, the total absence of the visual elements, i.e. the 38% will expand, somehow pressed by the context, to encompass the other 55%. This passage has had to occur in a definite, unavoidable manner, and has needed to happen in the best possible way so as to be effective, with no specific training or even conscious attention, and with addressing the matter in zero amount of time. That is, at the beginning of the switch to exclusive online teaching, neither the teaching staff members nor the students had any clue as to the actual existence of this problem and need, let alone receive any input as to the manner in which this change of focus should be performed. Technical and organizational aspects required our immediate attention and diligence in learning about them, and such traits of subtlety and finesse as the ones that represent our concern in this study were neither primordial nor even present in our conscious approach to the activity that had presented itself as a necessity. The need for the voice to successfully take over the information supplied by sight was far from merely being realized. And even as it was, later on, raising to our consciousness, it still did not become self-explanatory. Intuitively, it was obvious that students did not see their teachers, and vice versa, but the impact was not so great, because there was something else that compensated, in the first stage of the online teaching process, for this shortcoming, namely that, being in the second semester of the academic year 2019-2020, we knew most of our students from the previous face-to-face encounters. Every teaching staff member kept the same groups as in the first semester. We could put a face to the voices, and the transition was smoother because of this important helpful element.

However, *the 2020-2021 academic year started with the challenge of having new students*, whom teachers no longer knew, and at this point the importance of

paralanguage really came into play, showing its true weight and relevance. The Romanian-American University thought about organizing face-to-face gatherings at the beginning of the academic year with first-year students, in order to give them a chance to meet their teachers in person at the headquarters of the institution (and vice versa), at least once before the actual beginning of the online classes, trying to compensate for the handicap of a future communication without ever having seen the people you would be communicating with. However, the problem of having classes with students and teachers whom you had not previously seen on a regular basis from preceding face-to-face activities was not only valid in the case of first-year students. The reorganization of the groups that every teacher was assigned according to the new timetables and syllabuses meant that, unless it happened accidentally, teachers would not have the same students at class, even in the case of 2nd and 3rd year students. Hence, the same issue of communicating with new people with whom no visual appearance could really be associated remained with the more senior students as well.

I have chosen *students from the final year* because of their more senior age and experience both in the university and with the online platform and teaching. The idea was for them to have become familiarized with the Microsoft Teams and its settings and features so as to be able to focus on the subtle aspects at hand without disturbance and stress coming from other potential distractions. In other words, I picked students in the case of whom additional pressures had been naturally eliminated, so as to avoid their answers reflecting, more or less consciously, these rather than the topics at hand.

2. Endeavors to facilitate the study of the impact and relevance of paralanguage

2.1 Phase one. Personal observations – conducting the study incognito

The study has had *more components*. It basically started from a 10-minute TedTalk video on communication, *How to speak so that people want to listen*, delivered by Julian Treasure, available on YouTube. The video does not only address voice impact, it initially draws up some guidelines regarding what one should do so as to avoid being unpleasant and repelling people in communication in general. Thus, it begins by analyzing what Julian Treasure calls the "seven deadly sins of speaking", as well as some principles to be applied for being efficient and likeable, united as the elements defined by the acronym "hail" i.e. honesty, authenticity, integrity and love [1]. In the second part, Treasure refers to a set of paralanguage tools that may improve communication exchanges, making them more effective – register, timbre, prosody, pace, pitch and volume – giving definitions for every one of them; then, towards the end of the video, the speaker provides examples of exercises meant to enhance natural voice qualities before one delivers an actual speech. It is this second part, which focuses on the voice, that is relevant for this research.

One way in which I have conducted my investigation was to *test some of the elements pertaining to paralanguage without making the students openly aware of*

their existence in my discourse, or of the fact that I was subjecting them to any kind of test. I initially checked the validity of the first tool described by the presenter – register. Understood as the ability to "locate your voice", he illustrates it by mentioning the "falsetto" register, exemplifying it by pronouncing a few words on a really high pitch (i.e. the talk from "up here" in the nose), and, by contrast, from down in the throat (specifying that this is the location which most people speak from most of the time), but warns that the most impressive register is the one located in the chest, which gives "weight", "power" and "authority" to the speaker and her/his words [2]. Poyatos, who speaks of resonance, notices indeed the presence of a "*social perception*" of voices that are "*resonant, strong* and *rich*", and says that what they suggest are features such as "energy, good health, resourcefulness" [3]. Following Treasure's definition, for a week, I used chest voice with the groups that I had seminar activities with, trying to take notice of what changed in their reactions, feedback and behavior, if anything. I performed the verification of the effectiveness of register on various groups, from various years of study.

The following week, I did the same with the second feature described by Julian Treasure, namely timbre, i.e. the way a voice "feels"; to explain this, he resorts to adjectives and metaphors such as "rich, smooth, warm, like hot chocolate" [4]. Poyatos defines it as a "permanent voice register", "determined by the length and thickness of our vocal bands" [5]. By timbre Treasure refers not only to the natural traits of one's voice, but the learned and exercised ones. He accepts the fact that, for some people, who are born with a more pleasant and nuanced timbre, there is a natural advantage in captivating people's attention, but he says that timbre can also be moulded and worked upon intentionally, and that similar effects to what the voice can naturally do with innate endowment in this respect may also be obtained as a result of consciously using it in a certain manner and as a consequence of doing certain exercises. The nature of the subject that I teach, a foreign language that is also known to be melodious, due to the great number of vowels, has helped the testing of this particular feature, as I could use this specificity to the advantage of the point to be proven; I also strived to pronounce more beautifully or closer to native particularities, putting extra care in perfecting this aspect. Moreover, I used an additional trick for this week as an exception to the rule: I blended the usual, exclusive talk in English with sentences in Romanian; even though I normally carry out the class completely in English, using this language to give instructions about the exercises as well as any other comment that may arise in the seminar, I broke this rule to serve the purpose of my research, thus benefiting from access to and expression of two sets of pronunciations, from two different languages, so extra possibility for using a richer voice. Although this second tool referring to timbre was the core of my attention, I also resorted to some of the others mentioned in the video, and which I find to be mirroring timbre and more or less represent developments on it, to various extents. I tried to imagine my speech as if it were a song, using as many notes as possible, to encompass prosody. I used different

paces, depending on the information that I was delivering. For instance, when I explained what a familiar exercise required students to do, I did that on a faster pace, since it was not a novelty and they were used to the respective type of activity; by contrast, I used a slower pace and different pitch when I needed them to pay attention to something new that I was introducing, stressing the salient concepts or terminology, or when I asked more sensitive questions, which required profundity of thought, such as about styles of communication (and more exactly, for instance, whether they had ever been passive-aggressive, when and why etc.). I also took into consideration not avoiding silence at times, leaving them the opportunity to ponder a little more on answers when they involved introspection or depth, instead of, perhaps, trying to fill the void of breaks in speech with paraphrases of the requirements and with extra explaining. In this second week, in other words, I took into account and applied all the other tools that were recommended as focuses of attention in the resource video. Paying attention to what happened, I came up with the following results.

In both weeks one of the clear and immediately noticeable results was the way in which the students' behavior mirrored mine in terms of their voice qualities. The serious, grave tone in the first week elicited more seriousness and promptness in responses from their part. In the second week they replied with more empathy and warmth. Also, if in the first week I sensed that my approach determined a more rigid discipline in the students, in the second they seemed less disciplined and felt more at ease, which in some cases meant the fact that they had instances when they walked away from the computer for a few minutes or confessed to having answered the phone or not having paid attention upon some moments. In terms of time taken to respond, in the first week students were more prompt and took less to reply, their feedback being, nevertheless, more within the directing lines of the question, more according to expectations, flatter, less interesting and imaginative, manifesting less creativity. In the second week, by opposition, students took more time to give answers, but these were less uniform, more original, bolder, less according to expectations, more digressive and proving the ability to draw up unexpected associations more easily and readily. The two-column table below tries to render a more synthetic outlook of the contrastive features that this exercise that I have proposed initially has yielded.

Table 1. Comparative contrastive feature assignation as a result of students' behavior on the two weeks of incognito research

WEEK ONE (CHEST VOICE)	WEEK TWO (VOICE: RICH, WARM, FULL, NUANCED ETC.)
seriousness	playfulness
indifference	empathy
discipline	lack of discipline
timidity	boldness
prompt response/short reaction time	slower response/long(er) reaction time
predictable answers	unpredictable answers
flatness	creativity, imaginativeness
disliked by students	liked by students

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During the third week of November, I asked the students present in the previous two weeks to fill in a quick, one-question opinion poll to say which of the two weeks before it they liked more. I gave them no indication as to the things that I had done or observed in secret for half a month, so they were fed no potential objective reasons to make them tilt towards one option or another. I encouraged them to give an intuitive answer, on the model of what comes to mind first based on how they felt, without overthinking it. The condition to be able to participate in the poll was to have been present in both of the anterior two seminars. The number of the students who could answer, therefore, was only 32. All students, with four exceptions, opted for the second week. I asked each of the four students why they chose the first time period, and two of them had personal problems in the second, so there was a stress factor independent of the academic activity. The other two share a similar profile: they are shy, have much less English than the average per group(s) (being at a lower-intermediate level) and thus feel more comfortable in a drill-type English-learning situation, rather than in creative contexts in which they feel less willing to speak freely.

Further general conclusions deriving from phase one of this research, i.e. the incognito study that I have initiated, are as follows. The first week comes with the positive aspects of seriousness, discipline and promptness of response. In other words, it presents itself as a more predictable, *manageable and safer environment* for the teacher, and thus as less energy-consuming and non-threatening. In this first type, the class is more likely to go according to plan, which means less stress when it comes to *keeping the pace with the syllabus and lesson plans, more control when it comes to time management and sequencing per activities* and more predictable outcomes in general, when it comes to both student results and fulfilling the schemata that the teacher has proposed for herself/himself for the respective seminar. Interaction is more balanced and students' inputs are more uniform in terms of duration and even quality. Students get fewer opportunities to distinguish themselves through their answers, the situation as such favoring a kind of *uniformity among participants*. This obviously creates a *duller experience*, the element of surprise is virtually absent. The *teacher is a dominant figure*, and it appears that students perceive her/him as more powerful, more authoritative, to be feared in a certain sense even, but also more distant. In the theory of communication, the channel that gets illustrated is the circle, as there is a center ensured by the teacher, and the students, placed on the circle, are subordinate to this center and also equal among themselves [6]. In the second week, though, the situation changes dramatically. The *safety of the environment decreases significantly, as do its predictability and rigorous time management. The positive aspects enumerated for the context of study of the first week are precisely the ones that have to suffer in the second*. Patterning, in all its senses, is sacrificed. What is to be gained is *originality, creativity, a better mood and enjoyment of the class,*

empathy, and, I dare say, an *enhancement of brain functioning* as the students seemed to be able to draw more associations. The teacher is no longer a figure of authority necessarily in the traditional sense of the word, but, from what I have noticed, this authority is not lost but transformed. That is to say, the teacher receives, generally, and in a way, more respect based on precisely the freedom allowed, i.e. on the boldness of stepping outside what is still perceived as a normative way of holding the classes. The loss in terms of distance may make room for discipline derailments, but not some in what regards respect granted to the teacher, which may actually register a plus. The communication model in terms of channels for this week is the network, in which the leader or central figure is no longer obviously visible or immediately distinguishable in the interaction [7].

The chest voice impresses indeed, but it is more a domination tool than one that exerts genuinely free-will, involved responses. It is my impression that, in the context that I have endeavored to check its effects, it triggers a certain behavior by imposition rather than as a result of a sincerely collaborative attitude. In other words, it favors collaboration based on conformity rather than true inner conviction. It may also be about a sense of protection that it could inspire, but, if this were the case, it would have determined students to be proactive, and the type of feedback was more on the side of something correct, but mechanical and dry. In order to explain better the contrast that I am trying to illustrate here, if we were to analyze the type of reception among the four developed by Elihu Katz, behavior in the first week rather fit the instrumental, adaptive, utilitarian one (where positive attitude, meant to maximize reward and minimize punishment is a chief concern) and the ego-defensive one (maintaining face, image of self, the maximum favorable impression with a minimum of compromise), than the value expression and cognitive ones, which would more likely characterize the second week of interaction [8]. Out of the four types, the first two focus on the exterior and the other two on the interior of the individual, a reason for this being perhaps that the outside environment is perceived as more threatening and imposing in the first case, whereas in the second it is subdued, the person feeling comfortable enough and at ease so as to focus on his/her own thoughts and feelings and sharing them with the others. I, as a sender, on the other hand, felt that I was exercising more the power of coercion among those theorized by R.P. French and Bertram Raven during the first week, as compared to the second week, when it was rather all the other three – reward, reference, legitimacy and expert (so, minus coercion) – which somehow made the experience of the second week richer [9].

One more mention to be made here is the way in which motivation is enhanced by empathy, expression of self and freedom of expression in general (which is not a new discovery), as well as how these can be triggered and moulded by the conscious use of one's voice. A warm voice shows involvement, a personalized

type of interaction, and elicits a more truthful and involved feedback in its turn. It shows the presence of human touch and relates, in the minds of the receivers, to further valuable interpretations, such as caring for the others, being interested and respectful, wanting to achieve genuine communication. As a side conclusion, it is perhaps important to say that, as much as there are personalities that get through to people while on television, managing somehow to bridge a gap through artificial means of communication as if they were face-to-face with the audience, there are, equally, *voices* that can do that, which may be just as powerful an asset.

We may say that paralanguage alone gets to establish a very different type of setting and environment, if used intentionally and thoroughly. It not only dictates and illustrates power and status relations, but also impresses a wide variety of aspects of communication, such as the channel model used, emotive factors, motivation, creativity and, last but not least, the learning itself.

2.2. Phase two. Checking awareness and relevance of paralanguage in collaboration with the students

Another part of the investigation was *the actual use of the above-mentioned video as class material to be discussed by students, and as a starting point to occasion a quiz*. I played the talk on Microsoft Teams directly from YouTube, sharing the desktop and the sound, which meant that they all watched it together, at the same time. Beforehand, in the guise of a preparation, I asked them to try to jot down as they listened the answer to some questions related to the main aspects introduced by Treasure in his presentation, namely to remember and define the seven "sins" concerning speaking, to tell me what the acronym "hail" stood for, as well as enumerate and describe the voice tools that they were about to hear information on. This was a regular seminar activity – eliciting answers based on a certain clip, subsequent to its viewing – except that it prepared the ground for a more in-depth analysis on paralanguage aspects, which meant to ascertain students' awareness and perception of the importance and relevance of voice in communication situations. The initial resort to video-viewing was based on the already-verified logic that the use of technology in class, more precisely audio-visual materials "improves the outcomes of both students and teachers and increases the three types of engagement – behavioral, emotional and cognitive" [10].

I used the regular seminar activity first in order to give the students a chance to get familiarized with the notions related to paralanguage and to provide some minimal theoretical background to have a basis for discussion. The students were not homogenous in the group in terms of their familiarity with the notions in question, and seeing the same material all at once leveled them a little, just enough to have something to start a conversation from, and brought them to a metaphorical common ground. Then, the idea was to determine them to ponder over these

elements of paralanguage and their relevance as tools in discourse, and plant the seeds for further interest and study.

Insisting on the second part of the video and the voice tools, I asked them:

Question 1: *How many of the six features had you ever thought about and/or discussed in the context of how they may influence communication with the others, before seeing the video?* The students had to merely give a number.

Question 2: *How much do you think that these tools are effective?*, to choose from intervals – a) (almost) not at all; b) around 25% or more; c) around 45% or more; d) around 65% or more; e) around 85% or more.

Question 3: To *mention three among the six, the ones that you deem more important, in a random order*.

Question 4: To pick the *tools that you have personally and consciously used in your communications*.

Question 5: Last but not least, *would you personally do the exercises presented at the end of the video?* and, *in case the answer is no*, to further *state a reason* by picking it *from the following* options: a) they are not useful; b) they are embarrassing; c) other reasons (lack of time, fear of disturbing people in your proximity etc.)

Question 6: Can you come up with *other examples of instances of paralanguage* – conveying messages and meaning through the use of voice qualities (not words)?

Question 7: *Are voice qualities and paralanguage more important in our audio online encounters than in face-to-face ones? Would you have given the same answer previous to this discussion?*

The questions were asked in the third week. The number of students that provided answers were, for most questions (we shall explain this at the right time), 36, out of three groups of 3rd year Computer Science ones. They had a questionnaire which they were required to supply answers for in a limited amount of time – ten minutes, answers which they then submitted to me.

For Question 1, the answers provided are centralized in the table below.

Table 2. Answers to Question 1

| 0 tools	1 tool	2 tools	3 tools	4 tools	5 tools	6 tools
5 students	6 students	9 students	8 students	5 students	3 students	0 students

Chart 1. Image of students' awareness of the existence of paralanguage tools
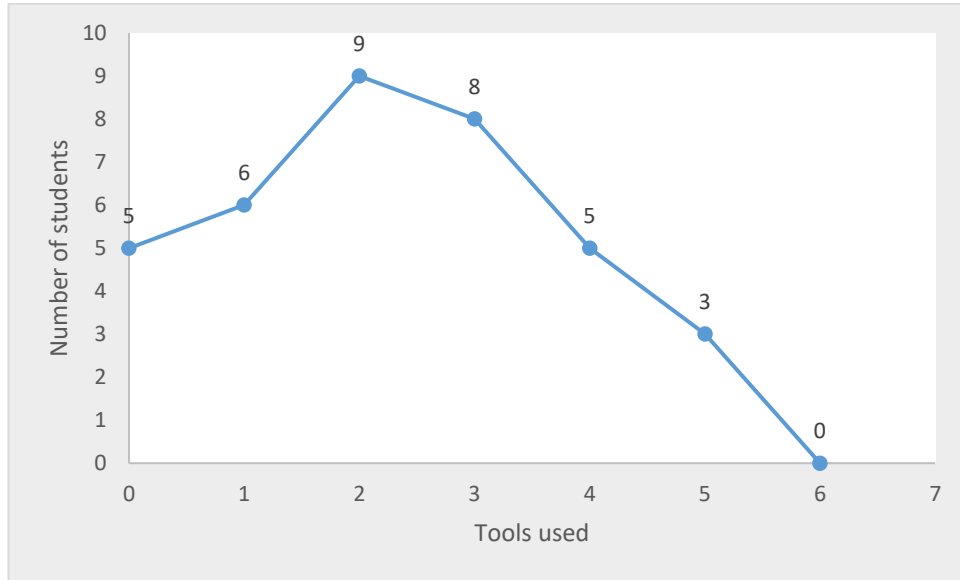
This first question tested previous awareness of the existence of these tools in the context of the influence that they can bring over communication acts. It is obvious from the chart above that most students were aware of only two or three tools, none having knowledge of all six. Over 50% knew a maximum of two tools, which means that awareness of them was low.

Question 2 still measures awareness, but subsequent to becoming privy to the talk in the video, asking students to rank the importance of the tools. Once exposed to them as explained in simple and synthetic terms in the clip, they are asked for their intuitive opinion, for a spontaneous answer after having been fed minimal information. These answers are raw, the result of an honest, on-the-spot reaction, which makes them valuable precisely because of the way they rely on intuition rather than study and thought-through processes; in case they point to the relevance of paralinguistic markers, this proves the validity of this factor in communication, since even individuals freshly-exposed to this logic are able to identify its importance. And this is precisely what happened, if we have a look at the results – a confirmation, through an intuitive feedback, of the weight that paralinguistic elements hold in communication. A salient aspect here is that 50% of the students, i.e. 18, thought that these elements have around or more than 85% importance in communication, which means an evident, overwhelming importance online, where the visual aspect needs to be taken over by paralanguage.

Chart 2. Percentages reflecting students' opinion on the relevance of voice tools
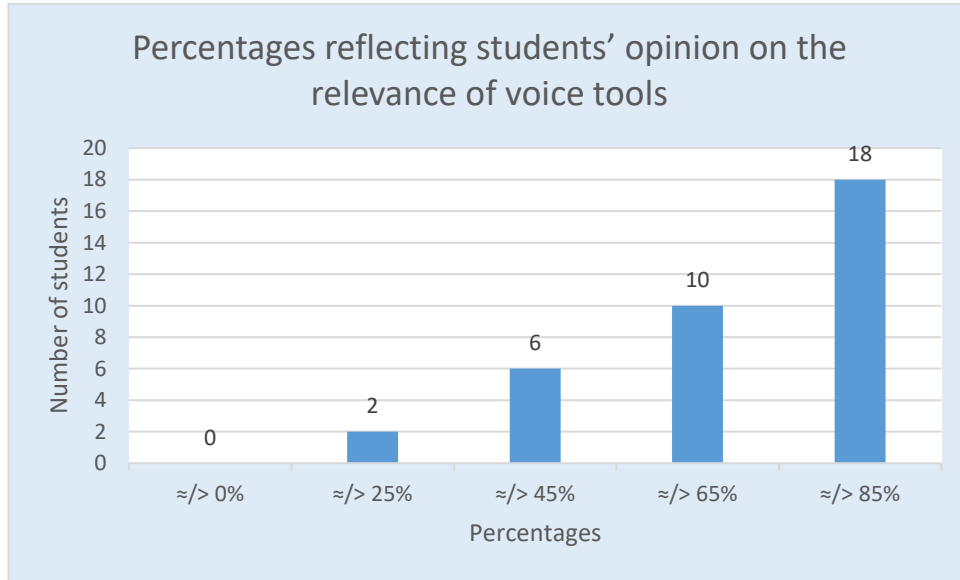
The first two questions were general, assessing awareness in broad lines. They focused on quantities and numbers and a bird's eye view on paralanguage characteristics, rather than on content. Starting with Question 3, the students are required to filter the information more thoroughly and give opinions on the introduced notions as a result of having assessed and compared them. To be able to do that, they have to gain and prove an understanding of these, and the ability to perform more complex mental processes of critical judgment, evaluation, comparison, decision-making in relation to context and reference etc. I did not require them to make a top three, because I wanted to avoid instilling in their minds the tendency to judge these features in terms of hierarchies, or to approach these in the sense of "either-or". The idea is rather to become mindful of them, integrate all of them (or as many as possible) and acquire the ability to identify and use them in communication. Hence, the results count the number of occurrences of every of the six notions, and are synthesized in Chart 3 below.

Chart 3. Students' choices of the most important tools among the six
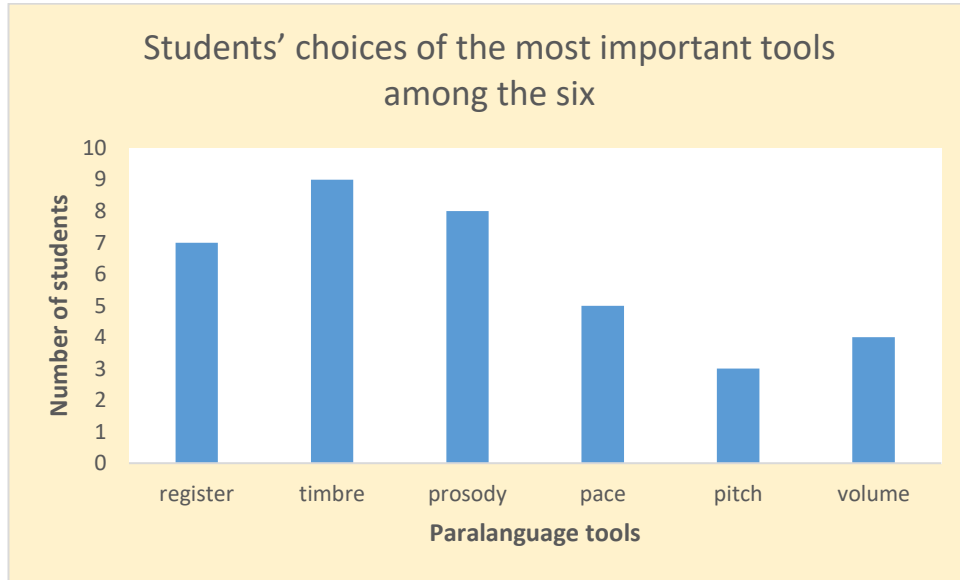
The other definitions provided in the video were for: prosody as not speaking on "one note", monotonously, or choosing the right prosody according to the type of sentence (e.g. not make an affirmative sentence sound like a question); pace as the speed with which one speaks (fast speed may show excitement, slow speed shows desire to emphasize) and, under this umbrella, silence is not an enemy and can be used at times meaningfully; pitch (high and low) may show intention, level of calm etc.; volume, with the observation that high volume does not always get more attention, and sometimes being quiet may achieve that better [11]. These elements have been defined differently by theorists. For instance, prosody is seen by Swati Johar as more complex a notion, including "characteristics of speech such as pitch, rhythm, stress and loudness" [12]. However, we will take the definitions presented by Julian Treasure in the video as reference.

What we notice from the chart is that, interestingly, the most referred to notions are, in descending order, timbre, prosody and register. The other notions, respectively, in order, pace, volume and pitch, which have received fewer mentions, are simpler to understand and less complex in terms of the ingredients that go into their semantic and conceptual makeup. Within logical predictions, students would have been more likely to choose these simpler concepts rather than the more complex ones that are harder to grasp, especially given their relatively low level of awareness of these from beforehand. Nevertheless, they have shown preference for the more complicated notions, which points to their intuitive ability to envisage paralanguage as a subtle and manifold process instead of seeing it

simplistically and mechanically. This choice of the students is promising in terms of the way in which they will be able to internalize paralinguistic relevance in communication in the future.

On the other hand, as it was to be anticipated, when it came to picking the tools that they have used before, the answers for Question 4 tilted towards the less complex tools among the six exemplified in the video, as visible in Chart 4 below. The "easiest" tools, namely volume, pace and pitch amassed together a percentage of 65%, in comparison with prosody, register and timbre, which totaled 35%. We further notice that prosody is perceived as the more accessible notion among the three that are more "alien" in nature, having acquired a percentage equal to that assigned to pitch, namely 17%. Also, we need to state the fact that timbre, the tool rated by students as the most relevant and perhaps the most complex, has received only 6% in terms of previous use, which means that it is also the one which students were least aware of.

Since this interrogation bears on tools that students have used previously and also *consciously*, the five students who gave the answer 0 to Question 1 were asked to skip the current one.

Chart 4. Tools that students have personally and consciously used in their communications
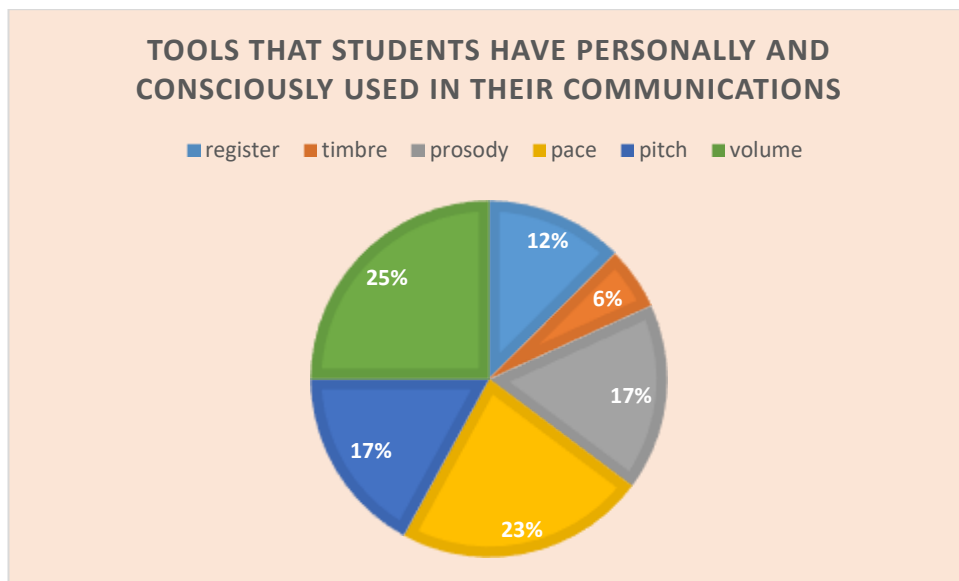
To Question 5, regarding the openness to do the suggested exercises to enhance voice qualities, 47.22% of the students (17) answered positively as far as their willingness to try them, whereas 52.77% (19) said no. Apparently, only approximately half of them see the usefulness and importance of such exercises. However, the second part of the question, in which those unwilling to practice the

drills are asked to justify their refusal, revealed interesting aspects. Among the three options that they had at their disposal, the numbers looked like this: two opted for a) they are not useful, six opted for b) they are embarrassing, and eleven opted for c) other reasons. Hence, we may conclude that unwillingness to perform the drills is mainly not caused by failure to see their relevance, but rather by other reasons such as embarrassment, shyness, fear to disturb etc. Out of all thirty-six students, only two end up not really understanding or agreeing to the importance of paralanguage in communication, which is roughly 5%, a small proportion indeed.

Question 6 elicited other examples of paralanguage from the students that represented the focus group. What is interesting here is that the five students who could not provide an answer to the first question were able at this point to make suggestions of instances of paralanguage, with the afterthought made possible by watching the video. The most common answers included the following examples: snorts and grunts that denote disapproval, yawns, laughter, sneezes and coughs to show boredom and/or disagreement. The replies show that the respondents can differentiate between laughter, coughs, sneezes and yawns occurring naturally, on the one hand, and these manifestations being intentional, on the other, and thus meant to convey hidden meanings. Indeed, studies in paralanguage confirm that yawning, when it is not a physiological act and is filled with non-verbal meaning, may point to something being "tiresome", "boring" and to the intention of "terminating" an encounter [13]. Coughing and throat-clearing could hide, when used as non-verbal cues, "anxiety", "embarrassment", "annoyance" or "social attention-getting" [14].

The last question, 7, was meant to check students' input regarding whether paralinguistic cues play a greater role in audio-only online encounters than in face-to-face ones. The answer was, unanimously, yes. For the second part of the question, a number of the respondents admitted that they would have said no, before seeing the video, namely, to be precise, ten out of thirty-six, which is a roughly more than a quarter of them. This reveals the benefits of watching the video on paralanguage and the instructiveness of the activity.

3. Conclusions

This paper has tried to highlight the results of a research conducted on the relevance of paralanguage in online teaching. The study consisted of two main parts. In the first, the teacher was interested in assessing the effect of conscious and intentional use of voice features in the audio online teaching of foreign languages, to check the influence these have on the students. The results show, beyond any doubt, that indeed reactions can be modified by resort to these ways of signaling beyond the conscious level. Feedback was different, and, quite importantly, the subjects were not consciously aware of what caused the change or even that there was a change in the environment, unless that was pointed out to them, and would have rather attributed their disposition to other factors – for instance, personal or

random causes, such as private problems or mood. The first part of the study was done, as it were, secretly, and constituted individual research. The second, however, included the students and relied on their insights. It started from a simple regular class activity to then draw on paralanguage and go further into past and present experiences and awareness related to this subject comprised in the form of a quiz.

In this paper, I have presented the synthesized results using tables and charts, in an attempt to show: an evolution in terms of students' awareness related to paralanguage as well as their openness to the topic, their opinions, and perhaps a change in outlook as far as this issue is concerned. Results prove that any material that draws attention towards paralinguistic concerns opens up a new horizon, as well as the possibility to improve communication, by performing it more knowingly and empathetically, rather than randomly. The research has also revealed the fact that students may have been privy to some instances of paralanguage without fully realizing that these are not merely fragmentary, interpretable products of their intuition, but shared knowledge to a great extent, the kind that has been theorized on. In this, they have gained some vision on how communication is indeed a complex process, and on how paralanguage can be used to the benefit of all actors involved in communication acts.

References

[1] Treasure, Julian (2014, June 27). How to speak so that people want to listen [Video]. YouTube. https://www.youtube.com/watch?v=eIho2S0ZahI&feature= youtu.be.

[2] Treasure, Julian (2014, June 27). How to speak so that people want to listen [Video]. YouTube. https://www.youtube.com/watch?v=eIho2S0ZahI&feature= youtu.be.

[3] Poyatos, Fernando (2002). Nonverbal Communication across Disciplines, Volume II: Paralanguage, Kinesics, Silence, Personal and Environmental Interaction. Amsterdam: John Benjamins Publishing Company. pp. 4-5.

[4] Treasure, Julian (2014, June 27). How to speak so that people want to listen [Video]. YouTube. https://www.youtube.com/watch?v=eIho2S0ZahI&feature = youtu.be.

[5] Poyatos, Fernando (2002). Nonverbal Communication across Disciplines, Volume II: Paralanguage, Kinesics, Silence, Personal and Environmental Interaction. Amsterdam: John Benjamins Publishing Company. p. 4.

[6] Pâinişoară, I.-O. (2008). Comunicarea eficientă. Ediţia a III-a, revizuită şi adăugită. Iaşi: Polirom. p. 62.

[7] Pâinişoară, I.-O. (2008). Comunicarea eficientă. Ediţia a III-a, revizuită şi adăugită. Iaşi: Polirom. p. 62.

[8] Katz qtd. in Pâinişoară, I.-O. (2008). Comunicarea eficientă. Ediţia a III-a, revizuită şi adăugită. Iaşi: Polirom. p. 53.

[9] French and Raven qtd. in Pâinişoară, I.-O. (2008). Comunicarea eficientă. Ediţia a III-a, revizuită şi adăugită. Iaşi: Polirom. pp. 49-50.

[10] Coancă, Mariana (2019). "Business English Literacy and Learning by Resort to Cloud-Based Tools Measuring Intermediate Students' Level of Engagement". Journal of Information Systems & Operations Management (JISOM), Vol. 13, No. 2/Dec. 2019. Bucharest: Editura Universitară. pp. 49-59. p. 58.

[11] Treasure, Julian (2014, June 27). How to speak so that people want to listen [Video]. YouTube. https://www.youtube.com/watch?v=eIho2S0ZahI&feature= youtu.be.

[12] Johar, Swati (2016). Emotion, Affect and Personality in Speech. The Bias of Language and Paralanguage. Basel: Springer. p. 3

[13] Poyatos, Fernando (1993). Paralanguage: A Linguistic and Interdisciplinary Approach to Interactive Speech and Sound. Amsterdam: John Benjamins Publishing Company. p. 346.

[14] Poyatos, Fernando (1993). Paralanguage: A Linguistic and Interdisciplinary Approach to Interactive Speech and Sound. Amsterdam: John Benjamins Publishing Company. p. 350.

USING TABLEAU SOFTWARE AS A SAAS PROGRAM IN BUSINESS IN CLOUD

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Abstract: *Cloud computing has become a modern, almost indispensable tool for many businesses. Modern business is in a continuous technological development and online commerce is still growing, and this article provides an overview of how to develop business using BI technologies in Cloud Computing. The article also presents how to work Tableau Software program for collecting and viewing the information needed to make decisions within companies.*

Keywords: *Tableau Software, e-commerce, software as a service, Bussiness Intelligence, business in cloud*

1. Introduction

The online environment is not only used for communication, information transfer or entertainment, but is also a business environment. This factor has led to the development of an entire branch of science called E-commerce or e-commerce.

There are several types of online commerce, including the following:
- Business-to-consumer (B2C): companies or organizations that offer services or products to individual buyers or users, ie individuals (amazon.com).
- Business-To-Business (B2B): this model of e-commerce is composed only of and for organizations (rtcoffice.ro).
- Consumer-to-consumer (C2C): users who sell to other users (ebay.com, olx.ro).
- Consumer-to-business (C2B): Internet users sell the services or products of advertisers (priceline.com).
- Mobile commerce (m-commerce): is characterized by electronic commerce on mobile devices (electromagnetic).
- Government-to-business (G2B): is expressed through electronic commerce between a government institution and legal entities, through the purchase of services, goods or information.
- Government-to-consumer (G2C): Covers the relationship between citizen and government by providing information and providing public services (for example, when a user pays taxes online). [1]

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For a more objective approach to the benefits of e-commerce, three categories will be presented: companies, consumers and society. For companies, the benefits are limited to: international expansion; reducing costs for information stored on paper; product modeling on the buyer's need; lower communication costs. The benefits for consumers are: the possibility to buy 24/24 hours, 7/7 days; a wider and more diverse choice, both in terms of price and delivery; relevant and up-to-date information; the possibility to participate in virtual auctions; facilitating competition, which can lead to lower prices. For society, it can be seen how e-commerce can reduce street traffic and reduce air pollution; increases the quality and efficiency of transactions. [2]

2. Cloud computing and Bussiness Intelligence

According to the definition given by the National Institute of Standards and Technologies (NIST) of the US Department of Commerce, Cloud Computing is defined as a model that can access a common space of computer resources (which can be configured) using the Internet, which can be offered quickly by the supplier. This cloud model consists of five key features, three service models, and four deployment models.

Cloud Computing is composed of five features that are presented below:
- On-demand self-service - the customer can access on-demand computer capabilities without direct interaction with different vendors.
- Broad network access - the resources are available through the internet, without special or customized settings, but they can be used directly in the client's platform.
- Resource pooling - resources are pooled in the form of a multiple custody model, allocated according to demand. The client is not aware of the exact location of computer resources, such as processing resources, storage, virtual machines, memory, or bandwidth.
- Rapid elasticity - the computing capacity can increase or decrease rapidly and elastic, depending on the consumer's needs, which can be purchased at any time, for any quantity.
- Measured Service - the ability to measure the level of abstraction of each type of service by automated cloud systems can be monitored, reported or controlled in a transparent way for both the consumer and the provider. [3]
There are three models of cloud services (figure 1):
- Cloud Infrastructure as a Service (IaaS) - the cloud provider provides the client with storage, processing and networking resources (other basic computing capabilities may be included) in which its software can be executed or implemented (here can be including operating systems). The consumer will not be able to control the infrastructure on which his programs run, but he has total control over operating systems, applications and storage.

- Cloud Platform as a Service (PaaS) - as in IaaS, the user has no control over the infrastructure, but also over the operating systems and storage space of the cloud. However, the user can run any application, either created by him or purchased.
- Cloud Software as a Service (SaaS) - as in the case of the IaaS and PaaS model, the user will not control the infrastructure or operating systems, but his applications will not be able to run in the cloud. The user will use the provider's application in the cloud, having only the rights to configure it, but not to modify or store it.
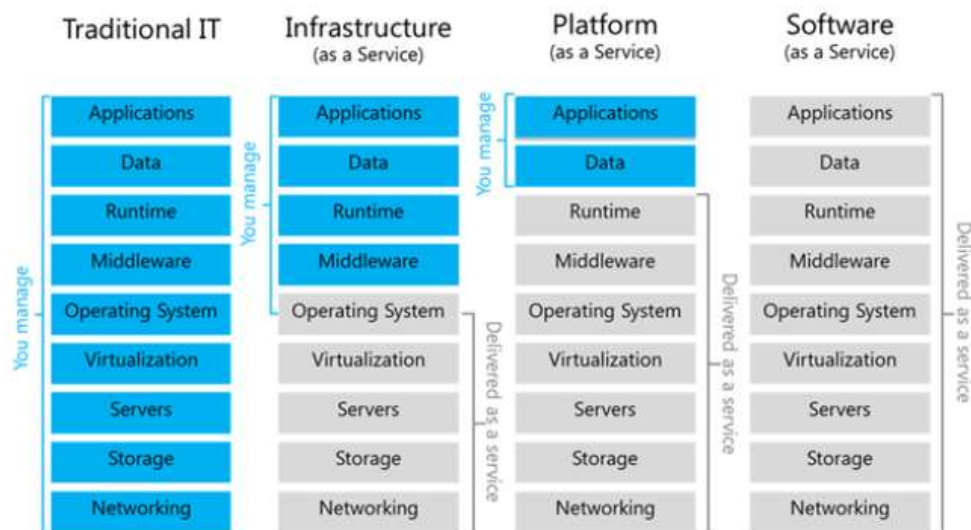
Figure 1. Cloud service models

The cloud reference architecture defines five main actors: the cloud consumer, cloud provider, cloud carrier, cloud auditor and cloud broker. Each actor is an entity (a person or organization) that participates in a transaction or process and / or performs tasks in the field of cloud computing. A cloud consumer can request cloud services from a cloud provider directly or through a cloud broker. A cloud auditor performs independent audits and can contact other auditors to gather the necessary information.

Security control in cloud computing is, for the most part, different from security control in any IT environment. Thus, despite the cloud service models used, the business models, and the technologies used to enable cloud services, cloud computing can present a completely different risks to an organization than the risks that come from traditional IT solutions.

The level of security of an organization is characterized by the maturity, effectiveness and completeness of the controls implemented, adjusted to security risks. These controls are implemented in one or more layers, from facilities (physical security) to network infrastructure (network security), from computer systems (system security) to information and applications (application security).

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Cloud computing is very useful for many businesses, reduces costs and allows them to focus on competence instead of IT and infrastructure issues. However, cloud computing has proven to have some limitations and disadvantages, especially for smaller business operations, especially in terms of security and downtime. Technical disruptions are inevitable, they can sometimes occur when cloud service providers become overwhelmed in the process of serving customers. This can lead to the temporary suspension of the business, as the systems of this technology are based on the Internet, therefore, a person will not be able to access applications, server or data in the cloud during an interruption. [5]

According to Timo Elliott, there are four steps to a business analysis (as shown in Figure 2) to achieve the most predictable results. [6]
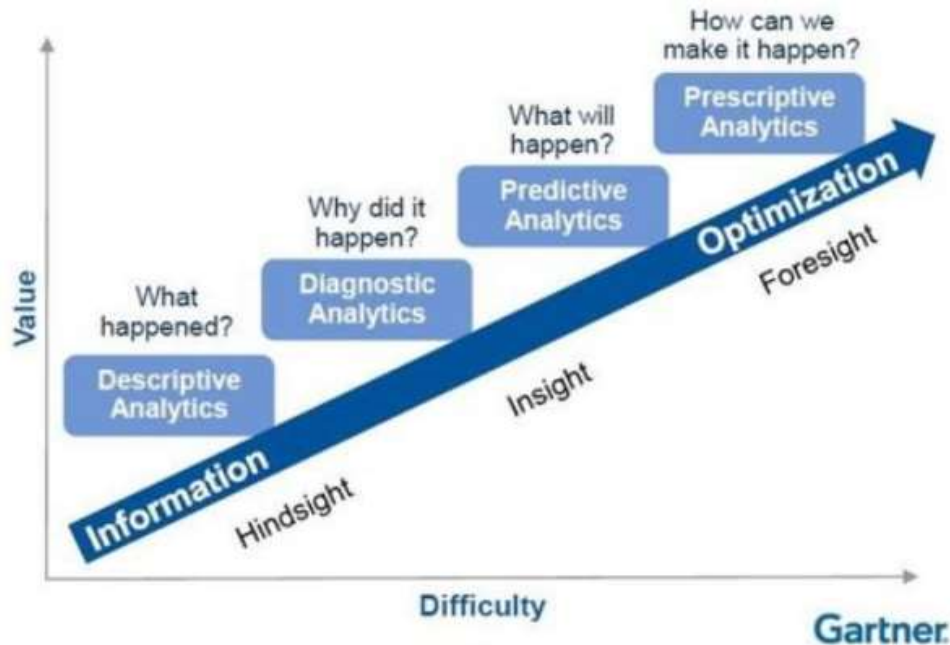
Figure 2. The steps for a business analysis

The first phase or step is the descriptive one, where the analysis of the business is focused on what happened in the past. Here the history of the data traded in the data warehouse is analyzed, in order to identify the causes of success and failure of the company. This is the most common post mortem analysis done by any company. For example, if the company's sales have fallen, it will be identified why they have fallen. Here BI technology will help identify hidden trends and relate the company's multitude of data to a declining particular sales segment. At this point, the second phase appears, that of diagnosis, where it is decided what is the reason behind what happened. The predictive phase will collaborate with various statistical tools, such as correlation and regression, to find out what will happen in the future. An example is the customer who leaves the business. But it does not

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help to identify the actions that need to be taken to prevent this. Therefore, the last phase of the BI analysis is also necessary, it is the prescriptive one. At this stage, not only the best possible actions are suggested to benefit from the forecast, but it will also show the effects of these actions on the business. This stage of business analysis is the most advantageous, in order to save time and money for business experiments and risk-taking, along with them.

3. Bussiness Intelligence in Cloud Computing

Cloud computing allows scaling up and down because the capacity is required by the company and it is gradually paid to the cloud computing service provider. [7] With the cloud-based solution there is a lower financial risk for the business, as the business only pays for what it uses and can terminate the service level agreement at any time.

Cloud Computing Business Intelligence trends for 2019 are given by a high percentage of 48% of organizations who say that cloud BI is either "critical" or "very important" for their operations in 2019. Organizations have more confidence in cloud BI than at any time, according to the results of the study. The year 2019 is facing a significant increase in cloud BI, made available by trusted providers, for accessing, analyzing and storing sensitive company data on cloud platforms running BI applications (Figure 3)
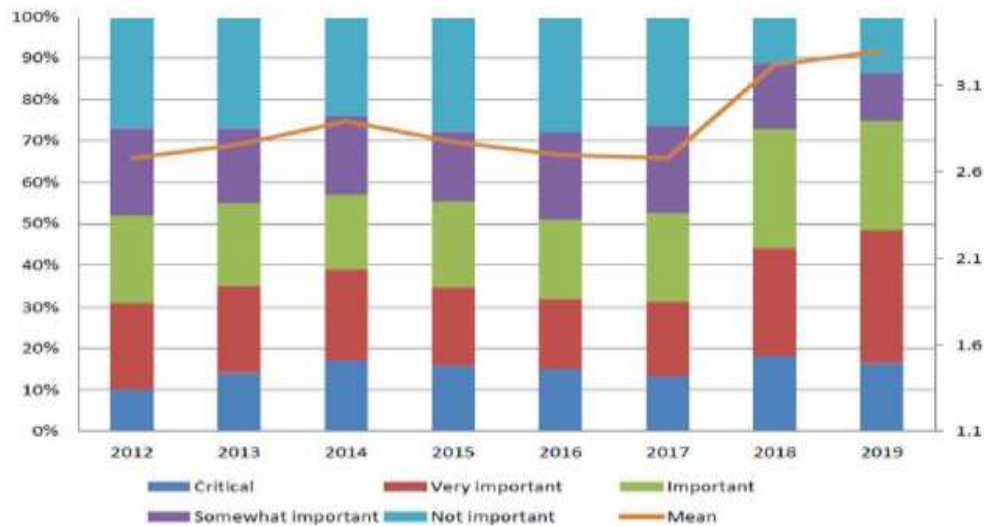

Figure 3. Cloud BI Importance 2012-2019 (according to Dresner Advisory Services)

Marketing and sales place the most importance on cloud BI technology in 2019. Business intelligence centers (BICCs) and IT departments have an above average interest in cloud BI, providing critical and very important scores, combined are over 50% (figure 4).
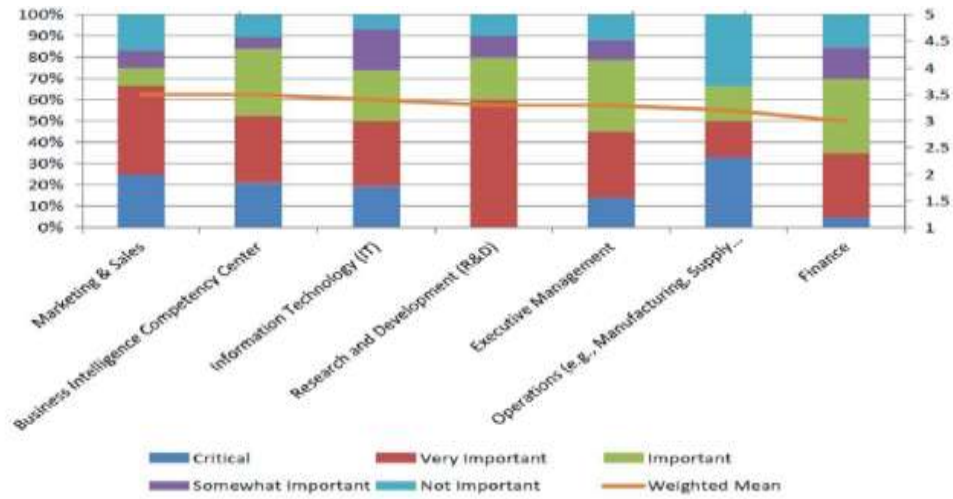
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Figure 4. Cloud BI Importance by function (according to Dresner Advisory Services)

The finance field leads everyone else in adopting private cloud BI platforms, which compete with the IT field in their lack of adoption for the public cloud. The areas of research and development are still the most likely to be based on the private cloud today. Marketing and sales are most likely to take a balanced approach to adopting the private and public cloud. (figure 5)
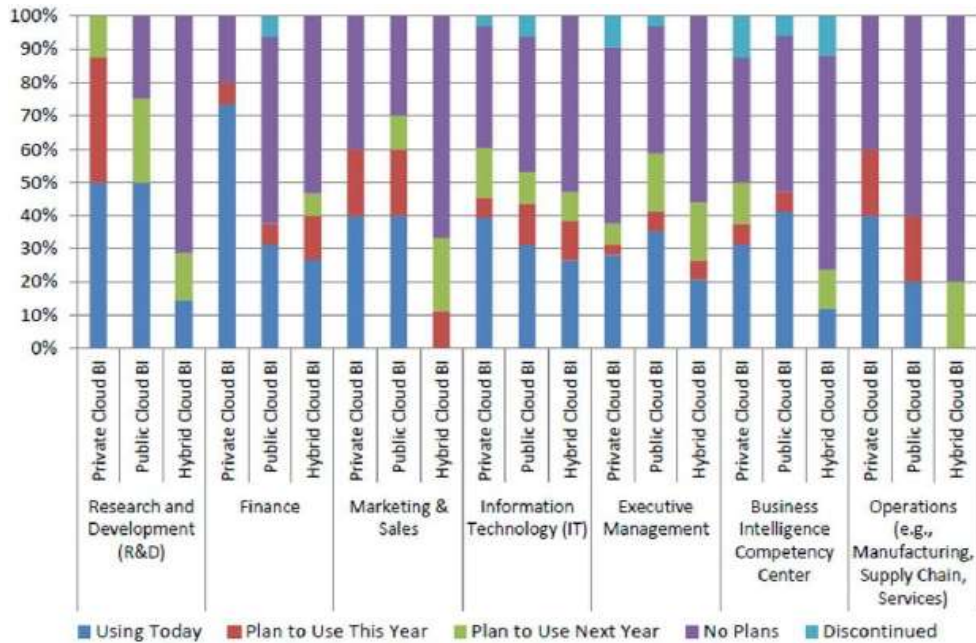

Figure 5. Plans for Cloud BI for deployment models and function (according to Dresner Advisory Services)

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The BI technology used in the cloud came with the advent of the first Cloud applications, but some of the first, being pioneers of Cloud BI have disappeared from the market, for example Oco, LucidEra and PivotLink. However, Cloud BI solutions have developed a lot with the migration of corporate data online. Some of such solutions are: SAP Analytics Cloud, IBM Cognos Analytics, Microsoft Power BI, Tableau.

4. Tableau Online software - an example of Saas program

Tableau Software is an interactive data visualization software company founded in January 2003 by Christian Chabot, Pat Hanrahan and Chris Stolte in Mountain View, California. With Tableau, data analysis is very fast, and the views created are in the form of dashboards and worksheets. Data created using Tableau can be understood by professionals at any level in an organization. It even allows a non-technical user to create a custom dashboard. The most used tools in the Tableau suite are: Tableau Desktop, Tableau Public, Tableau Online, Tableau Server and Tableau Reader.

The data analyzed in Tableau Software can be classified into two categories:
▪ Developer tools: such as dashboard creation, charts, report generation and visualization are part of this category. Tableau products in this category are Tableau Desktop and Tableau Public.
▪ Distribution tools help to share views, reports, dashboards that have been created using development tools. The products that belong to this category are Tableau Online, Server and Reader.

Once the user has access to the Tableau Software program (after creating an account), the first thing they need to do is create a project or upload a project already done in the Tableau Desktop application. Separate pages (workbooks) can also be made, but working with projects offers a better organization of the data.
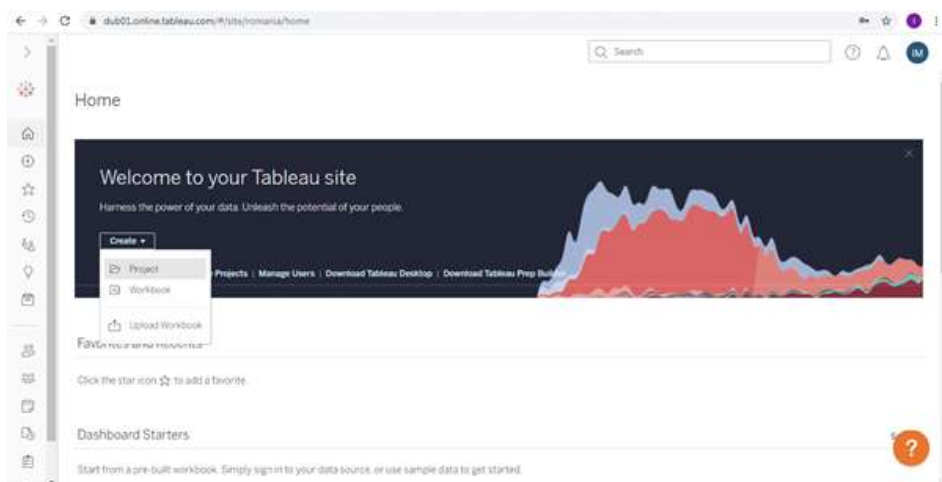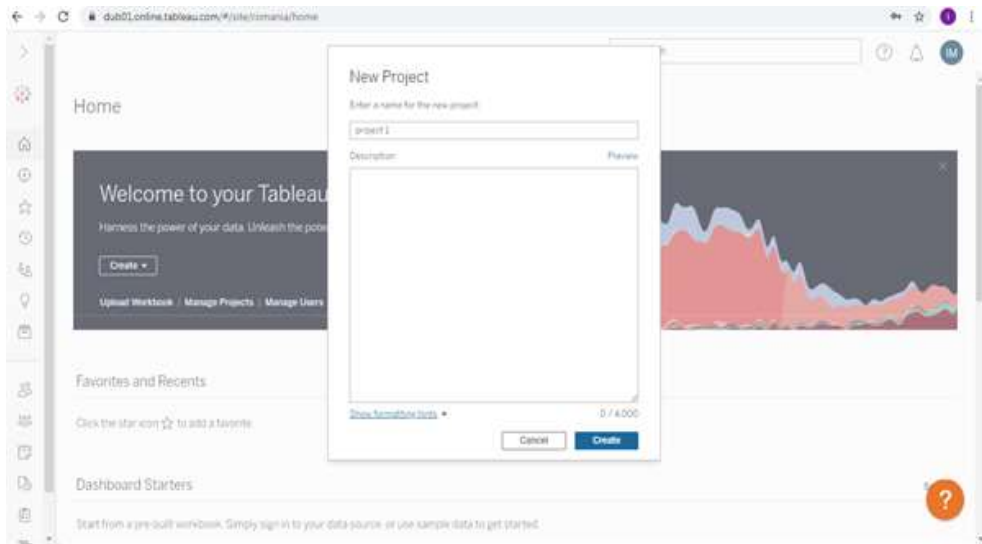
After completing the project, the user proceeds to the next stage - uploading data to the program. It can also load data from an Excel file or enter data from the keyboard. Next we chose to enter the data from an Excel file from the computer.
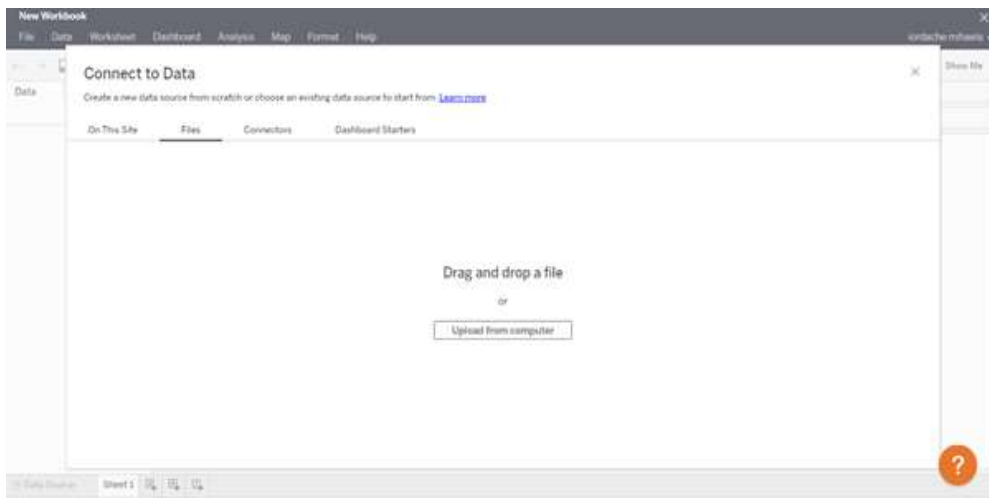

After the data in the file have been selected (spreadsheet), the columns that are of interest in the analysis are selected from the initial data table.
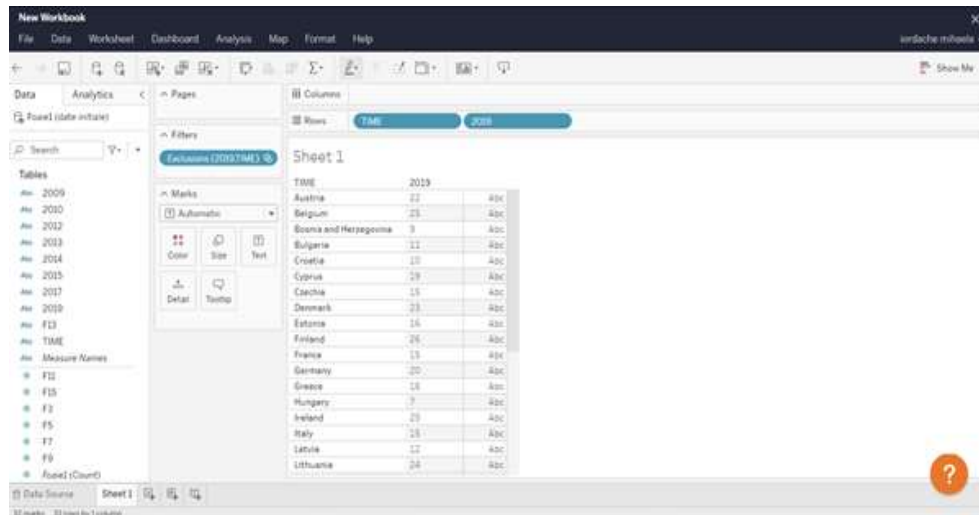
If there is an Excel file with several pages with similar data (for example a column with common data), Tableau Software allows links between its pages. For example, common data refers to the recording of the values of some indicators for the same countries, the same units of measurement and others. We cannot link pages with raw data to pages with aggregated data - such as amounts, averages, percentages, and more.
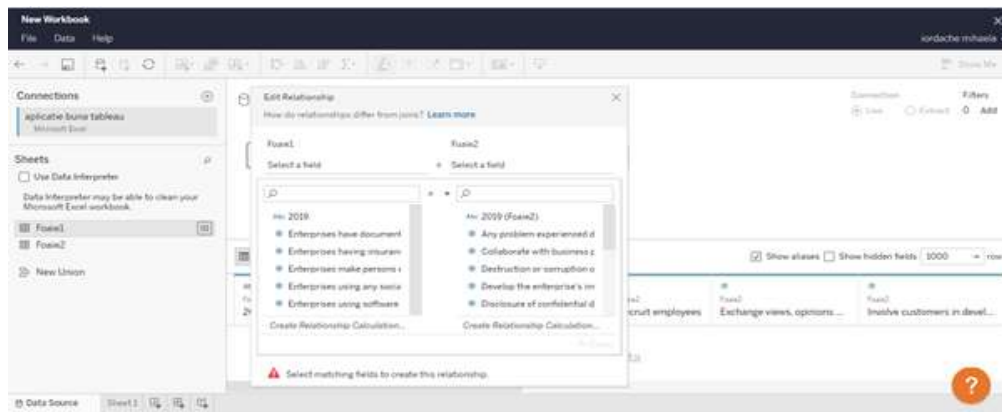
To load data from several spreadsheets in an excel file, select each spreadsheet, then click the update now button.
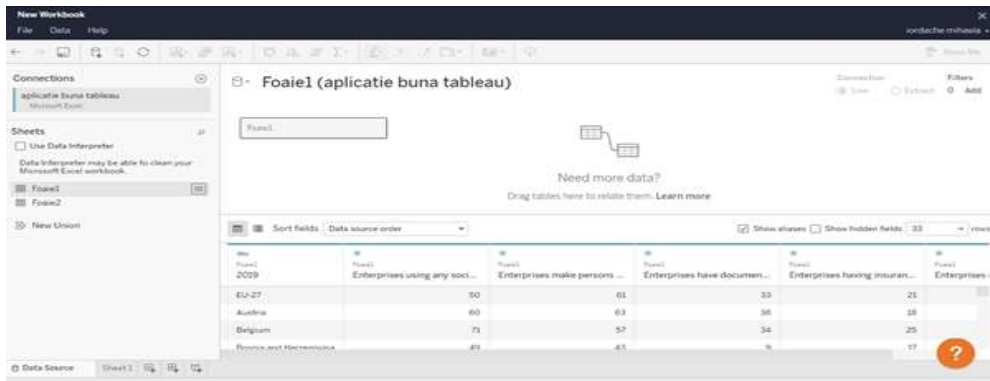
After loading the raw data from Excel files, you can move on to viewing them more easily by making graphs. Thus, the data can be viewed according to the options chosen by the user.
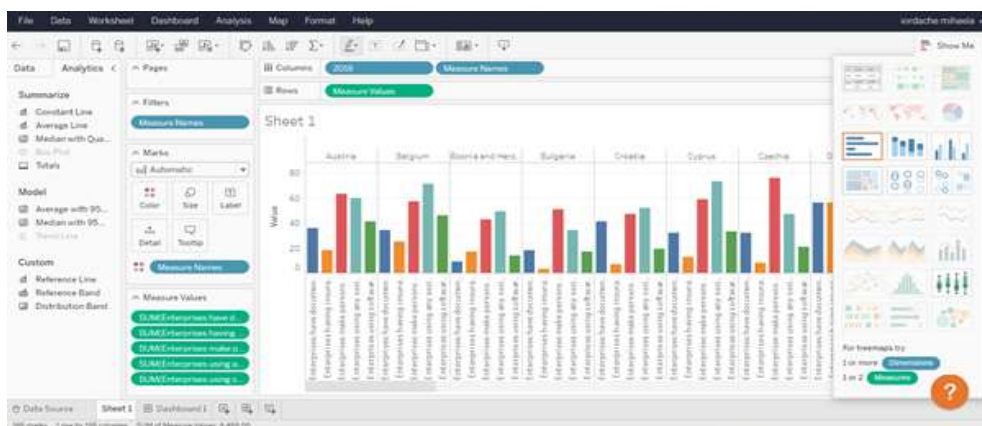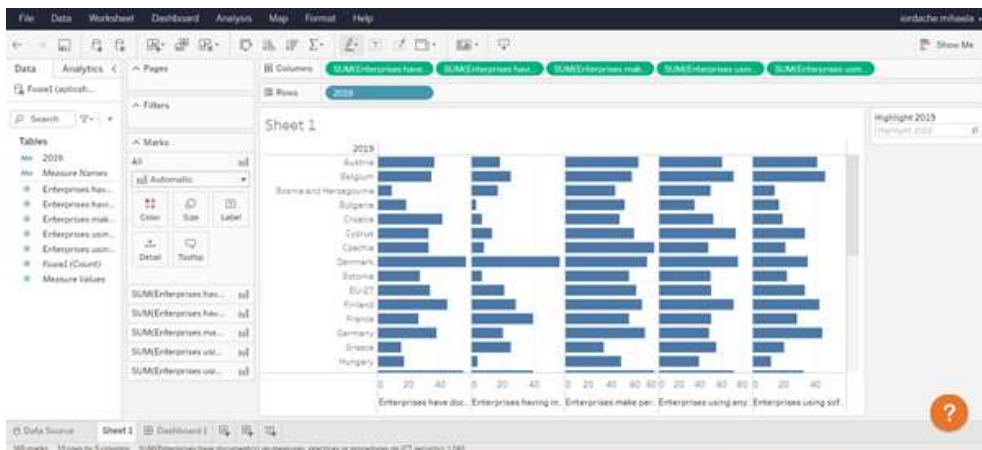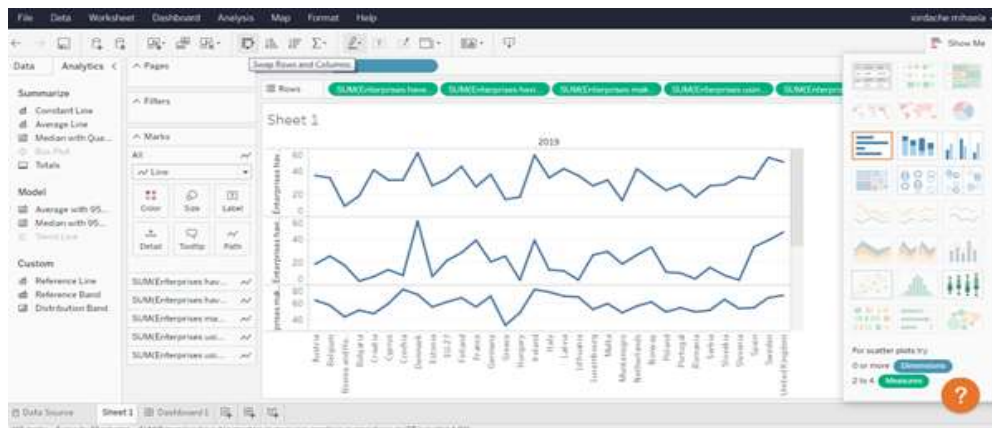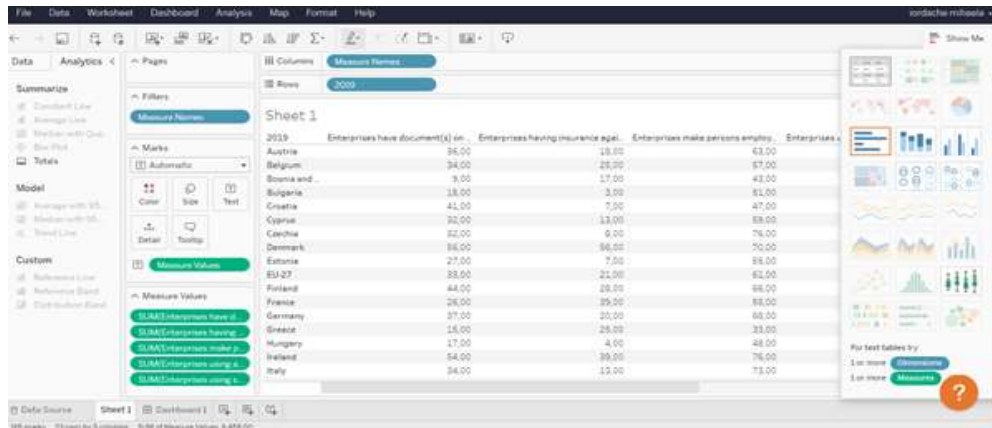
Depending on the information needs that underlie the decision-making at the managerial level, various aggregate indicators can be calculated (total grades - per row / column / total grade / and others).

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4. Conclusion

E-commerce is no longer something new for the Romanian society, as it was ten years ago, anyone can place an order online, without making a trip to the store and without this being a fad. At the same time, studies show that t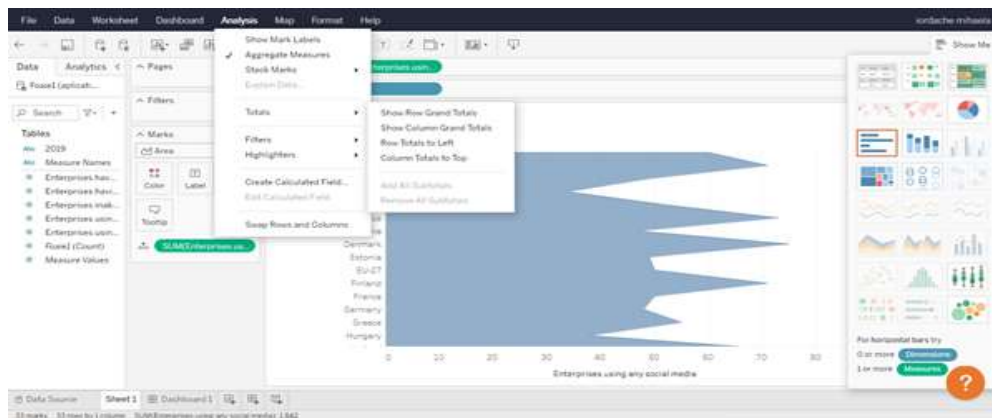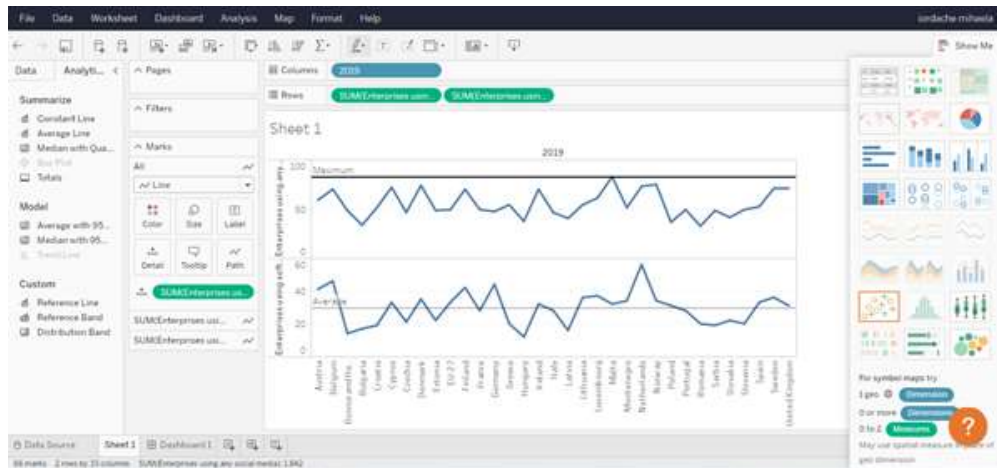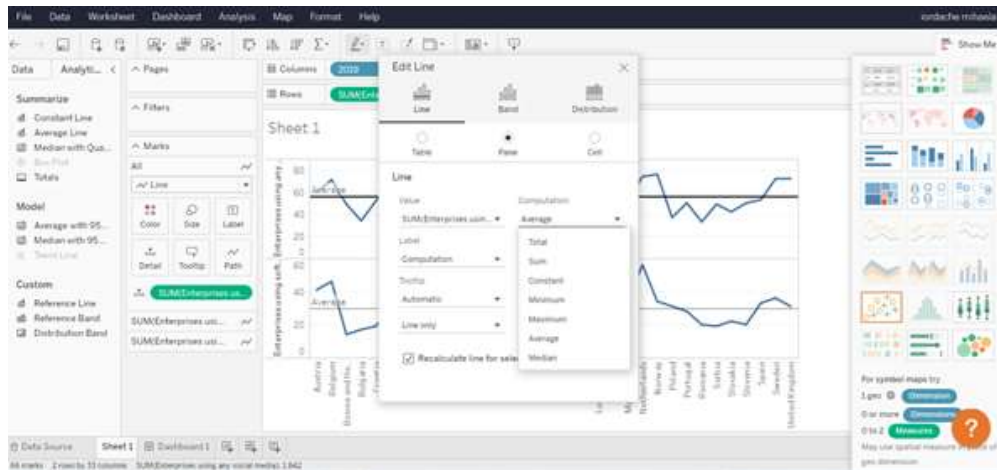raditional sales are not being replaced by electronic ones, so both types of sales are important for a business. However, online sales offer an easier opportunity to study the buyer, his behavior on the site, general business trends and building sales forecasts, and in this area, Business Intelligence applications have become increasingly qualified to provide a answer as close to the truth as possible. The importance of using the Cloud for a BI tool comes at the same time as reducing the costs of implementing IT infrastructure, BI application developments and hiring qualified staff, but also with the changes in data volume, which can be unexpected and the changes at the infrastructure level, they will become more expensive and more difficult to

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implement, compared to cloud services that allow scalable capabilities to be clicked, and payment is often made only for what is used in the cloud.

References

[1] http://www.rasfoiesc.com/business/economie/comert/COMERTUL-ELECTRONIC-CONCEPTE-G12.php

[2] www.legi-internet.ro/introd_comel.ppt

[3] https://nvlpubs.nist.gov/nistpubs/Legacy/SP/nistspecialpublication800-145.pdf

[4] *https://blogs.msdn.microsoft.com/dachou/2018/09/28/cloud-service-models-iaas-paas-saas-diagram/*

[5] https://en.wikipedia.org/wiki/Cloud_computing#cite_note-The_real_limits_of_ cloud_computing-116

[6] https://timoelliott.com/blog/2013/02/gartnerbi-emea-2013-part-1-analytics-moves-to-the-core.html

[7] https://www.govtech.com/security/Cloud-Computing-Public-Sector-Opportunities.html

[8] http://dresneradvisory.com/

[9] https://cloudsecurityalliance.org/wp-uploads/2011/07/csaguide.v2.1.pdf

[10] https://ec.europa.eu/eurostat/statistics-explained/index.php/

[11] https://intellipaat.com/blog/what-is-tableau/

[12] https://nvlpubs.nist.gov/nistpubs/Legacy/SP/nistspecialpublication500-292.pdf

[13] https://powerbi.microsoft.com/en-us/

[14] https://www.datapine.com/blog/cloud-vs-on-premises-bi-strategy/

[15] https://www.govtech.com/security/Cloud-Computing-Public-Sector-Opportunities.html

[16] https://www.phocassoftware.com/software/what-is-business-intelligence

[17] https://www.tableau.com/

OBTAINING THE NUMERICAL RATIO OF CORNERED-SOUND SOURCES

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Abstract: *The placement of loudspeakers in a room, from home systems to concert rooms, has been studied for many years. As a consequence of this throughout the years audiophiles and professionals have developed rules and methods concerning the placement of cornered-sound sources. There are reasons to choose the best places of a loudspeakers in a room, from getting a better sound quality to avoiding acoustical problems such as resonances, standing waves, reverberation or just the esthetic of the cornered-sound sources. It is well known that placing a loudspeaker on the floor, against a wall or in a corner increase the Sound Pressure Level in varying increasing values. However, audiophiles have different opinions about the sound quality that can be obtained. These extra dBs can help us to increase the Sound Pressure Level in cases when we do not have any more loudspeakers. In this paper we want to establish a numerical relationship between some of the rules and methods mentioned used by audiophiles and practitioners; this relationship will be established by means of a rudimentary experiment placing a loudspeaker in a corner.*

Introduction

Resources must be handled with care in limited or low budget projects. The genesis of this work was the personal experience of the authors when installing the sound sources for a concert using the equipment of a small audio rental company. There were four speakers, two for each side of an open-air acoustic shell. The speakers were to be placed on top of two 6-feet scaffolding towers.

During the initial testing the technicians, at 150 feet from the sources, thought that the speakers on one side of the acoustic shell were not working because they could not hear any sound coming from them. However, when they walked into the shell they were surprised because they could hear sound coming from all speakers in the shell. They were further surprised when they realized that the speakers located at the side of the shell from which they could not hear any sound were place on the scaffolding towers. The speakers located at the side of the acoustic shell from which the technicians could hear a sound were located on the floor.

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Technicians know the rule-of-thumb that a "loudspeaker on the floor has a Sound Pressure Level gain of +3dB, on the floor and against a wall a gain of +6dB and, in a corner, a gain of + 9 dB." Verifying personally on the field what the theory states was a pleasant experience. However, under the current circumstances and with limited number of speakers, at 150 feet, the sound coming from by the speakers on the scaffolding was missing and it is necessary to produce a satisfactory quantity of sound [1].

After this unexpected and inexplicable event, we wanted to recreate a similar experience in the studio, first, by placing a loudspeaker hanging from the ceiling and, second, placing it at a corner.

From sound theory [2] we know that if we assume that the sound source is at the center of a sphere of a given radius r, the sound energy will travel through the 8 quadrants (right spherical triangles) of the sphere [3]. Now, if we place the sound source at a corner of the room, the area of the sphere is reduced to 1/8 of its area when it was at an elevated position. Due to the configuration of the walls, the sphere is reduced to only one quadrant. However, because the sound energy remains the same the sound intensity travelling through the quadrant will increase an eightfold. According to the dB Power Ratio we know that every time the number of sound sources is doubled this will result in an additional gain of +3dB. This is so because each time you double the power ratio into the formula $Lp = 10*log (P1/P2)$ you will get +3dB. Likewise, continue doubling of the sound source will result in +6dB, +9dB, etc.

1 Rudimentary experiment cornering a loudspeaker.

We proceeded placing the monitor loudspeaker on a drum throne, taking measurements around a sphere of 1-meter radius. The source signal consisted of a 400Hz tone, getting from an oscillator TEAC model 122A. The amplified loudspeaker was a Thonet &Vander model Vertrac 2.0. The Decibel meters were a portable Radio Shack and application Iphone Decibel X by sky Paw CO. LTD. The hydraulic set of the throne were set to 1-meter height.

The room was a studio recording isolated to 60 dB of attenuation. The reverberation time of the room was 0.6 seconds. The Sound Intensity obtained was 81 dB

Testing 8 points over the front hemisphere, the sound variations were under 2 dB as shown in Figure 1. (Video available at YouTube: Acoustic Prediction Loudspeaker suspended Vs. Cornered)
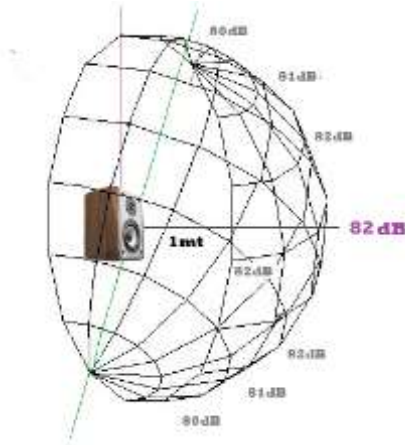
Figure 1. Measurements over the front hemisphere

The step was to place the loudspeaker at a corner (See Figure 2) to test the dB variations while maintaining the same control settings. As we can be seen in the video, uploaded on Youtube, the result was the one we expected according to the rule-of-thumb previously mentioned; an increment of +9dB when compared to the initial suspended position.
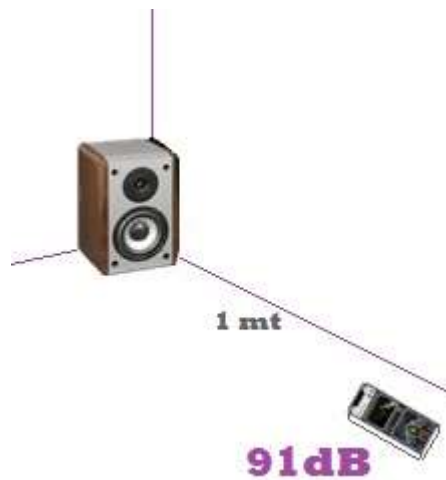
Figure 2. Measurement over the cornered loudspeaker

2.-Calculating the relation.

Knowing that the intensity of the sound is the acoustic power per unit of area in a direction perpendicular to that area, we calculated the area of a 1-meter radius sphere. This area multiplied by the sound intensity will produce the corresponding acoustic power (Expressed in W).

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The rest of this paper aims to justify mathematically the result of the experiment already described.

2.1.-Calculating the surface of a sphere of radius 1.
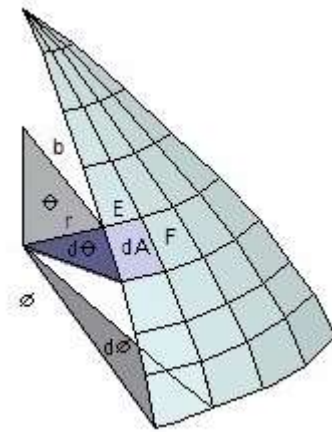
Figure 3. Source of radiation [4]

From the Figure above we can get the following relations. [5]

$$b = r * \sin(\theta)$$

$$E = b * d\emptyset$$

$$F = r * d\theta$$

$$dA = E * F$$

Then we get

$$dA = r * \sin(\theta) * d\emptyset * r * d\theta$$

or its equivalent

$$dA = r^2 * \sin(\theta) * d\theta * d\emptyset$$

Now we can write the integral like

$$\int_0^\emptyset \int_{\theta 1}^{\theta 2} r^2 * \sin\theta * d\theta * d\emptyset$$

Solving the integral for dθ for one hemisphere

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$$r^2 \int_0^{2\pi} (- \cos \theta \ \Big|_0^{\pi}) \, d\emptyset$$

$$r^2 \int_0^{2\pi} (- \cos \pi - (-Cos(0)) d\emptyset$$

$$r^2 \int_0^{2\pi} \left(-(-1) - (1)\right) d\emptyset$$

$$2 * r^2 \int_0^{2\pi} d\emptyset$$

The formula for the area of the sphere is given by

$$A = 4\pi r^2$$

Knowing that its radius 1 meter, the total area is

$$A = 4\pi$$

2.2 Getting the Sound Power on both measurements.

2.2.1 Sound power for 82 dB.

For 82 dB we can use the following formula to get the Sound power expressed in Watts. [6]

$$Lp = 10 * \log \left(\frac{P1s}{P2r}\right)$$

Where Lp is Power the level in dB.
      P1s   is the Sound Power measured with the loudspeaker suspended.
      P2r   is the Reference Power in Watts.

We must find P1s, using the measurement of 82dB as Lp and the reference Level $1*10^{-12}$ Watt as P2.

$$82 = 10 * \log \left(\frac{P1s}{10^{-12}}\right)$$

$$10^{\frac{82}{10}} = \cancel{10}^{\log \left(\frac{P1s}{10^{-12}}\right)}$$

$$P1s = 10^{8.2.} * 10^{-12}$$

$$P1s = 10^{-3.8}W$$

2.2.2 Sound power for 91 db.

For 91 dB we can use the following formula to get the Sound Power expressed in Watts.

$$Lp = 10 * \log\left(\frac{P1c}{P2r}\right)$$

Where Lp is Power the level in dB.
$\quad$ P1c is the Sound Power measured with the loudspeaker cornered.
$\quad$ P2r is the Reference Power in Watts.

We must find P1c, using the measurement of 91dB as Lp and the reference Level $1*10^{-12}$ Watt as P2.

$$91 = 10 * \log\left(\frac{P1c}{10^{-12}}\right)$$

$$10^{\frac{91}{10}} = 10^{\log\left(\frac{P1c}{10^{-12}}\right)}$$

$$P1c = 10^{9.1} * 10^{-12}$$

$$P1c = 10^{-2.9}W$$

2.3 Obtaining the Intensity of the Sound.

Now we will proceed to dividing the Sound Power values previously obtained (P1s= $10^{-3.8}$ W and P1c= $10^{-2.9}$W) by the total sphere's area and 1/8 of this total respectively [6].

$$Is = \frac{10^{-3.8}}{4\pi} \quad 1.26 * 10^{-5}$$

$$Ic = \frac{10^{-3.8}}{\frac{\pi}{2}} = 1 * 10^{-4}$$

Where Is is Intensity of the sound suspended
$\quad$ Ic I Intensity of the sound cornered

3. Solving the numerical ratio

We can now introduce the sound intensity into the dB formula to get the numerical ratio related to the area of radiation. The level (L) in dB will be

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$$L = 10 * \log\left(\frac{1 * 10^{-4}}{1.26 * 10^{-5}}\right)$$

$$L = 9 \ dB$$

Conclusion

In the sound reinforcement field, understanding the behavior of the sound reflection within the acoustical environments can help us to get the maximum efficiency of our resources. Contrary to the empirical studies on this topic by audiophiles, the authors believe that there are situations where it is necessary to increase the dBs based on theoretical foundations.

While the motivation for this paper was open-air and real-life project, it is important to take into account that in closed rooms, we must consider acoustic laws related to phenomena such as early reflection effects, passing through delays, to intelligibility.

As indicated before, keeping constant the sound source power on an imaginary sphere and then concentrating that density over an octant will increase the power ratio eightfold. When this result is calculated by mean of the decibel power formula, we will get 9 dB of gain as it was demonstrated theoretically.

References

[1] Siegfried Linkwitz, Room Reflections Misunderstood?, Audio Engineering Society Convention Paper 7162. NYC, NY, USA 2007
[2] Don Davis and Eugene Patronics, jr. Sound System Engineering 3rd ed. Elsevier Focal Press, 2006
[3] Granville, Smith, and Mikesh. Plane and Spherical Trigonometry and Tables. Ginn and Company, 1934.
[4] H. F. Hopkins and N. R. Stryker, A Proposed Loudness-Efficiency Rating for Loudspeakers and The Determination of System Power Requirements for enclosures. Society of Motion Picture Engineers Convention, 1947.
[5] Jose Mujica, Infinitesimal Calculus with Analytic Geometry and Computing Applied to Audio, First Edition. (In Spanish, Editorial Oasis, Venezuela, 1982)
[6] ISO 3740:2019, Determination of sound power levels of noise sources.

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TAX PRESSURE - GENERATING FACTOR OF FISCAL EVASION IN ROMANIA

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Elena Lucia CROITORU[2]

Abstract: *The Fiscal Pressure implies certain limits of taxability on the part of the contributors. These limits are imposed by the contributor's reactions who can resist to the increase of compulsory duties, reacting by reduction of productive activity, fraud and in the end by evasion. Up to a certain point, if the honest contributor voluntarily makes the tax payment, on a different point, when the taxes exceed certain limits of the sustainability, there are phenomena that bring serious disservice to the state's will of collecting these revenues. The main purpose of this paper is to analyze de influence of the tax pressure on the fiscal evasion and to show that the existence of a high fiscal pressure creates an optimal environment for fiscal evasion.*

Keywords: *tax pressure, fiscal evasion, fraud, shadow economy, taxpayer*

1. The Fiscal Pressure concept

Up to a certain point, if the honest contributor voluntarily makes the tax payment, on a different point, when the taxes exceed certain limits of the sustainability, there are phenomena that bring serious disservice to the state's will of collecting these revenues. So the Fiscal Pressure implies certain limits of taxability on the part of the contributors. These limits are imposed by the contributor's reactions who can resist to the increase of compulsory duties, reacting by evasion, fraud or reduction of productive activity.

The Fiscal Pressure concept is used usually in the designate literature the extent of GDP redistribution through the payment and/or collection of taxes. Thus, fiscal pressure can be defined as the *relative expression of the tax burden borne by the* contributor or *how pressing the taxes are or, in other words, how big the tax burden is on the* contributor's *shoulders.*

In the US, the fiscal pressure is determined by considering the individual income taxes, the taxes on sailed goods and its excise duties, the social securities, the profit taxes, the VAT. Calculating the fiscal pressure at the federal states level, the taxes and fees paid to it are taken into account the property, the inheritance, certain on the sale of goods, *vices taxes.*

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In EU, the fiscal coefficient or fiscal pressure is used in the fiscal practice by considering the tax receipts from: production taxes, income taxes and contributions. Thus, în a study conducted in 2018 at the level of EU Member States on fiscal pressure, the following aspects can be found:

- Regarding fiscal pressure based on contributions, France hit the maximum value – 18%, while the minimum value was registered in Denmark – 0,9%.
- Regarding fiscal pressure based on income taxes, Denmark reached the maximum value with 28,9% and Romania the minimum one – 4,9%.
- Regarding fiscal pressure based on taxes on production, the maximum value was registered by Sweden (22,4%) and the minimum value was registered in Ireland (8%)

	EU	Euro area	Denmark	France	Ireland	Romania	Sweden
Contributions	13.30	15.20	0.90	18.00	4.20	11.50	3.40
Taxes on income	13.20	13.00	28.90	13.30	10.70	4.90	18.60
Taxes on production	13.60	13.30	16.40	16.70	8.00	10.70	22.40
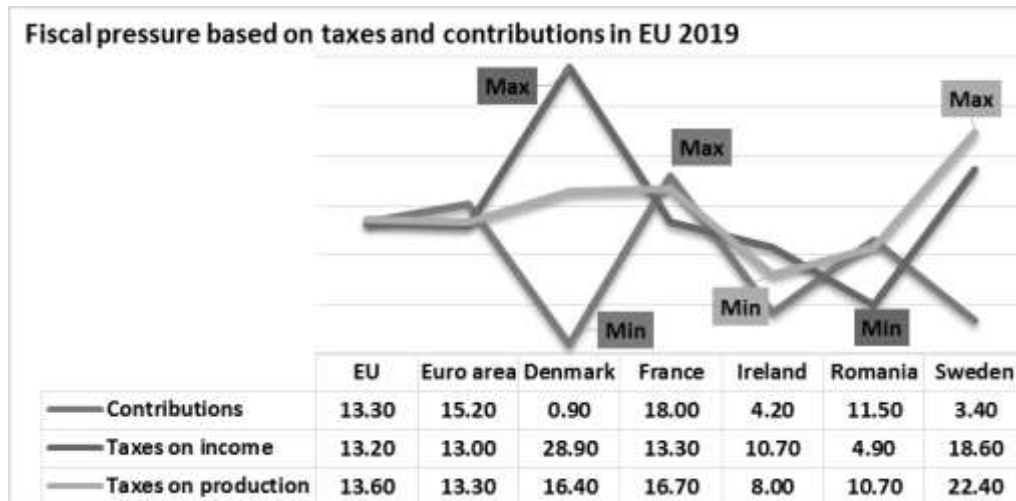
Source: data processed based on Newsrelease 166/2019, https://ec.europa.eu/eurostat/documents
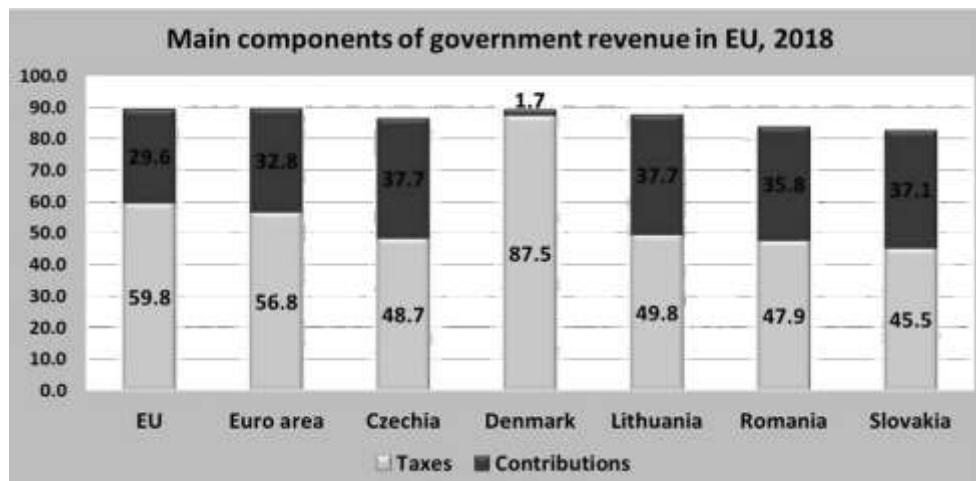
Source: data processed based on, ec.europa.eu/eurostat/documents

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As a result, the fiscal pressure expresses and measures the weight of taxes paid/collected in relation to the GDP.

$$\textbf{Fiscal Pressure} = \frac{\textbf{Fiscal Revenues}}{\textbf{GDP}}$$

The scale and dynamics of fiscal pressure is measured and estimated by the tax rate. The size of this rate shows the share of the national income taken by the state, the size established by tax laws or regulations.

Thus, in practice, three types of tax pressure rates are used:

- *The low tax rate* implies a low pressure on the contributors, so relatively low revenues to the state budget. For some authors of neoliberal orientation, such a tax rate can stimulate the effort to obtain a stability of the available national income, for an acceleration of the economic growth and, therefore, for an increase of the fiscal receipts to the budget.
- *The high tax rate*, especially a marginal rate of increasing taxation, could generate tax evasion and fraud, decrease in GDP, hence decrease of collected taxes to state budget.
- *The optimum tax rate or fiscal pressure* consists of an edge taxation up to and past it where the tax receipts are lower. A rate that exceeds the optimum level has a discouraging effect over both the investors and the employees.

The fiscal pressure is influenced by many factors, of which we mention:

- *External factors such as:* GDP level; the national economy's degree of development; the use of resources prioritisation set by public authorities (social protection / economic development); the efficient use of the public expenses financed by collected taxes from contributors; the contributor's degree of adherence to the government's policy; the contributor's degree of consent to tax payment; the size of the public debt.
- *Internal factors such as:* progressive scale of tax quotas; the way to establish the taxable matter; the products submitted as subject to consumption taxes.

2. The possible effects of high fiscal pressure:

- risk of inflation through taxation - meaning that any increase in tax rates can influence the increase in prices;
- tax evasion and tax fraud;
- diminishing productive efforts (for instance fiscal optimization over fiscal abstinence);
- political resistance - claims, taking positions in favour of some taxes or against others;
- international evasion in the sense of relocation some activities to those countries where the tax legislation is more favourable with the consequences for the country of residence;
- deterioration of international competitiveness. For the developed countries, with significant exchanges, with companies capable of facing competition - it is an important factor of economic growth and employment.

Many specialists envision as the main cause to increasing fiscal pressure the continuous increase of the public expenses, whose evolution is subject to certain economic, social, and political "legalities".

Any significant increase of the tax degree and of the obligatory duties can bring the risk of the competitiveness, meaning a price increase along with decrease of self-financing capacity of investments and/or modernization.

Opinions may differ from one author to another. Thus, J.B. Say proposed the minimum tax, while D. Ricardo believes that any tax deduction reduces by itself the accumulation power of capital.

Proponents of Keynesian theory believe that an imposed limit on tax deductions would be related to certain confusions, or technical purposes, because the contributors benefits from paying taxes to growing financial public resources would not be taken into consideration.

The fiscal pressure's optimal level was a particular concern to the economist Laffer, who represented the graph (Laffer curve), in 1974, starting from an idea of A. Smith (1776) - the tax rates, if they are too high could destroy the basis on which taxation acts.

Graphical representation of Laffer curve
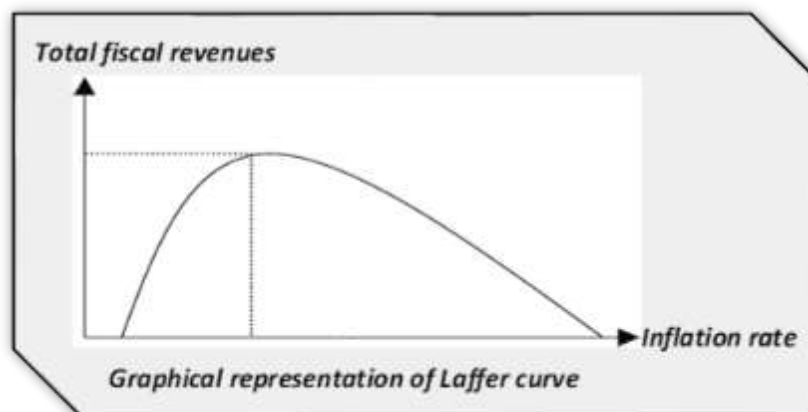
Laffer estimates that there is a verge of fiscal pressure, which can lead to a reduction in the tax return if exceeded also discouraging the contributors to invest, produce, save.

According to the Laffer curve, the sum of the mandatory duties is a tax pressure rate increasing function only up to a maximum verge that corresponds to the maximum level of the curve, after which decreases until is cancelled if the rate reaches the theoretical level of 100%. Also, this verge differs not only from one fiscal system to another, but also from one tax to another and according to contributors and its capacity to withstand the fiscal pressure.

3. Fiscal pressure indicators

In practice, tax duties are identified mainly by taxes and fees, which represent the oldest and traditional means of financing that the state has available for carrying out its functions and tasks, while being in a permanent evolution. In addition, the public authority also calls for the establishment of special contributions, called contributions, in order to ensure adequate social protection for people in difficulty.

Theoreticians who consider social contributions as tax deductions are based on the inclusion in the structure of state budget of public budgets nourished through the mandatory collection of these contributions. Although social contributions pressure the subjects, they support them, as they are required by law. The distinction between the components of fiscal pressure is important from the following points of view:

- The contributors have a different perception of tax and contributions. If the tax is perceived as an irrecoverable loss, the contributions are perceived as a guarantee or assurance, not being of the direct insurance nature in the future is perceived as a manifestation of social solidarity.
- The administrative capacity of the state is different for the two categories of duties.

The taxation level or the taxation degree, represents the indicator that expresses, in fact, the *fiscal pressure (FP)* and its level.

$$FP = \frac{taxes + fees + fiscal\ contributions}{GDP}$$

Besides the fiscal pressure given by the degree of taxation calculated from a technical point of view, one can also discuss a psychological fiscal pressure considered by the taxability verge of each contributor and his tolerance to taxes. It can be calculated according to the *individual tax pressure (IFP)* formula:

$$IFP = \frac{Tax\ obligations\ borne\ by\ the\ taxpayer}{Tax\ revenues\ obtained\ before\ taxation}$$

This means that the fiscal pressure is given by the tax degree, respectively the degree in which the contributors bear on account of the results obtained from their activity, the taxes and fiscal duties as obligations that must be collected by the state. It should be kept in mind that in case of exceeding the portability verge, the taxes become counter-productive, meaning that they can no longer be paid by its contributors and thus the tax evasion is encouraged.
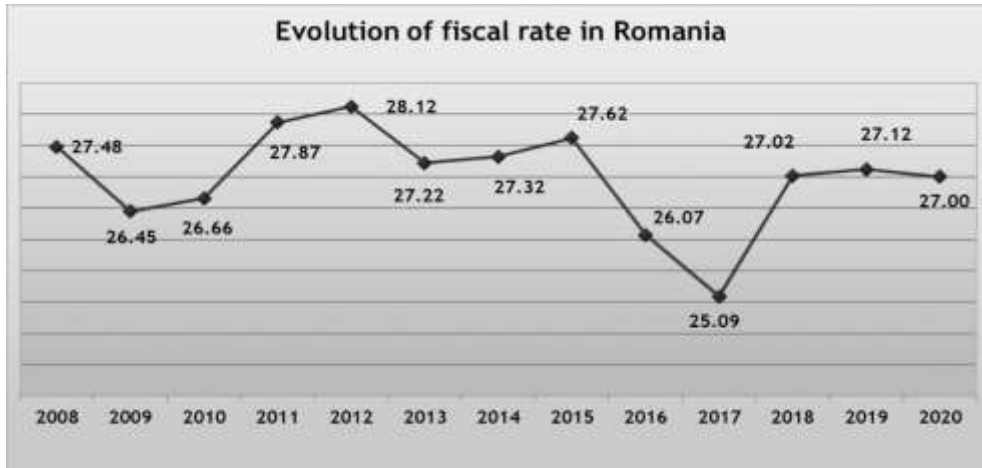
Source: data processed based on ANAF reports 2008-2019, www.anaf.ro

Thus, the evolution of fiscal pressure in Romania in 2008-2019, calculated by reporting the total of fiscal revenues colected by ANAF and GDP is constant (with a value of 27%), recording a minim in 2017 (25,09%) and a maximum in 2012 (28,12%).
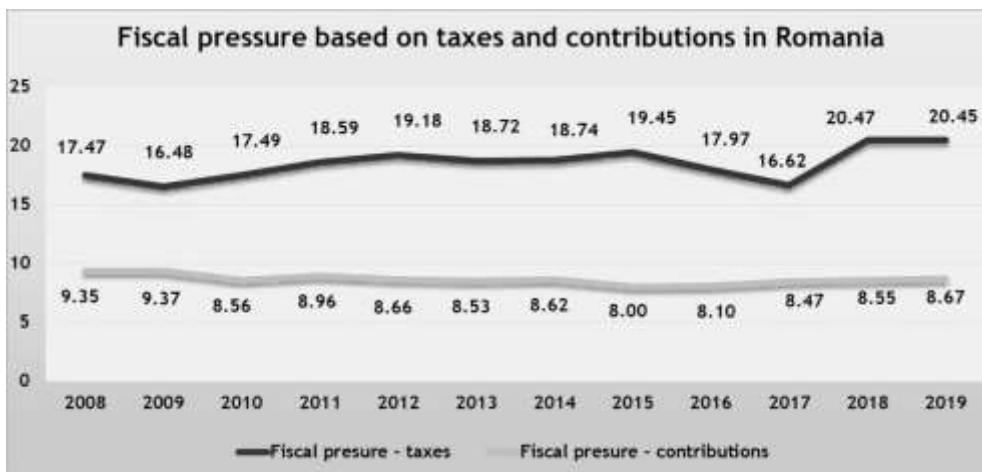
Source: data processed based on ANAF reports 2008-2019, www.anaf.ro

Also, if we analyze the evolution of the fiscal pressure on the main categories of fiscal obligations in the period 2008-2019 (taxes and contributions) we can see that the evolution of the fiscal pressure related to both taxes and social contributions is relatively constant throughout the study period. At the same time, the graph shows that the fiscal pressure exerted by taxes is approximately twice higher than the contributions for the entire analyzed period. In the case of the fiscal pressure generated by taxes in the period 2008-2019, the average of the indicator is

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approximately 18.5% with a minimum of 16.48% registered in 2009 and a maximum of 20.47% registered in 2018. While, in the case of the fiscal pressure generated by contributions in the same period, the average of the indicator is approximately 8.6% with a minimum of 8% registered in 2015 and a maximum of 9.37% registered in 2009.

4. The tax evasion concept

The tax law imposes so many fiscal obligations that the pressure resulted as a direct effect became the motivation into creative smart activities in order to avoid it. These activities happened of course, with sustain backup coming from law and fiscal experts.

Tax evasion has been always an witty active job due to the impact that fiscal dues wields upon the contributors wealth, tangible to the most sensible point, money.

Tax evasion is one major interest chapters of most studied ones in Public Finances and Fiscal and Financial Law courses, both by theorists or practitioners as well as by ordinary people, who show interest in such fields. However, despite everything that has been and will be written of its causes, forms, modalities, extent, control and sanctions to combat tax evasion, the word itself that describes this phenomenon is quite inaccurate and so it is the corresponding field. Thus, tax evasion is a notion difficult to postulate since there is no self-defining/proper definition, *being associated with three meanings and a double appreciation in terms of legality*:

- 1st meaning attributed to tax evasion, especially in the period between the two world wars, was: *it is included in the tax fraud taking an extensive form*.
- 2nd the most common meaning is *tax evasion is assimilated to fraud*.
- 3rd meaning is a broader definition of tax evasion, which also includes tax fraud.

Tax evasion is a logical result of flaws and inconsistencies flowing from the imperfect and badly assimilated legislation and its application methods, wicked methods, as well as of the unpredictability and failure of the legislator, whose excessive taxation is as guilty, as those who cause this evasion.
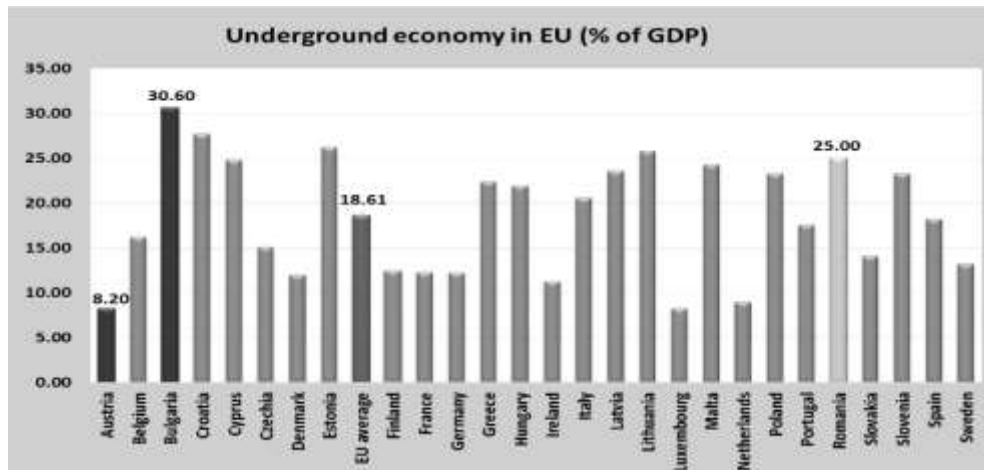
Source: Source: data taken from the study conducted by Professor Schneider, University of Linz, Austria, September 2019, www.econ.jku.at
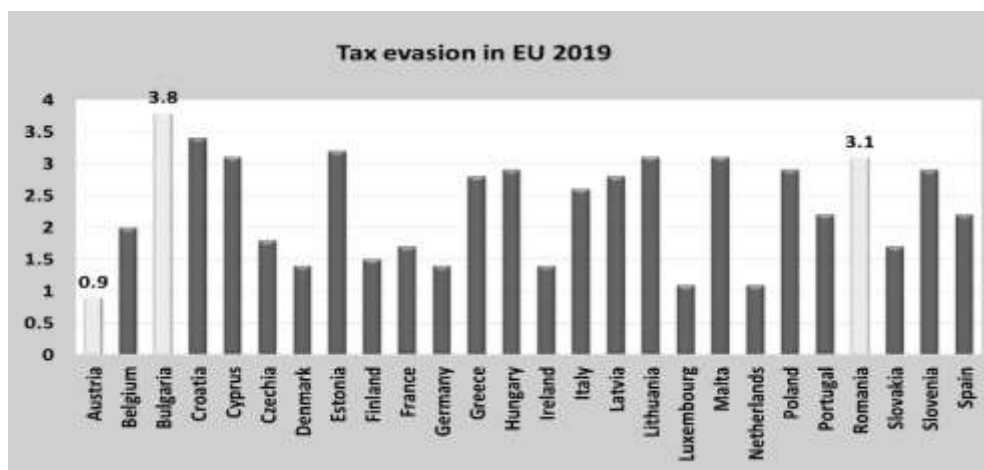
Source: data taken from the study conducted by Professor Schneider, University of Linz, Austria, September 2019, www.econ.jku.at

The migration process of capital and labour towards the states with lower taxation determines the need to approach new mechanisms of control at EU level.

In order to prevent tax evasion and fraud, with serious consequences on EU financial resources, EU decision-makers have adopted a series of measures aimed at counteracting the negative effects that fiscal optimization solutions have on EU financial resources.

In parallel with fiscal harmonization and the coordinated efforts, the EU stepped up its fight against tax evasion and fraud, which poses a threat to fair competition and is the cause of a major budget deficit. Also, combating tax fraud and aggressive tax planning is a major challenge for the EU. Improving tax cooperation and

coordination along with increasing transparency in the relations between Member States in the field of fiscal policy allows them to avoid significant revenue losses and at the same time contributes to ensuring a high level of equity at EU level.

In order to complementing the made progress, the EU through the Commission has proposed several new initiatives in this area. These initiatives include a proposal to revise the Directive on administrative cooperation and amendments to the Fourth Money Laundering Directive. In addition, the EU aims to relaunch the proposal on a common corporate tax base and to draw up a comprehensive list of tax havens.

Also, in recent years, the EP has played an important role in developing new fiscal policies and launching new initiatives in combating tax avoidance, tax evasion, aggressive tax planning and money laundering.

5. Tax evasion causes

Tax evasion is one of the most complex economic and social phenomena of the utmost importance that today's states deal with and whose undesirable consequences seek to limit them as much as possible, totally eradication of it being impossible.

The effects of tax evasion directly affect tax revenues at all levels of, leading to market mechanism distortion and might contribute to social inequalities (with their increase) due to "access" and "inclination" to tax evasion of the contributors.

The dimensions of tax evasion differ from country to country, depending on their tax laws and realities also the effectiveness of its fiscal system, measured not so much by the level of tax revenues attracted to the budget, but by consented tax degree.

The state's level of tax evasion is inversely proportional to the tax rate of contributors in that state.
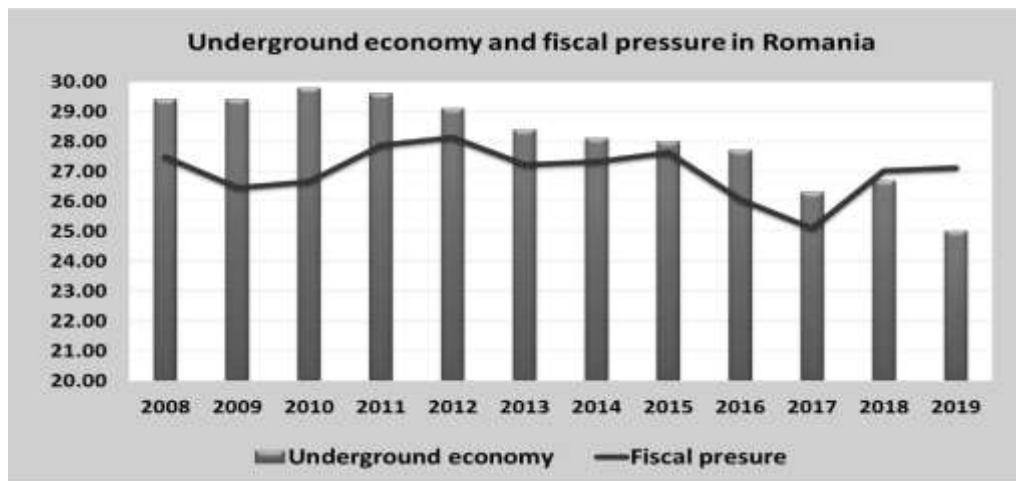
Source: data taken from the study conducted by Professor Schneider, University of Linz, Austria, September 2019, www.econ.jku.at and data processed on ANAF reports 2008-2019, www.anaf.ro

In order to properly comprehend and dimension the tax fraud phenomenon, to elaborate and apply effective measures against it, we must first understand its causes.

The tax evasion has many causes of which we mention the most important ones as it follows:

- excessive taxation (fiscal pressure), especially for some contributors this excess is partly explained as rightful, precisely the extent of tax evasion;
- the fiscal legislative system, which in addition to being incomplete, presents large gaps, inaccuracies and ambiguities that creates a vast maneuverer space for the tax contributor to evade the payment of fiscal obligations;
- contributor's psychology along with insufficient fiscal and civic education;
- the way of organizing, functioning and the endowment of the fiscal structures and those of the financial-fiscal controlling;
- lack of clear, precise, and unitary regulations to combat this phenomenon.

The avoidance possibilities differ from one social category to another, depending on the nature and origin of the income or assets that are subject to taxation, the way in which the taxable matter is established and the fiscal control is organized, as well as other specific factors. The employees are the ones of all the social categories who have the least possibilities of circumvention, because their imposition is made based on the declaration of the employer. In contrast, industrialists, traders, freelancers have full opportunities for tax avoidance, since taxation is based on a declaration.

6. Conclusions

When the fiscal dues burden too hard on a taxable matter has a tendency to escape from it, so they "get on the run" with taxable matter.

The fiscal fines will not cause the taxpayer to declare his exact income gained, but to take a series of careful measures and precautions in order to evade the obligations towards the state. There is a phenomenon called *the taxpayer psychology* to not pay only what one can't afford. The tax evasion spirit arises from a playful preoccupation on the subject and is a form of human selfishness. This mentality and conduct also occurs even to the most honest ones and consist in the withdrawal of his duties towards the tax, without any hesitation.

Our human nature tends to place the particular preoccupation before the general wellbeing considering taxes more of a burden instead of a legitimate contribution to the public expenses as there are needed for the good functioning of our society. Since ancient times, taxpayers have sought to reduce their tax obligations, using the most diverse and creative methods. To deceive fiscal structures is a test of ability instead of dishonesty; to pay the said taxes seems to be more of a naivety proof instead of integrity. This represents the *human nature's spirit* to evade from the tax

obligations, lively and strong demonstrated through the various classes of contributors.

References

[1] Brezeanu, P. *Fiscalitate. Concepte, teorii şi abordari practice*, Editura Wolters, [Bucureşti], [Romania], 2009;

[2] Dobrotă, G., Chirculescu, M.F. *Analiza presiunii fiscale şi parafiscale în România şi în Uniunea Europeană*, Analele Universităţii "Constantin Brâncuşi", Seria Economie, 4/2010, [Târgu Jiu], [Romania], 2010;

[3] Hoanţă, N. *Evaziunea fiscală,* Tribuna Economică, [Bucureşti], [Romania], 1997;

[4] Moraru, D. (coord.). *Finanţe publice şi evaziune fiscală,* Editura Economică, [Bucureşti], [Romania], 2008;

[5] Nedelescu, D.M., Croitoru, E.L. *The influence of fiscal pressure on performance administration of the fiscal system in Romania*, Romanian Economic Business Review, pag 40-46, ISSN 1842-2497, ISSUE 4, VOLUME 13, WINTER 2018, [Bucureşti], [Romania], 2018;

[6] Schneider, F., *Shadow economies around the world with latest results (2019) for Romania and her neighboring countries: What did we learn over the last 20 years?* University of Linz, [Linz], [Austria], 2019;

[7] Toader, S. *Evaziunea fiscală în Romania în perioada de tranziţie,* Editura PROUniversitaria, [Bucureşti], [Romania], 2007;

[8] Toader, S. (coord.). *Fiscalitate. Reglementare şi practică fiscală*, Editura Universitară, [Bucureşti], [Romania], 2010;

[9] Ungureanu, M.A. (coord.). *Politici şi Practici Financiare,* Editura Universitară, [Bucureşti], [Romania], 2013;

[10] Ungureanu, M.A. (coord.). *Fiscalitete comparată şi tehnici de optimizare fiscală,* Editura Universitară, [Bucureşti], [Romania], 2017;

[11] ec.europa.eu

[12] www.europarl.europa.eu

[13] www.anaf.ro

[14] www.bnr.ro

[15] www.econ.jku.at

ADAPTIVE IMAGE DENOISING SOLUTION

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Abstract: *Digital images can be affected by many phenomena which corrupt the image, reducing its quality and which fall under the name of noise. Image noise is usually named after the distribution of the noise signal. As such, the noise signals are encountered and can be modeled by a Poisson, Gaussian, or even normal distribution or salt and pepper noise, which represents very high and very low impulse signals. This article aims to describe a simple voting image denoise algorithm that combines several filters that are specialized in certain types of digital image noise. The obtained results are compared with a well-established denoising technique, comparing the resulting image quality, and compute time.*

Keywords: *image denoising, Gaussian noise, salt and pepper noise, voting system, median filtering, bilateral filtering*

1. Introduction

For a digital camera sensor to capture light, it is equipped with charge wells, that when hit with photons they store and accumulate photoelectrons. As the electrons accumulate, the light intensity of the pixel corresponding to the charge well increases, but due to thermal effects, thermal electrons can also appear and get stored in the charge well. These electrons are characterized by a Gaussian distribution and are known as Gaussian noise [1]. The image can also be affected by salt & pepper noise, which can appear during the ADC conversion, the transmission of the image, or by shot noise caused in low light conditions by the discrete nature of photons, which is represented by a Poisson distribution.

Image denoise is the process of reducing or eliminating the noise from an image, thus bringing it closer to its original form. Image denoise can also be helpful when trying to add missing data to a picture, such as when we are dealing with shot noise or rendering optimization techniques.

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The goal of this paper is to find a simple and intuitive image denoising algorithm that combines several known algorithms through a voting system. Such a system would decide how much and in what way each algorithm should contribute to the final image. In order to obtain this system, this research targets specific types of noise and tries to identify and remove them individually. This work will assume that the images used are grayscale, namely that they have an only one-color channel, although these concepts can be extended to color images.
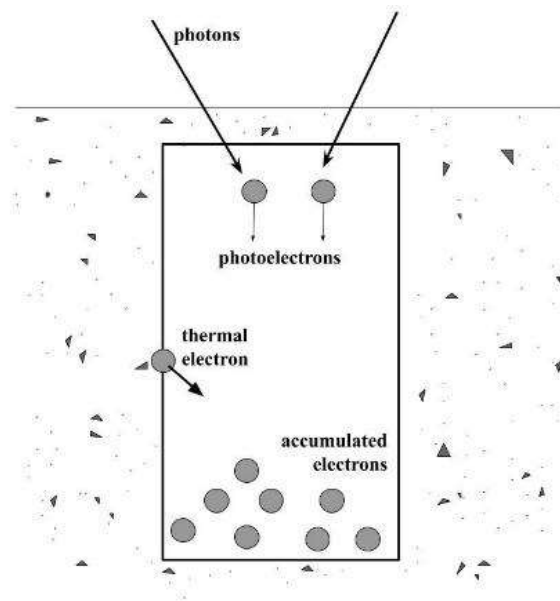
Figure 1 Charge Well Representation, Adapted from [1]

1.1. Previous work

Image noise is a severe problem affecting several areas of work and research, from computer tomography to astronomy. The noise models encountered in these various areas differ, be it Gaussian, speckle in ultrasound images, Rician noise in MRI images [4] or salt and pepper noise caused by transmission or ADC errors, as well as others.

The earliest attempts to reduce noise started with image processing in the spatial and frequency domain, but soon after they moved to the wavelet transform domain, much of the interest being attributed to Donoho [8].

To understand the dimension of image denoise, it is essential to give a broad categorization of the various techniques used in academia. In the area of probability theory, statistics differential equations, the list of denoising algorithms can contain spatial domain filtering, random fields, domain thresholding, statistical models, dictionary learning methods, diffusion methods, and hybrid methods [11].

Besides these methods, this listing also includes spatial adaptive filters, stochastic analysis, morphological analysis, statistical estimators, and order statistics [12].

The article [14] mentions that methods based on spatial domain filters are suitable for decreasing the high-frequency noise, in detriment of blurring the contrast information. In the case of dictionary learning, the method proposes unnecessary and overcomplete dictionaries. For this scenario, the load is computational heavy. Hybrid methods boost the quality of denoised images and have an ample increment in PSNR [10].

One of the most popular and efficient techniques mentioned in scientific research block-matching with 3D filtering (BM3D) [2]. BM3D reached the theoretical limit for image denoising, but AI techniques have the potential for advancement in the field [13]. Knaus and Zwicker obtain another remarkable result in this domain. They propose dual-domain image denoising (DDID), a simple algorithm that produces exceptional results [15].

A comprehensive survey of the various denoise techniques used in different domains of activity, as well as their evolution over time is presented in Motwani et al. [4].

In recent years, the focus moved to more exotic methods, such as 3D filtering in [2] and the use of deep neural networks for noise removal [3][9] that have promising results.

1.2. Problem motivation

Image denoising has many applications, from restoring old pictures or enhancing new ones, to correcting acquisition ADC errors on digital cameras or corruptions caused during image transfer. Furthermore, image denoise became even more of an interesting problem as it nowadays is an essential preprocessing step in real-time ray tracing, by approximating missing data that could not be otherwise computed in real-time.

2. Proposed method

As stated before, this paper recommends a method for filtering specific types of noise, precisely Gaussian and salt-and-pepper by identifying them individually and applying filtering techniques. The characteristics of the noise are adapted and then combined through a voting-based algorithm. The first step is removing salt and pepper noise and then proceeding with analyzing the image in order to remove the Gaussian noise.

2.1. Salt and pepper

Since salt and pepper noise is characterized by impulses of very high and very low pixel values, a popular and straightforward method of eliminating the noise is by using a median filter, which is a non-linear filter for each pixel in the original

image. It computes and substitutes the original pixel with the median value in the neighborhood of that pixel (1), where it represents a user-defined neighborhood around location [6].

$$y[m, n] = median\{x[i, j], (i, j) \in \omega\} \tag{1}$$

Although this filter can successfully remove most or even all the salt and pepper noise, it has the disadvantage that it tends to degrade the rest of the original image as well. In this step, the mission is to replace only the noisy pixels of the image, leaving as many useful pixels unchanged as possible. The essential property of the salt and pepper noise is used to achieve that. It has values either very close to zero or one (the maximum intensity value). With that in mind, it can be proposed to create a mask equal in size to the original image, having values of one on the positions corresponding to noisy pixels (values very close to zero or one) and values of zero on the rest of the mask. After that, it can proceed to apply the median filter to a copy of the original image. Lastly, the pixels from the median image are copied to the original image only on the positions where there is a value of one on the mask. As expressed in (2), where *y* is the resulting image, *x* is the initial image, *t* is the median filtered image, and *i* is the mask. A comparison can be seen in Figure 2.

Figure 2. From left to right: a. Salt and pepper noise; b. median filtered image; c. image filtered with our method

$$y[m, n] = \begin{cases} x[m, n], i[m, n] = 1 \\ t[m, n], i[m, n] = 0 \end{cases} \tag{2}$$

Gaussian noise, on the other hand, has the property that it can be averaged out by applying an averaging filter such as a box filter or a Gaussian filter. Nevertheless, since these types of filters behave like a low-pass filter, all high-frequency signals in the image will be dampened, which can be observed in the resulting image as smoothed edges. Since this is an undesirable effect, denoise filters, like the bilateral filter, have been developed to preserve the edges.

The method assumes a Gaussian distribution of noise in the input image and uses a method from Gonzalez et al. [5] to identify the standard deviation of the Gaussian noise distribution, which it will then pass to the bilateral filter as a standard color

deviation. For the pixel diameter and space standard deviation, the values of 25 pixels and 21 pixels are chosen empirically. First, it uses the input image from which the salt & pepper noise has been filtered out, and it creates a preliminary heavily filtered image by applying the bilateral filter with some predefined parameters. At this point, the intention is to remove the Gaussian noise from the image without concerns of losing image quality. Afterward, it can subtract the filtered image from the noisy image and obtain the high-frequency signal of the noisy image. The assumption here is to be mostly the Gaussian noise. After, it proceeds to compute the standard deviation of the noise map and use this value as the standard color deviation of bilateral filtering on the original image, having the other two parameters, the pixel neighborhood diameter and the spatial standard deviation set to predefined values.

When putting both filters together, the result is an adaptive solution for filtering both types of image noise, represented in Figure. 3. In contrast, the results of applying the combined algorithms can be observed in Figure. 4.
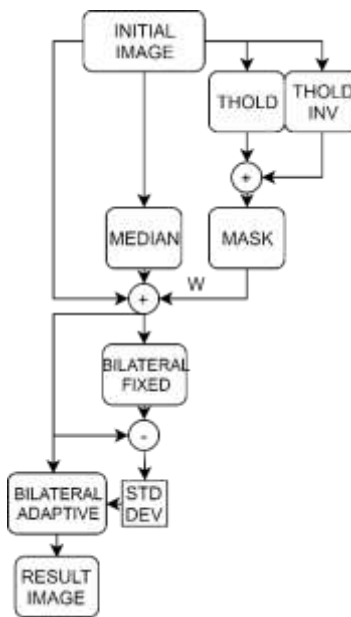
Figure 3. Proposed solution

3. Performance measurements

The focus of this section is to compare the result of the proposed algorithm with the Fast Non-Local Mean Denoise (FNLMD) implemented in OpenCV. We are interested in the MSE, PSNR, and compute time for the two algorithms, given an image of a specific size and standard deviation for the Gaussian noise map, which we combine with the original image through an averaging. The images are grayscale single-channel, ranging from 490x733 to 3840x2160 pixels in size. The

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results are represented in Table 1, and a sample of the resulting pictures can be observed in Figure 5.

Figure 4. From left to right: a. Image affected by salt and pepper and Gaussian noise; b. Image filtered without salt and pepper noise filter; c. Image filtered using both filtering methods

The observation here is that the proposed method performs well for small amounts of Gaussian noise, but it is outperformed by FNLMD as the standard deviation of the noise increases. It also performs very well when removing salt and pepper noise, removing it almost completely, while FNLMD fails to remove most of this type of noise. Another aspect that stands out is the compute time, which can be up to two orders of magnitude smaller for usual images.
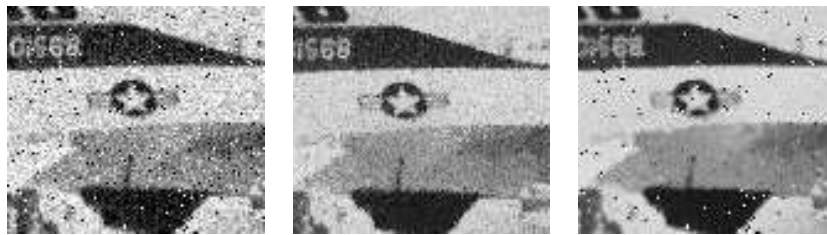
Figure 5. From left to right: a. Image affected by salt and pepper and Gaussian noise; b. Image filtered without salt and pepper noise filter; c. Image filtered using OpenCV FNLMD

Algorithm	FNLMD and Voting Performance Comparison				
	Image size	*σ*	*MSE*	*PSNR*	*Time(s)*
Noisy	490x733	0.05	0.0102	19.883	N/A
	490x733	0.15	0.029	15.258	N/A
	1920x1080	0.05	0.0109	19.588	N/A
	1920x1080	0.15	0.0304	15.159	N/A
	3840x2160	0.05	0.011	19.494	N/A
	3840x2160	0.15	0.0307	15.116	N/A

	490x733	0.05	0.0016	27.845	0.325
	490x733	0.15	0.007	21.305	0.267
Voting-Based	1920x1080	0.05	0.003	25.068	0.625
	1920x1080	0.15	0.009	20.107	0.626
	3840x2160	0.05	0.003	24.25	2.447
	3840x2160	0.15	0.01	19.826	2.519
	490x733	0.05	0.005	22.704	9.346
	490x733	0.15	0.003	25.109	8.74
FNLMD	1920x1080	0.05	0.008	20.508	37.555
	1920x1080	0.15	0.008	20.816	44.374
	3840x2160	0.05	0.007	21.139	173.623
	3840x2160	0.15	0.009	20.430	175.532

Table 1 FNLMD and voting algorithm performance comparison

4. Conclusions

The proposed voting-based image denoise algorithm performs well for removing Gaussian or salt and pepper noise from an image. When compared to a well-established algorithm, such as FNLMD, it can obtain similar or even better results in certain situations, such as when removing salt and pepper or small amounts of Gaussian noise.

As future work, the algorithm can be improved by replacing the current solution for Gaussian noise removal with another that would only require the noise distribution as input. A promising future approach could be using the method described in [7].

Also, a further development may be the integration of the proposed algorithm in a voting-based image processing pipeline, using elements from [16-18].

Acknowledgements

References

[1]   Peter Corke, *Robotics Vision and Control*, Springer, 2011, DOI: 10.1007/978-3-642-20144-8.

[2]   Dabov Kostadin, Foi Alessandro, Katkovnik Vladimir, Egiazarian Karen, *Image restoration by sparse 3D transform-domain collaborative filtering*, 2008 https://doi.org/10.1117/12.766355.

[3] Y. Chen, T. Pock, *Trainable Nonlinear Reaction Diffusion: A Flexible Framework for Fast and Effective Image Restoration*, IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 39, no. 6, pp. 1256-1272, 1 June 2017. DOI: 10.1109/TPAMI.2016.2596743.

[4] Motwani Mukesh, Gadiya Mukesh, Motwani Rakhi, Harris Frederick, *Survey of image denoising techniques*, 2004.

[5] Barry R. Masters, Rafael C. Gonzalez, Richard Woods, Digital Image Processing, Third Edition, Journal of Biomedical Optics 14 (2), 2009, DOI: 10.1117/1.3115362.

[6] Nikos Drakos, Computer Based Learning Unit, University of Leeds, Ross Moore, Mathematics Department, Macquarie University, Sydney, URL: http://fourier.eng.hmc.edu/e161/lectures/smooth_sharpen/node2.html, Accessed in April 2020.

[7] V.R. Vijaykumar, Vanathi P.T., Kanagasabapathy Prathapan*, Fast and Efficient Algorithm to Remove Gaussian Noise in Digital Images*, IAENG International Journal of Computer Science. 37. 78-84, 2010.

[8] D. L. Donoho, *De-noising by soft-thresholding*, IEEE Transactions on Information Theory, vol. 41, no. 3, pp. 613-627, May 1995, DOI: 10.1109/18.382009.

[9] Junyuan Xie, Linli Xu, Enhong Chen, *Image denoising and inpainting with deep neural networks*, 25th International Conference on Neural Information Processing Systems - Volume 1 (NIPS'12). Curran Associates Inc., Red Hook, NY, USA, 341–349, 2012.

[10] Fan L., Zhang F., Fan H., *Brief review of image denoising techniques*, Vis. Comput. Ind. Biomed. Art 2, 7, 2019, DOI: 10.1186/s42492-019-0016-7.

[11] Hong-Ying Yang, Xiang-Yang Wang, Pan-Pan Niu, Yang-Cheng Liu, *Image denoising using nonsubsampled shearlet transform and twin support vector machines*, Neural Networks, Volume 57, 2014, Pages 152-165, ISSN 0893-6080, https://doi.org/10.1016/j.neunet.2014.06.007.

[12] M. Elad, M. Aharon, *Image Denoising Via Sparse and Redundant Representations Over Learned Dictionaries*, IEEE Transactions on Image Processing, vol. 15, no. 12, pp. 3736-3745, Dec. 2006, DOI: 10.1109/TIP.2006.881969.

[13] C. Knaus, M. Zwicker, *Progressive Image Denoising*, IEEE Transactions on Image Processing, vol. 23, no. 7, pp. 3114-3125, July 2014, DOI: 10.1109/TIP.2014.2326771.

[14] Bhawna Goyal, Ayush Dogra, Sunil Agrawal, B.S. Sohi, Apoorav Sharma, *Image denoising review: From classical to state-of-the-art approaches*, Information Fusion, Volume 55, 2020, Pages 220-244, ISSN 1566-2535, DOI: 10.1016/j.inffus.2019.09.003.

[15] C. Knaus and M. Zwicker, *Dual-domain image denoising*, 20th IEEE ICIP, Sep. 2013, pp. 440–444.

[16]   Costin-Anton Boiangiu, Radu Ioanitescu, Razvan-Costin Dragomir, *Voting-Based OCR System*, The Journal of Information Systems & Operations Management, Vol. 10, No. 2, 2016, pp. 470-486.

[17]   Costin-Anton Boiangiu, Mihai Simion, Vlad Lionte, Zaharescu Mihai – *Voting Based Image Binarization*, The Journal of Information Systems & Operations Management, Vol. 8, No. 2, 2014, pp. 343-351.

[18]   Costin-Anton Boiangiu, Paul Boglis, Georgiana Simion, Radu Ioanitescu, *Voting-Based Layout Analysis*, The Journal of Information Systems & Operations Management, Vol. 8, No. 1, 2014, pp. 39-47.

A MODEL FOR AUTOMATIC RESUME SUMMARIZATION

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Abstract: *Recruitment is a primary method of employing candidates for a job position and is a prime process of any organization. While this method is still the major process, it still lacks speed and accuracy of candidate choice due to the bulk and piles of resumes which are submitted for any job position. Consequently, a large number of resumes are either ignored or misplaced and only a fraction of them gets noticed. This research is aimed at developing a model to summarize the resumes by extracting important details which are essential to the recruiter and lists them in a file. The paper entails the details of the model for the summarization process and compare it with the previous methodologies. The comparison of the proposed methodology with the previous methodologies indicates the differences in the design and percentage improvement in the performance of the summarization process.*

Keywords: *model, resume, resume summarization, Natural Language Processing (NLP)*

1. Introduction

A resume is a document that an applicant submits as a first step to apply for any job opportunity. It is also an important part of the candidate application as it briefly presents the timeline of the candidate's profile. Resumes generally contain important information such as qualification, professional experience, achievements and hobbies [1]. The resume is the backbone of any job application and one important way to make leave a positive and strong impression upon recruiter [2]. However, not all resumes are well written as many applicants usually submit resumes that are very verbose and ponderous and it takes a lot of time for the recruiter to go through it and skim the important information. Since, there is no standard rule of designing and writing resumes due to which poorly crafted resumes are less appealing, hard to understand and catch the eyes of the recruiter to pick out important points from the candidature's profile. For this reason, the current search presents a model for the automatic resume summarization using the natural language processing techniques for extracting key information from a resume and listing them in a file for easy access and quick deliberation.

Automatic text summarization dates back to the almost 40 years back whose first architecture was built on IBM [13]. After which a significant work is done by Luhan which suggests to generate the summaries for the text to solve the problem

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of understanding detailed documents. It emphasizes the importance of generating summaries of the documents as they serve as a quick tool to provide the overview of the document and thus reduces the time consumption of the reader [12]. Summarization process is a complex task which requires deep learning based natural language processing techniques [14]. In recent years, the summarization approaches using machine learning techniques have proven to improve the performance the performance of the summarization tasks [15]. But the problem with the summarization approaches is that they simply extract sentences whereas the summaries formulated by humans are more coherent and not simply a skim of sentences. This indicated the need of advanced approaches that extract passages and link them in a coherent manner. Moreover, deep phrase selection, structure building and ordering of sentences ae the problems to be addressed in the succeeding approaches [16]. The performance of text classification and data clustering is reported to be improved by a machine learning approach called as particle swarm optimization (PSO). The work of [17] has analyzed the effects of feature set on feature selection. Moreover, the significance of learned feature weights on the PSO is also analyzed. Furthermore, the learned feature weights which are produced by the PSO approach have also been used by the text summarization problem [13]. In another work, PSO approach is used to extract and classify text from the HTML web pages for [18]. Another significant work of done by the PSO approach is the document clustering which is proposed by Cui et al [19]. Web documents are reported to be classified using PSO where the terms with the highest weights are used as features for classification [20]. Apart from data clustering and classification, Swarm intelligence has also been used for the automatic text summarization where the text features are scored respective to their importance. The results of the study have shown the similarity of the summarization produced by the proposed methodology with that of MS word and suman summarization [21].

The aim of this research is to implement an automatic resume summarization model to simplify the process of recruiting that deals with resume checking. The resulting system takes resumes in different format for processing and publish a list each summarized resumes in a .txt file. In the approach deployed in this work, emails are extracted using pattern recognition using python re package; skills are mined using some pre-defined texts and are cross-checked with the predefined skills document listed in an external *csv* document.

The section 2 of the paper presents a review of the previous studies which are related to the proposed model, section 3 describes the materials and methods needed to implement the proposed model, section 4 describes the results followed by discussion and conclusion in section 5.

2. REVIEW of the RELATED WORK

Before the past century, resumes were barely in existence and jobs were awarded based on some natural qualities, such as relation, blood type (royalty or peasantry).

This is because, jobs were neither coordinated not stratified enough to warrant the use of resumes. Proper use of resume or Curriculum Vitaes never really started until after the world war, after which such use was almost so normal [3]. The summarization methods are generally categorized in three types. i.e. general linguistics, statistical and hybrid approach that is the merger of the other two categories [13].

According to [4], text summarization is the technique of making long pieces of text short with the intention to create a coherent and fluent summary having only the main points outlined in the document. Additionally, resume summarization is the shorting of a full resume or CV listing the personal information, skills and experiences. While text summarization can be from unstructured text, resume summarization can be from unstructured, semi-structured or structured text. Automatic text summarization is achieving text summarization with natural language processing in machine learning.

Some of the approaches used to extract important information from resumes include Named Entity Recognition (NER) using Natural Language Tool Kit (NLTK), where text blocks are classified into segments which are in turn chopped into words and these words are labelled using the Natural Language Tool Kit which labels by assigning tags to each word [5].

A research by [6] discussed some recent advances in Deep Learning and how the techniques is evolving and being applied in every sphere of life including document analysis. [7] described how Artificial Intelligences (AI), and the applications of Natural Language Processing (NLP) are applied in the recruitment industry and how AI is propelling significant automation across the hiring processes thereby optimizing the recruitment of quality candidates.

While a weight-based text summarization was model was proposed by [8] where sentences in a document are scored by attaching weights to the different language elements (noun, phrases, etc.); [9] applied the summarization heuristics to generate variable length summary extract from a single document. In order to evaluate the qualities of the generated summaries, the research further compared the original documents to the summaries and the experiment revealed that 65% of the documents showed less than 10% variance in scores.

Using a combination of linguistics and machine learning based approaches, [10] developed a parsing-specifications separation framework for extracting structured information from unstructured resume. The author demonstrated the process using one example and opined that it may not work for other formats.

Using three named approaches, [11] developed a resume summarization system using Python for NLP. The system was applied on 200 Data Science applicants following three steps. (i) Construction of a dictionary of all the skill sets categories, (ii) Development of an NLP algorithm to pass the whole resume and search for the words in the dictionary (iii) Count the occurrences of the target words for each candidate and aggregate.

Creating a summarization system can be very time consuming, as there are no standard algorithms for doing this and unlike other Machine Learning fields, Natural Language processing does not follow a regular pattern. Existing resume summarization systems are largely in use in industries and companies that can afford to build such systems as they work entirely based on hard-coded programming.

3. MATERIALS and METHODS

Fig 1 depicts the architecture of the proposed model for the resume summarization system. The input to this model is the domain-specific textual PDF documents of resumes that contain multifarious information of the candidate which can be fragmented into various parts i.e. personal information, qualification, experience, skills, hobbies and achievements. The features from these parts are then calculated and the performance of the model is evaluated. The platform requirements for the implementation of the proposed system are enlisted as follows.

a) A stack of resumes in the same format (preferably PDF format) in the same directory as the algorithm.
b) A working anaconda environment.
c) Installed anaconda libraries.
d) Jupyter lab
e) A working model
f) Test feed.
g) The importables: *csv, re, spacy, pandas, io, pdfminer modules– PDFResourceManager, PDFPageInterpreter, TextConverter, LAParams, PDF page – os, sys, getopt, numpy, beautifulSoup – a bs4 module, request, en-core-web-sm.*
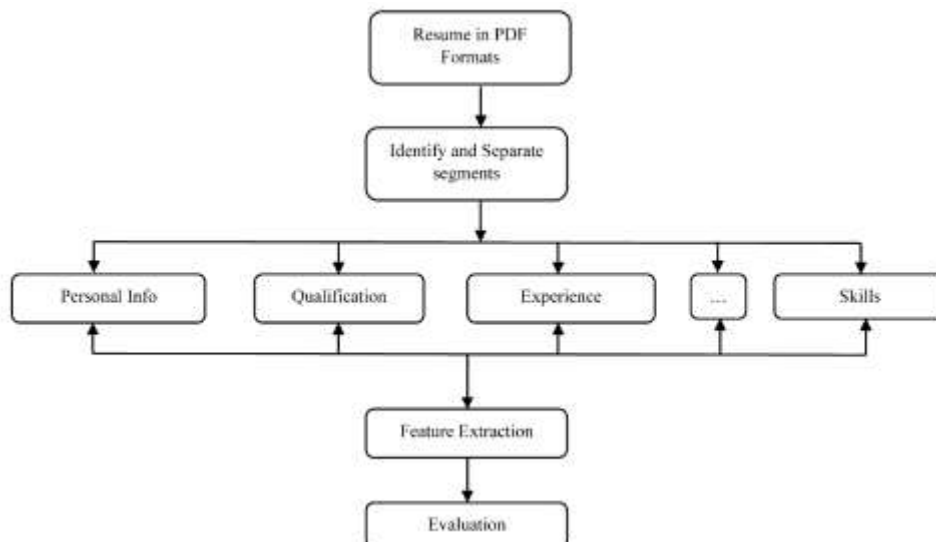

Fig 1. Design architecture

Fig 2 shows a resume sample (downloaded from the source *reddit.com)* that consists of various kind of information of the resume owner. The working of the proposed model is explained in Fig.3 which depicts the dynamic flow of the activities needed to be performed for the implementation of the proposed system model.

Jon Snow

Made at ResumeGem.com
jon.snow@housestark.raven

EXPERIENCE

Kingdom of the The North | Winterfell

Warden of the North   304 AL-Present

- Participated in strategic talks regarding the threat of the White Walkers and the Night King
- Used personal charm to strengthen alliance with Queen Danaerys Targaryen

King in the North   303 AL- 304 AL

- Led a coalition of Northerners and Free Folk to victory against House Bolton at the Battle of the Bastards
- Forged an alliance with Danaerys Targaryen, securing access to Dragonglass reserves beneath Dragonstone
- Led expedition to capture a wight, in an effort to build consensus regarding the existence of the Night King
- Restored Stark rule and began rebuilding the North after its devastation during the War of the Five Kings

The Night's Watch | Castle Black

Brother of the Night's Watch   300 AL- 302 AL

- Organized the defense of Castle Black and withstood massive assault by Mance Rayder's coalition of Free Folk
- Defeated a band of Night's Watch mutineers, avenging the death of Lord Commander Jeor Mormont
- Infiltrated the forces of Mance Rayder and gained valuable intelligence on the Wilding army

Lord Commander   302- AL- 303 Al

- Negotiated improved relations between the Free Folk and the North, Offering land in exchange for protections
- Arose from the dead after being assassinated by a nativist faction of the Night's Watch
- Rescued a band of Free Folk from Hardhome where they were besieged by The Army of the Dead

Steward to Lord Commander Jeor Mormont   298 AL-300 AL

- Chosen as Steward to Lord Commander Mormont- an indication of leadership potential
- Killed a wight that was attacking Commander Mormont. Received Longclaw, a Valyrian steel blade as reward
- Assisted in cooking, cleaning, hunting, and message delivery which was vital to Castle Black's operations.

EDUCATION

Student of Maester Luwin & Ser Rodrick Cassel | Winterfell   285 AL- 298 AL

- Trained in various arms including bow and arrow, longsword, and close combat
- Received a Highborn education studying statecraft, oration, military strategy, and Westerosi History

SKILLS & INTERESTS

Weapon: Longclaw-Valyrian Steel Blade
Pets: Ghost(Direwolf)
Language: Common Tongue
Supernatural: Can Rise From the Dead

Fig. 2. A sample resume downloaded from the source *reddit.com*
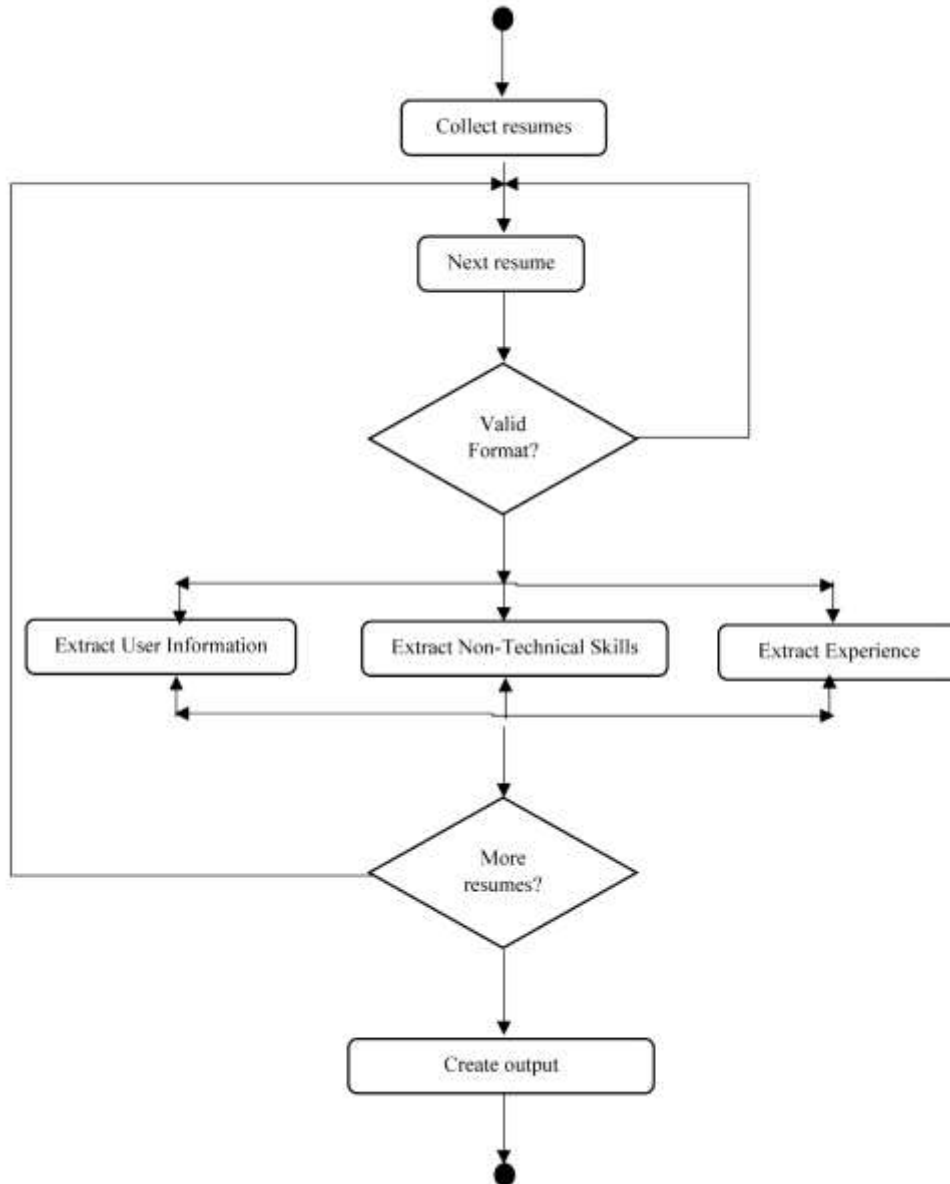
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Fig. 3. Activity Flow

Fig 4 depicts the flow chart of the proposed model that describes the step by step implementation of the proposed auto resume summarization model. The Algorithmic specifications of each step are defined as follows.

01 | Start
02 | Import the importables.
03 | Select files that contain technical skills and non-technical skills

04 | Collect all resumes
05 | Pick next resume
06 | Extract Name, Phone Number and Email address.
07 | Convert the list of all predefined technical skills into an array.
08 | Check for skill in array.
09 | Save skills.
10 | Convert the list of all predefined non-technical skills into sets.
11 | Check through the resume for any non-technical skills
12 | Save the non-technical skills.
13 | Go to 05 unless resume is exhausted.
14 | Display a data frame for each and convert to csv format.
15 | End
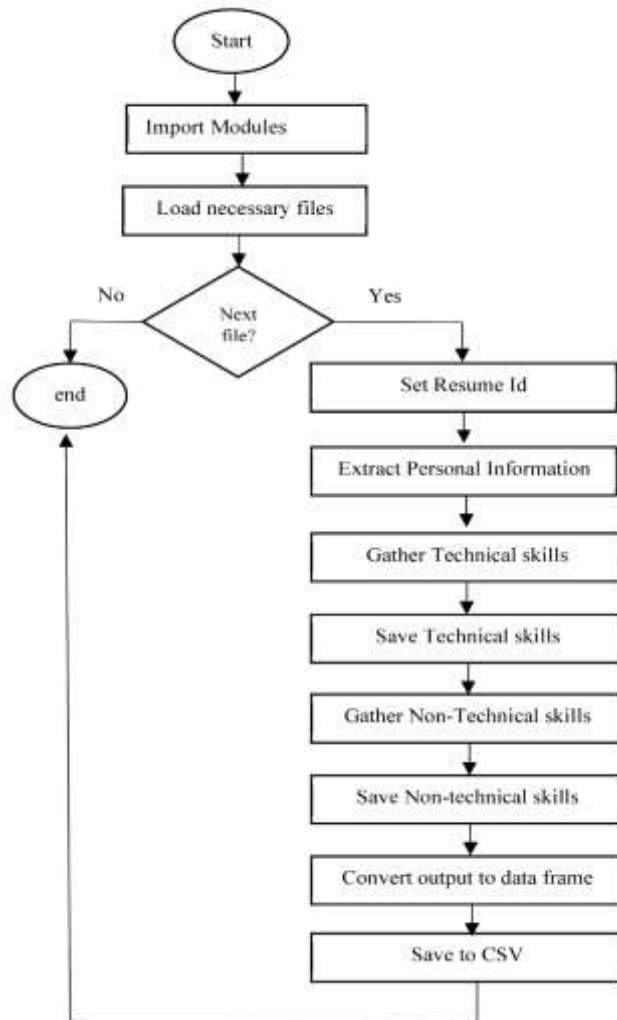
Fig 4. Flow chart of the proposed model for auto resume summarization

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4. Results

The low-level specification of the summarization model consists of four integrated modules i.e. conversion, extraction general and resume list module. The detailed implementation and results of the proposed resume summarization model is described in the following subsections.

4.1 Conversion Module

Fig 5 describes the python code implementation of the conversion module that is used to convert pdf documents into plain text. The conversion module is used to convert pdf into texts. It holds to arguments which are the filename and the number of pages whose default is "None".

```python
def convert(fname, pages=None):
    if not pages:
        pagenums = set()
    else:
        pagenums = set(pages)

    output = StringIO()
    manager = PDFResourceManager()
    converter = TextConverter(manager, output, laparams=LAParams())
    interpreter = PDFPageInterpreter(manager, converter)

    infile = open(fname, 'rb')
    for page in PDFPage.get_pages(infile, pagenums):
        interpreter.process_page(page)
    infile.close()
    converter.close()
    text = output.getvalue()
    output.close
    return text
```

Fig. 5. Conversion module of the resume summarization model

4.2 Extraction Modules

The extraction modules of the proposed resume summarization model are of three types i.e. name extraction module, phone number extraction module and email extraction module. Fig 6 describes the python code implementation of the name extraction module of the resume summarization model. Fig 7 describes the python code implementation of the extraction modules of the phone number and email from the resume documents. The functionality of each extraction module is described as follows.

    a) **Name Extraction Module:** This module extracts the name of the resume owner.
    b) **Phone Number Extraction Module:** This module extracts the phone number on the resume.

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c) **Email Extraction Module:** This module extracts the email address on the resume.

```python
#Function to extract names from the string using spacy
def extract_name(string):
    r1 = str(string)
    nlp = en_core_web_sm.load()
    doc = nlp(r1)
    for ent in doc.ents:
        if(ent.label_ == 'PER'):
            print(ent.text)
            break
```

Fig. 6. Name extraction module of the resume summarization model

```python
#Function to extract Phone Numbers from string using regular expressions
def extract_phone_numbers(string):
    r = re.compile(r'(\d{3}[-\.\s]??\d{3}[-\.\s]??\d{4}|\(\d{3}\)\s*\d{3}[-\.\s]??\d{4}|\d{3}[-\.\s]??\d{4})')
    phone_numbers = r.findall(string)
    return [re.sub(r'\D', '', number) for number in phone_numbers]
```

Fig. 7. Phone Number and Email Extraction modules of the resume summarization model

4.3 General Module

Fig 8 describes the python code implementation of the general module of the proposed resume summarization model. This module includes all the operations that are used by the other modules.

```python
def general_extraction():
    convert_non_tech_list_to_set = set(your_list[0])
    tech_list = your_list
    tech_att_list = your_listatt
    skillsatt = []


    pdfs_to_string(get_resume_list(noOfResumes))

#     for resume in resume_string_unformatted:
#         print(extract_name(resume))

    for resume in resume_string_list:
        current_skills = []
        skills_index = []
        y=extract_phone_numbers(resume)
        print('Phone Number: ', extract_phone_numbers(resume))
        y1 = []
        .
        .
        .
```

Fig. 8 General module of the resume summarization model

4.4. Resume List Module

Fig 9 describes the python code implementation of the resume list module of the resume summarization model. This module acquires all the resumes that are needed to be summarized.

```python
#function to get the resume list.
def get_resume_list(noOfResuems):
    for i in range(noOfResumes):
        # all resumes have to be in pdf format.
        resumeList.append(path + 'resumes_'+ str(i) + '.pdf')
        print(resumeList)
    return resumeList
```
Fig. 9. Resume list module of the resume summarization model

5. Discussion and conclusion

A resume is an important part of the recruitment procedure of any organization as it briefly presents the timeline of the candidate's profile. Resumes generally contain important information such as qualification, professional experience, achievements and hobbies [1]. This information is important for the recruiter to document and help in making a valid decision for the candidate. For this reason, there is a need to summarize the resumes for the ease and convenience of the recruiters. Summarization of resumes is concerned with the use of natural language processing techniques for extracting key information in a resume and listing them out for easy access and quick deliberation.

Text summarization is an approach that makes the long pieces of text short with the intention to create a coherent and fluent summary having only the main points outlined in the document. Additionally, resume summarization is the shorting of a full resume or CV listing the personal information, skills and experiences. While text summarization can be from unstructured text, resume summarization can be from unstructured, semi-structured or structured text. Automatic text summarization is achieving text summarization with natural language processing in machine learning [4]. Previous studies have presented some approaches that extract the important information from resumes include Named Entity Recognition (NER) using Natural Language Tool Kit (NLTK), where text blocks are classified into segments which are in turn chopped into words and these words are labelled using the Natural Language Tool Kit that labels by assigning tags to each word [5]. Swarm intelligence is another approach that is used for analyzing the performance of text classification and data clustering using particle swarm optimization (PSO) which is also used for the text summarization problem [13]. It is also used for the extraction and classification of text from the HTML web pages [18, 20]. Web documents are reported to be classified using PSO where the terms with the highest weights are used as features for classification [20]. Apart from data clustering and classification, Swarm intelligence-based approaches i.e. PSO has also been used for the automatic text summarization [21].

Despite a lot of techniques have previously been presented for the automatic text summarization problem, however an efficient resume summarization model will require a

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very large dataset of different skills in order to produce an accurate result. Developing a summarization model can be very time consuming and tedious, as there are no standard algorithms for doing this and unlike other Machine Learning approaches, Natural Language processing does not follow a regular pattern. Existing resume summarization systems are largely in use in industries and companies that can afford to build such summarization systems as they work entirely based on hard-coded programming.

This paper presents a natural language processing-based model for the auto summarization of the resumes. The input to this model is the domain-specific textual PDF documents of resumes that contain multifarious information of the candidate which can be fragmented into various parts i.e. personal information, qualification, experience, skills, hobbies and achievements. The features from these parts are then calculated and the performance of the model is evaluated. The low-level specification of the summarization model consists of four integrated modules i.e. conversion, extraction general and resume list module. Each module is implemented in Python and is used to either extract or summarize certain information of resume.

It is concluded that as the resume summarization system can be time consuming and existing machine learning approaches i.e. Natural Language processing does not follow a regular pattern due to which a generalized summarization model is not an efficient solution. It is further interpreted that the different skillset is needed in the different recruitment areas that is why the data that works for one industry might not work for another especially when the both industries specialize on different things. Hence, a generalized model for the auto summarization of resumes might not work well in all industries and more specialized or customized model is needed to work well for various industries.

REFERENCES

[1] Susan Heathfield (2018). Learn Why a Resume Is Important for an Employer.https://www.thebalancecareers.com/resume-and-why-is-it-important-1918246

[2] Mike Simpson (2019). How To Write A Killer Resume Objective. https://theinterviewguys.com/objective-for-resume/

[3] Howden, D. (2016, Februiary 4). *Die hard: the troubled history of the resume.* Retrieved from Worrkable: www.workable.com/resource/blog/recruiting/die-hard-the-troubled-history-of-the-resuem

[4] Michael J. Garbade(2018). A Quick Introduction to Text Summarization in Machine Learning. https://towardsdatascience.com/a-quick-introduction-to-text-summarization-in-machine-learning-3d27ccf18a9f

[5] Steven Bird, Ewan Klein, and Edward Loper (). Natural Language Processing with Python – Analyzing Text with the Natural Language Toolkit. O'Reilly. Available at http://nltk.org/book_1ed/

[6] Minar, M.R., & Naher, J. (2018). Recent Advances in Deep Learning: An Overview. ArXiv, abs/1807.08169.

[7] Oodles AI(2020). Applications of natural language processing (nlp) in recruitment. http://oodlesai.over-blog.com/2020/01/applications-of-natural-language-processing-nlp-in-recruitment.html

[8] PadmaLahari, E., Kumar, D.S. and Prasad, S. (2014) 'Automatic text summarization with statistical and linguistic features using successive thresholds', in 2014 International Conference on Advanced Communication Control and Computing Technologies (ICACCCT), IEEE, pp.1519-1524.

[9] M. K. Dalal, M. Zaveri (2011). Heuristics based automatic text summarization of unstructured text. In Proceedings of the ICWET '11 International Conference & Workshop on Emerging Trends in Technology, Mumbai, Maharashtra, India, February 25 - 26, 2011

[10] Y. H. Kulkarni (2017). Text Mining 101: Mining Information from A Resume. Downloaded June 2020 from https://www.kdnuggets.com/2017/05/text-mining-information-resume.html

[11] V. Raman (2019). How I used NLP (Spacy) to screen Data Science Resume. Towards Data Science. Accessed Septemebr 2019 from **Error! Hyperlink reference not valid.**

[12] H. P. Luhn, "The automatic creation of literature abstracts". IBM Journal of Research and Development. 2(92), 159-165, 1958.

[13] Kyoomarsi, Farshad, Hamid Khosravi, Esfandiar Eslami, and Pooya Khosravyan Dehkordy. "Optimizing machine learning approach based on fuzzy logic in text summarization." *International Journal of Hybrid Information Technology* 2, no. 2 (2009): 105-116. http://gvpress.com/journals/ IJHIT/vol 2_no2/ 10.pdf

[14] Graeme Hirst, Chrysanne DiMarco, Eduard Hovy, and Kimberley Parsons. "Authoring and Generating Health-Education Documents." In *User Modeling: Proceedings of the Sixth International Conference UM97 Chia Laguna, Sardinia, Italy June 2–5 1997*, vol. 383, p. 107. Springer, 2014.

[15] M. A. Fattah, and F. Ren, "GA, MR, FFNN, PNN and GMM based models for automatic text summarization". Computer Speech and Language. 2008. 23(1), 126-144.

[16] Inderjcet Main , the MITRE corporation 11493 Sanset Hills noad , USA , 2003 .

[17] M. S. Binwahlan, N. Salim, and L. Suanmali, "Swarm based features selection for text summarization". IJCSNS International Journal of Computer Science and Network Security. 9(1), 175-179, 2009

[18] C. Ziegler, and M. Skubacz, "Content extraction from news pages using particle swarm optimization on linguistic and structural features". IEEE/WIC/ACM International Conference on Web Intelligence. 2-5 November 2007. Silicon Valley, USA, 242-249

[19] X. Cui, T. E. Potok, and P. Palathingal, "Document clustering using particle swarm optimization". IEEE Swarm Intelligence Symposium. 8-10 June 2005. Pasadena, California, 185-191

[20] Z. Wang, Q. Zhang, and D. Zhang, "A pso-based web document classification algorithm". IEEE Eighth ACIS International Conference on Software Engineering, Artificial Intelligence, Networking, and Parallel/Distributed Computing. 30 July – 1 August 2007. Qingdao, China ,659-664

[21] Binwahlan, Mohammed Salem, Naomie Salim, and Ladda Suanmali. "Swarm based text summarization." In *2009 International Association of Computer Science and Information Technology-Spring Conference*, pp. 145-150. IEEE, 2009.

IMPROVING THE IMAGE BINARIZATION PROCESS BY USING A WEIGHTED-VOTING SCHEME

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Abstract: *An essential step in the OCR (Optical Character Recognition) flow is the stage of image binarization. There are considerable algorithms used for the stage of binarization. The significant difference between them is the method that computes the pixel threshold value. These algorithms can categorize into two groups: those that require a single threshold value for the whole image (which can recognize larger areas or objects) and those that use a threshold obtained from the pixel's local space (pixels in the neighborhood of the given pixel and that can identify smaller clusters of pixels). The objective of this paper is to present a voting-based image binarization algorithm that makes use of results from both categories of algorithms previously mentioned.*

Keywords: *image binarization, thresholding, voting-based processing, Otsu, Kittler, Niblack, Sauvola*

1. Introduction

The binarization method proposes a separation of planes - background and foreground, in order to select the relevant data in the image to investigate it. The first step is the conversion of the input image to a grayscale image, and then the proposed thresholding algorithms split the output image into two types of pixels: foreground pixels and background pixels [1].

The proposed method makes use of the qualities of multiple thresholding algorithms and combines them to achieve a better result.

1.1. Previous work

Image thresholding methods group into two major categories: global and local [2].

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Global thresholding methods compute a statistic on the whole image and obtain a threshold value for every pixel. Such methods are high-speed but work best on (near) ideal image conditions (smooth background, uniform lighting, low noise), and most images are not ideal. Thus, global methods will mostly have bad results.

Local thresholding methods take into consideration the neighboring pixels when computing the threshold value. These methods overcome the problems presented by global methods by calculating pixel threshold values by probing information from neighboring pixels. They also achieve good results on non-ideal images, but they deal with noise more than global methods do. Thus, objects and pixel clusters can be erroneously identified.

Voting based image binarization algorithms try to combine the two previously presented approaches by using them in image areas where they work best. One of the first attempts to combine them is found in [3].

The most basic method of voting based image binarization presented in [4] is the one which democratically chooses the value of a specific pixel, based on the results of all the chosen thresholding algorithms. If most algorithms decided that a pixel should be of value 0, then the output image will contain this pixel with value 0 or value 1 otherwise. This method can be further developed by adding weights to specific algorithms before probing the pixel values. This way, the solution will have a more personalized result.

One solution presented in [5] uses a window of *N*M* pixels and analyzes the number of objects found within that specific window. If the number is below a certain previously chosen threshold, then it is optimal to apply a local algorithm. Otherwise, they choose a global algorithm. They also save a matrix (equal to the dimension of the image) of threshold values. If the area analyzed by the window falls in the local category, then they increment that threshold. Otherwise, they decrement it. After the window moves through the entire image input, local and global algorithms apply depending on the values from the computed threshold matrix.

In [6] is presented a voting technique applied to a data set that contains only text-based documents that combine the following algorithms: Niblack, Nick, Sauvola, Wolf, and Otsu. Their approach describes a system that generates candidates for each algorithm. Based on tournaments, validation tests, and voting-based procedures, the viable candidate is selected from the pool generated.

Another approach found in academia also uses a window, but this time the window is iteratively expanding. This process stops when the standard deviation inside the window is constant. In this case, no new information given anymore. Afterward, a global thresholding method utilizes the newly generated window.

This voting-based approach is present in other fields of Image Processing and Computer Vision. For example, these procedures returned precise results in areas such as Image Segmentation [7], Layout Analysis [8] and OCR Systems [9].

1.2. Problem motivation

The goal of this article is to present a method that makes use of the knowledge from previously mentioned works but tries a slightly different approach to window placement. This way, the proposed method should take less time to compute, while obtaining good results overall.

2. Proposed method

As mentioned beforehand, the images targeted are document images that contain handwriting (Figure 1.a). After choosing the input image, this one is converting to grayscale using an algorithm called Color to Grey [10] (Figure 1.b).
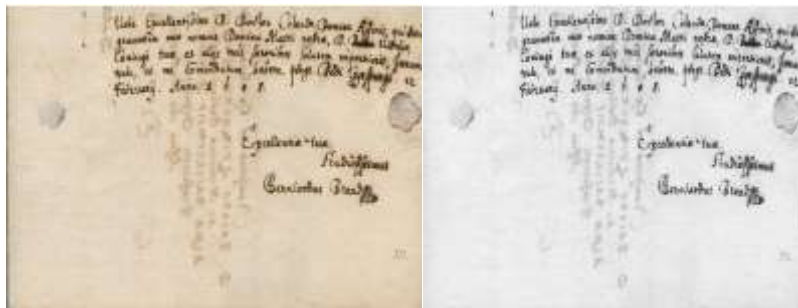
Figure 1. From left to right: a. Original document image; b. Grey scaled image

The proposed method uses both global and local thresholding methods to solve the problem.

The method relies on results from the following algorithms: ***Global Binarization***: Otsu, Kittler; ***Local Binarization***: Niblack, Sauvola.

To understand the principle of the proposed method, in the next section, are presented the algorithms of the chosen thresholding method.

OTSU

Two classes of pixels are involved: pixels in the area of the foreground and pixels in the background. The foreground represents the layer where the objects are. The algorithm Otsu iteratively seeks for the threshold value that decreases the similarity within these classes. For the two previously described groups, the scope is to compute the weighted sum of the standard deviation [11]:

$$\sigma_\omega^2(t) = \omega_1(t)\sigma_1^2(t) + \omega_2(t)\sigma_2^2(t) \tag{1}$$

This method works ideally when the input image histogram has a bimodal distribution, like all global thresholding algorithms.

Otsu is proven to obtain the best results among all global thresholding algorithms (Figure 2.a), as it can handle the background noise, and identifies text correctly.

KITTLER

This method uses Gaussian distribution to find the threshold value. It tries to approximate the histogram as a bimodal distribution and finds the cutoff point to segment the image into either foreground or background [12].

Moreover, it obtains great results on bimodal distributions but has trouble when the difference between foreground and background pixels is too small (Figure 2.b).

NIBLACK

The threshold value is calculated by this method using a local window. In this case, the estimation of the threshold is computing using the local mean and standard deviation for the pixel values in a local window defined to an image [13]. The formula used to estimate the value is:

$$T_{Niblack} = m + k * s \qquad (2)$$

where:

- m - mean of the local window of pixels,
- s - standard deviation of the local pixel window,
- k - a fixed value.

In this case, k has a value of 0.2.

This method always correctly identifies text regions from image documents as foreground (Figure 2.c). However, it also tends to create a lot of binarization noise in areas that do not contain text.

To summarize, Niblack is a suitable candidate for the proposed binarization algorithm, knowing that our input images consist of old document type images that contain text.

SAUVOLA

Sauvola is a particularized version of the previous method presented - Niblack. In some specific conditions such as variation of light in the processed document or texture [14], Sauvola might have better results than Niblack. The value of the threshold results using the equation:

$$T_{Sauvola} = m * \left(1 - k * \left(1 - \frac{S}{R}\right)\right) \qquad (3)$$

where:

- m - mean of the pixels under the window region
- S - the dynamic range of variance
- k - fixed value.

The value of k is chosen 0.2, like for Niblack. This method computes images with lower noise than Niblack, basically solving the problem with non-text areas. Although it also produces wrong results on images with low contrast (Figure 2.d).

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Figure 2. From left to right: a. Otsu Thresholding, b. Kittler Thresholding; c. Niblack Thresholding; d. Sauvola Thresholding

THE VOTING METHOD

This section introduces the method used to construct the final image, starting from the presented thresholding algorithm candidates.

The first step is to apply all four algorithms presented previously onto the grayscale image. As a result, four images are created (each one for the methods Otsu, Kittler, Niblack, Sauvola). For the second step, the four images were combined into one by using majority voting as follows: each pixel in the resulting image will be black if most of the methods have the corresponding pixel with that same value. Otherwise, the color will be white, meaning that the pixel will be part of the background.

The results obtained were close to the ground-truth, but since the technique was used with equal weights set to all thresholding algorithms, there was more noise in the output than desired. Where global algorithms performed well, the local algorithms would add noise or vice-versa.

To eliminate it and obtain even better results, individual weights were assigned to each binarization algorithm. The values were selected as follows: the global algorithms received a higher value as they performed better on the data set, while local ones received a smaller number.

The weight did not exceed the value 2, which represents the total number of methods – 2 [4].

3. Performance measurements

In order to have significant results in section performance measurements, the proposed method was applied to three separate image type documents, which contain text and have variable light and contrast conditions.

MEASUREMENTS

To measure how efficient a method is compared to another; the pixels were split into three categories [15]:

- *TP* – true positive; the pixels which have the same value are part of objects in both the resulting image and the ground-truth

- *FP* – false positive; the pixels which are part of an object in the resulted image only

- *FN* – false negative; the pixels which are part of an object in the ground-truth only

$$Precision = \frac{TP}{TP + FP}$$

$$Recall = \frac{TP}{TP + FN}$$

$$F - measure = \frac{2 * Recall * Precision}{Recall + \ Precision}$$

For results closer to the ground-truth, the value of the F-measure is higher.

Figure 3. Image1 – From left to right: a. ColorToGray; b. Niblack; c. Otsu; d. Kittler

For the first image (Figure 3.a), the proposed method produces a very good result (Figure 4) compared to the other existing techniques (Figure 3.b, 3.c., 3.d.). The only problem seems to be the optimal block size, which is generated for the Niblack algorithm (it may be too high), which seems to generate a bit of noise in the writing sections.
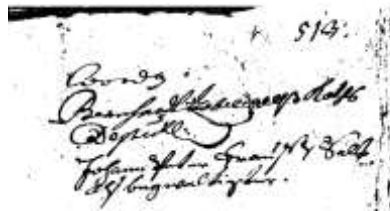
Figure 4. Image1 – Proposed algorithm

The main problem with this image is the difference in the writing's opacity. The first, third, and fourth lines are less dark than the second. In the Otsu algorithm, the last two are faded almost completely. In this aspect, our method identified all rows correctly and had less noise in the output. The differences between the algorithms results can be found in the table below (Table 1).

Algorithm	Recall	Precision	F-measure
Otsu	52.30	56.96	54.53
Kittler	63.12	65.60	64.34
Niblack	64.02	25.93	36.91
Proposed	94.81	62.41	75.27

Table 1 – Results Image 1

For the second image (Figure 5.a), the situation is similar to the previous one, as the proposed method (Figure 6) manages to binarize the image correctly

Figure 5. Image2 – From left to right, up to bottom: a. ColorToGray; b. Niblack; c. Otsu; d. Kittler

The proposed algorithm generates a similar result to the Otsu and Kittler binarizations (Figure 5.c and 5.d) but does not generate binarization noise like the Niblack thresholding algorithm (Figure 5.b). The main problem of this case was to eliminate the writing from the page above.
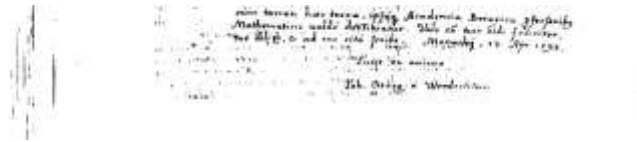
Figure 6. Image 2 – Proposed algorithm

The results obtained for the second image are presented in Table 2.

Algorithm	Recall	Precision	F-measure
Otsu	46.87	70.17	56.20
Kittler	46.58	70.52	56.10
Niblack	44.74	17.31	24.96
Proposed	74.68	74.68	74.68

Table 2 – Results Image 2

The third image (Figure 7.a) also obtains very good results in comparison to the other algorithms and does not segment any characters or essential data. The damage created by the paper fold is significantly minimized compared to Niblack and Otsu algorithms.

Algorithm	Recall	Precision	F-measure
Otsu	87.82	69.63	77.68
Kittler	70.40	88.36	78.37
Niblack	71.51	35.80	47.71
Proposed	92.61	85.60	88.97

Table 3 – Results Image 3

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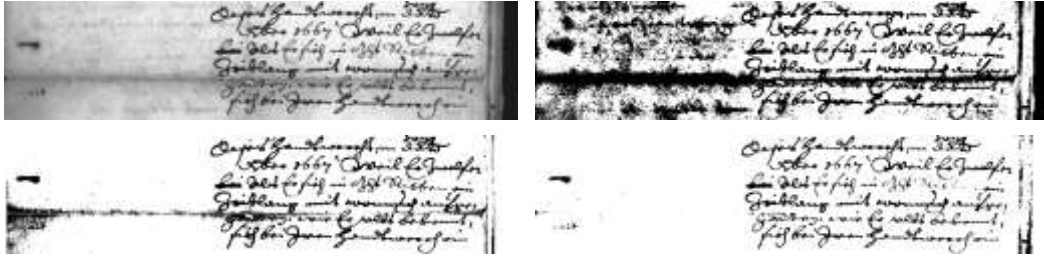
Figure 7. Image3 – From left to right, up to bottom: a. ColorToGray; b. Niblack; c. Otsu; d. Kittler
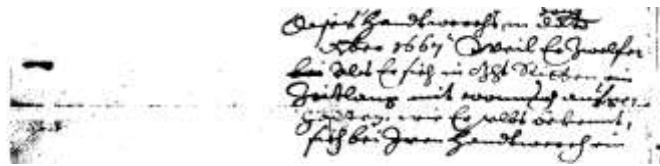
Figure 8. Image3 – Proposed algorithm

4. Conclusion

After analyzing and comparing the resulting images from multiple algorithms and the proposed one, the conclusion that rises is that the results are at least satisfactory. By voting between the use of the local or global algorithms, it manages to eliminate the binarization noise generally created by global algorithms when they have to deal with lots of objects or variable contrast and by local algorithms when they deal with areas with very few objects. The proposed algorithm manages to deliver a clear output image, which can be later used in the OCR process.

Acknowledgement

References

[1] Nabendu Chaki, Soharab Hossain Shaikh, Khalid Saeed, "Exploring Image Binarization Techniques", Springer, New Delhi, India, 2014, DOI: 10.1007/978-81-322-1907-1.

[2] Reinhard R. Beichel, Ph.D. Medical Computer Vision & Graphics Lab – The University of Iowa, Course 55:148 Digital Image Processing, Chapter 5, Part

I, Segmentation: Thresholding, 2000, Accessed on 15 November 2019, URL: http://user.engineering.uiowa.edu/~dip/lecture/Segmentation1.html.

[3] Costin-Anton Boiangiu, Alexandra Olteanu, Alexandru Victor Stefanescu, Daniel Rosner, Alexandru Ionut Egner, "Local Thresholding Image Binarization using Variable-Window Standard Deviation Response" (2010), Annals of DAAAM for 2010, Proceedings of the 21st International DAAAM Symposium, 20-23 October 2010, Zadar, Croatia, pp. 133-134, Editor B. Katalinic, Published by DAAAM International, Vienna, Austria 2010.

[4] Alexandru Pruncu, Cezar Ghimbas, Radu Boeru, Vlad Neculae, Costin-Anton Boiangiu; "Majority voting image binarization", The Journal of Information Systems & Operations Management, Vol.12 No.2 - 2018, pp. 422-430.

[5] Costin-Anton Boiangiu, Mihai Simion, Vlad Lionte, Zaharescu Mihai – "Voting Based Image Binarization", The Journal of Information Systems & Operations Management Vol. 8, No. 2 / December 2014 (Journal of Information Systems, Operations Management), pp. 343-351.

[6] Costin-Anton Boiangiu, Giorgiana Violeta Vlăsceanu, Alexandru Marian Atanasiu; Petrisor Alin Damian, Cristian Panaitescu, "A voting approach for image binarization of text-based documents" UPB Scientific Bulletin, Series C: Electrical Engineering and Computer Science, Vol. 81, No. 3, 2019, pp. 53-64.

[7] Costin-Anton Boiangiu, Radu Ioanitescu, "Voting-Based Image Segmentation, The Journal of Information Systems & Operations Management Vol. 7 No. 2 / December 2013 (Journal of Information Systems, Operations Management), pp. 211-220.

[8] Costin-Anton Boiangiu, Paul Boglis, Georgiana Simion, Radu Ioanitescu, "Voting- Based Layout Analysis", The Journal of Information Systems & Operations Management Vol. 8 No. 1 / June 2014 (Journal of Information Systems, Operations Management), pp. 39-47.

[9] Costin-Anton Boiangiu, Radu Ioanitescu, Razvan-Costin Dragomir, "Voting-Based OCR System", The Journal of Information Systems & Operations Management, Vol. 10 No. 2 / December 2016 (Journal of Information Systems, Operations Management), pp 470-486.

[10] Gooch, A. A., Olsen, S. C., Tumblin, J., & Gooch, B., "Color2Gray: Salience-preserving color removal", ACM Transactions on Graphics, 24(3), 634-639, 2005 https://doi.org/10.1145/1073204.1073241.

[11] H.J. Vala, Astha Baxi, "A review on Otsu image segmentation algorithm". International Journal of Advanced Research in Computer Engineering & Technology (IJARCET). 2 (2), 2013.

[12] Puneet and Naresh Garg, "Binarization Techniques used for Grey Scale Images", International Journal of Computer Applications 71(1):8-11, June 2013, DOI: 10.5120/12320-8533.

[13] S. Farid and F. Ahmed, "Application of Niblack's method on images", 2009 International Conference on Emerging Technologies, Islamabad, 2009, pp. 280-286.

[14] J. Sauvola, M Pietikainen, "Adaptive document image binarization, Pattern Recognition", Volume 33, Issue 2, DOI: 10.1016/S0031-3203(99)00055-2, 2000, pp. 225-236.

[15] Soharab Hossain Shaikh, Asis Umar Maiti, Nabendu Chaki, "A new image binarization method using iterative partitioning", Machine Vision and Applications(24), No. 2, pp. 337-350 February 2013.

FUTURISTIC GROWTH ANALYSIS OF ECOMMERCE COMPANIES AND EMERGING STRATEGIES APPLIED BY THEM TO INCREASE BILL VOLUME AND MARKET SHARE, SUGGESTIONS TO IMPROVE LOCAL ECOMMERCE BUSINESS ACCORDING TO NEW TRENDS

Dr. Pooja SHARMA[1]

Abstract: *Information Technology has been playing an important role in the development of the business in emerging economy like India .People are using smart phones internet regularly and continuously for their business purpose as well as for their other task .Smart phone users are increased because of that E-Commerce accessibility has been reaching to the customers conveniently .It can be expected for the future advancement helps a lot in development of the business .E commerce has a lot of benefits which we have seen during the covid-19 and the pace of that is increased because the reach of the customer of physical marketing was low due to the covid-19 .It becomes an opportunity for e-commerce now the traffic on these sites are increased sales of these sites are increased they are like using a new product new services or sing in a new area. After 2016 E-Commerce has reached at a new era of success it was hundred million in 2016 now it is expected to increase twice by 2022 as per global retail development Index. The objective of this paper is to study about the growth of E commerce and linkages between sales bill volume and market share as well as strategies followed by selected E commerce companies during covid-19 to increase market share.*

Keywords: *E-Commerce, Information Technology, Business, Developing Economy, Covid -19*

Objectives:

1. To study the growth for E commerce and government initiatives in India.
2. To identify the major companies contributing in E commerce and strategies followed by them for growth.
3. To find out the linkages between the bill volume and market share of Ecommerce.

Introduction

Nowadays E-Commerce is growing popular in emerging economy like India. E-Commerce started in India in 1995 and for this purpose digital platform is required to sell the product. With the help of e-commerce goods can be delivered over a

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Digital Network. E-Commerce is rapidly going in the metro cities of India and it has reached at the tier 2 & 3 cities also because of the covid-19 as changes of the landscape in of ICT .E commerce is now growing rapidly in several emerging market and developing economy. The new technologies are coming to give the suitable platform or to increase the security which is the most important issue related with the digital platform with the customers and they are reaching at this platform but because of the security issue they just want to take back foot step because of this security issue only but E-Commerce is providing a convenient and suitable platform or strategy like cash on delivery to provide the most satisfaction to the customers .There are some major issues related with the E-Commerce mainly problems are facing by customers security issue, quality issue however we have not yet achieved an ideal world of secure transaction due to the internet accessibility of everyone . By 2025 the issues related with the privacy. E-Commerce will grow 200 to 120 billion.

Research Methodology:

Data: The study conducted is based on secondary data taken from Global retail Development index, E commerce portal of Indian Government and from the other news portal. The data has been taken from the year 2017 to 2020 for the bill volume and market share of Ecommerce linkages.

Limitation: The data has taken from secondary source so authentication of data dependent on information shown on official websites and news portals.

Research Design & Tool : The study is descriptive type of research. Elasticity technique is used to reflect the change between the variables. In this paper Elasticity of Market share (ε) is calculated for identify the linkages between bill volume and market share of Ecommerce.

Literature Review:

Some of the research papers are reviewed for the study:
Rathore, A. S., Pant, M., & Sharma (2017), explained that the internet provide accessibility to find the best deal to buy the products on digital marketing. The consumers are searching on online marketing, e-commerce marketing campaign marketing and social media marketing .E mail direct marketing nowadays having a more and more customer base.

Chaffey et al. (2014), explained about the internet marketing and application of internet and digital technology to achieve marketing object is the success depends upon the networking networking uses for this purpose social media and the best new phone for the fencing of e-commerce there are some factors which can strengthen positive ones shop my reducing the possibility of risk.

Bhandari ,Namita and Kaushal,Preeti (2013), discussed about online consumer behaviour which is affected by some factors like trust information about the product and services convenience .

Devi .C.S and Anita. M (2013), explained the challenges and opportunities of digital marketing when used by the companies by online payment mobile phones social media advertisement and any other digital medium for increasing the sales.

Morris (2013), conducted a study on 'More Consumers Prefer Online Shopping' Shoppers increasingly want what's called a "seamless Omni channel experience," meaning one in which retailers permit them to buy product by various ways in which the customer is more comfortable.

Dehkordi, G. J., Rezvani, S., Rahman, M. S., Fouladivanda, F., &Jouya, S. F. (2012), focused on conceptual supporting of four different tools that firms may use in their marketing aspect to enhance their service and quality for their customers. This review reveals advantages and issues related to each of the tools which were mobile marketing, e-mail marketing, web marketing and marketing through social network sites (SNS).

Chari, A., Raghavan, M. (2010), studied Foreign Direct Investment in India's Retail Bazaar. This study was basded on secondary sources and potential benefits from allowing large retailers to enter the Indian market by FDI.

Coker B. L. S., Ashill N. J., Hope B., (2011), discussed about the risk involved in purchasing product online .In his study he found preliminary pool of items was generated with evidence of content validity and the IPPR scale was purified using principal axis factor analysis.

Findings and Faces of E commerce with the changing environment of Covid - 19

Government flagship initiatives for E-Commerce development

Government of India has taken several initiatives to be used boost. The E-Commerce sector in India from the last few years' government has given the leverage to E-Commerce company and platforms to organise traditionally offline markets even for the agriculture product also customer can access online. The reach of the product has become convenient to the customers

Government has started following projects:

1. Digital India - Digital Population in India-687.6m

2. Start-up India –To make entrepreneurs

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3. Make in India –Developed India

4. Skill India – Focus on digital educators

Government has been contributing various schemes for growth in e-commerce industry .Now during covid-19 government has started vocal for local for the developing local market in developed and accessible for everyone.

On 2 ,March 2017 the government permitted 100% FDI in online retail of goods and services to attract more foreign investment in the sector for the purpose of the growth 100% FDI is also allowed in B2B E-Commerce in India but FDI is not permitted in the inventory based model of e-commerce which is not allowable to those companies who are having their own inventories and services and sell their product directly to the customers by using online platforms under the skill India project of the government is empowering of providing digital skills to the youth to increase trained workforce to adopt changes or to train 400 million people under the new policy of national policy for skill development by 2020 Skill India scheme of government will support to develop this market rapidly.

Indian government policy on FDI in e-commerce

1. FDI up to 100% was permitted under automatic route in business to business e commerce.
2. It is applicable in following circumstances a manufacturer is permitted to sale its product manufacturer in India through e commerce.
3. Indian manufacturer is allowed to sell its own single brand product in terms of value at least 70% of its product in house and outsource must be can be 30% from Indian manufacturers.
4. A single brand retail trading entity operating by brick-and-mortar stores.

Growth of e commerce in India

Indian E-commerce market is a fourth largest Market in the world and is largely organised and prospective customers are increasing due to the various reasons in Indian .E-Commerce market is prepared to reach nearly 300 to 350 million Shoppers over the next five years this is the platform which can be used and keeping their stores running 24 * 7 this makes convenient to buy the product to select the product for the customers. India is a country which is having more than 70% of their population is young energetic and this is one of the reason to boost up the E-Commerce business in India. It has seen that Indian consumers have matured over the years and uses and accept the new upcoming banking and wallet facility for making the payment of the goods and services in India .The E-Commerce sector is estimated to have more than hundred of players and expected to grow in your future also the growth of e-commerce industry in India was in 2010 4.4 billion in 2016 it was 38 billion dollar but in 2020 it is 120 billion dollar so we can just see

the growth of e-commerce in India it is going rapidly and it is expected to reach 48.7 billion in 2021 .

E commerce business is classified in four categories as per the business transactions:

1. Business To Customers
2. Customer To Business
3. Customer To Customer
4. Business To Business

There are different sectors of e-commerce where the customers can access and buy the product fashion product, electronics& media products, food and personal care product furniture appliances and toys hobby product so the most important thing is that in 2020 the selling product and the sales was increased due to the pandemic Covid-19 and the most of the food products and fashion product bought by the customers during the Covid-19 and second toys and hobby products and next preference is given to the electronic and media product and forth to the furniture that it is expected that E-Commerce growth rate will increase 15% in 2020 to reach at 25% in 2025.

Data Analysis & Findings:

Growth of E commerce B2C in India

The top 7 E-commerce website in India Amazon, Flipkart, Myntra, Jabong, ShopClues, Snap deal, Paytm Mall. These companies are selected on the basis of their earning as it is important financial parameter to know about the performance of any company.

Table: 1 E – commerce contribution in GDP

Year	Population (million)	GDP Per capita PPP	E commerce Sales (million)	GRDI score	Market share
2019	1371	78.74	1202	6902	18%

Source: Global Retail Development Index

Table: 2 Elasticity of Sales volume and Market shares

Year	Sales (billions)	Market Shares	E-commerce Bill Volume (Billion) (Δ SE)	Market Size(billion) (ΔE)	Elasticity of Market share % (ϵ)
2017	2304	10.2%	889	38.5	-
2018	2842	11.9%	954	32.70	66.67
2019	3453	13.7%	1023	152.5	66.08
2020	4135	15.5%	1089	687.62	93.14

Source: https://www.unido.org/sites/default/files/2017-10/WP_15_2017_.pdf
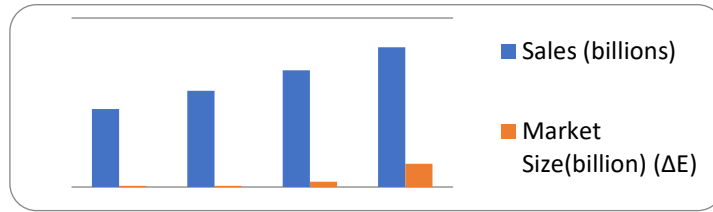
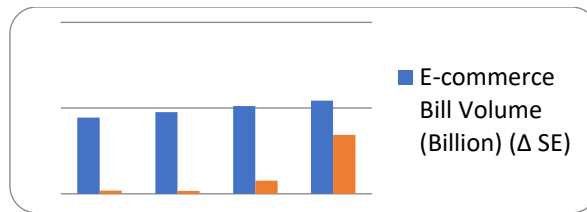Figure 1: Sales (billions) and Market Size (billions)

Figure 2: Market Size (billions) and E- commerce Bill Volume

Table: 3 Expected Elasticity of Market share of 2021

Year	Sales (billions)	Market Shares	E-commerce Bill Volume (Billion)	Market Size(billion)	Elasticity of Market share %
2021(Excepted)	4878	17.5%	1184	829	112.25

112.25 (Elasticity calculated on the basis of Expected Market share of 2021)

Analysis: Elasticity shows that change in bill volume will reflect in market share as we can see in the table: 2-4. The Market share elasticity refers to the % change in market share due to the % change in % increase in Bill Volume. Therefore, the higher the bill volume, the more market share and economic development of country.

It has been that Market share, Bill Volume and sales are continuously increasing continuously which shows growth of E –commerce in India.

 The Compound Annual growth rate of e commerce is going to increase 19.6% from 2019 to 2023.

Strategies followed by companies for increasing sales during Covid -19:

1. During covid in April Reliance Industries started Home delivery of basic needs product in partnership with local Kirana stores in Mumbai.

2. Hershey Chocolate maker partnered with Swiggy and Dunzo to introduce online stores for increasing market share and to reach the product at every customer.

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3. In order to increase digital platform access government of India allocated 8000 crore to bharat net project to provide broad band services in rural areas .

4. It is expected that it will increase the double by 2022 by end of the year Indian organised retail will reach only 18% share of the market in 2019 but because of the large population or due to the Covid small shopkeepers are providing online selling facility for increasing accessibility of the customers and customers are preferring to buy the product from the online platform so it is expected in near future opportunity will grow for the small shopkeepers .Now with comparison of other countries India will also lead to the other developed countries. Rating of E commerce will also increase.

5. The kirana shops using different digital payment space to sale the products after started this pandemic.

Conclusion & Suggestions:

This study is related with e commerce market and current working in India. Now a day's due to Covid people do not want to go and spend time in market to buy various things because its again time consuming, tiresome activity and mainly to avoid the risk to be infected from Covid19. Finally we found that among the top 7 companies like Amazon and Flipkart chains the major contributing sector is electronics and food but the most demanding sector is readymade garments sector along with makeup need and jewellery.

Some conventional sectors like food and grocery become most popular during the Pandemic situation but the major challenges true to overcome the gap between production & the supply and security delivery ,Why we prefer the local e-commerce because we are well aware about that and it is more localized, fast and Secure delivery option .If local E-Commerce is promoted by the government as like gem or any other platform like e-market place definitely our Indian economy will boost during every tough situation.

So Although we are focusing on localization E-commerce but we need a secure payment for Global Business in India most of the persons do not have the credit cards in India and they donot believe that this is secure in rural specifically so there would be a better option to make payment in online buying such as like SBI yono app and Bheem app and other apps for secure payment.

Reference:

[1] Rathore, D. A. S., Pant, M., & Sharma, C. (2017, January). Emerging trends in digital marketing in India. In International Conference on Innovative Research in Science, Technology and Management (pp. 107-115).

[2] Chaffey, D. (2019). Digital marketing. Pearson UK.

[3] Reddy, M. P. R. S. E-Retailing in India: Opportunit Challenges. Innovations and Sustainable Growth in Business Management, 45.

[4] Mohan, D. M. (2017). Role Of Digital Marketing Industry In India. Journal of Marketing Strategy, 5(3), 81-89.

[5] Morris, B. (2013). More consumers prefer online shopping. Wall Street Journal, (June 3).

[6] Singh, S., & Singh, M. (2012). Can FDI in retail change the life of farmers? A Case of North India. A Case of North India (December 10, 2012).

[7] Coker, B. L. S., Ashill, N. J., & Hope, B. (2011). Measuring internet product purchase risk. European Journal of Marketing.

[8] https://www.unido.org/sites/default/files/2017-10/WP_15_2017_.pdf

[9] https://retail.economictimes.indiatimes.com/news/e-commerce/e-tailing/e-commerce-revolution-in-india-gets-its-second-wind-post-covid-19/77460376

[10] https://www.unido.org/sites/default/files/2017-10/WP_15_2017_.pdf

[11] https://www.livemint.com/industry/retail/lockdown-impact-india-e-commerce-market-picks-pace-may-touch-rs-7-trln-by-2023-11589530943145.html

[12] https://www.forbes.com/sites/louiscolumbus/2020/04/28/how-covid-19-is-transforming-e-commerce/#73e783603544

[13] https://www.tonydonofrio.com/blog/retail/welcome-to-the-disruptive-$30-trillion-global-future-of-retail.html

[14] https://www.bigcommerce.com/blog/covid-19-ecommerce/#understanding-panic-buying-and-coronavirus.

[15] https://www.financialexpress.com/industry/sme/cafe-sme/personal-data-protection-bill-utilising-personal-data-in-e-commerce-uncertainty-or-opportunity/2051417/

PRACTICAL CONSIDERATIONS FOR A SAFE E-LEARNING PROCESS

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Abstract: *Considering the current pandemic context of 2020, it is of utmost importance for both students and teachers to know that in the online environment there are a plethora of threats, risks and vulnerabilities, all specific to most informatic environments. Because the internet and the mobile technology represent the main element for a successful continuation of the educational process during the Covid-19 pandemic, all users of a computer or similar device are in dire need of information and awareness regarding the informatic security topic.*

Keywords: *social network, cyber security, e-learning, computer security, homework, teleworking*

1. Introduction

In the current conditions, the professional and personal activities of a very large number of people are now very much interconnected through modern communication technologies. Electronic devices, mobility and the cloud concept all contribute to the increase of quality and efficiency of different tasks, of the collaboration level, but also to a growing culture of "easiness".

The main effects of this new tendency are the, on one hand, the facilitation of most legit/normal actions, but also the facilitation of cyber-crimes. Those illegit actions are also commercialized on an illegal market based on selling and exploiting sensitive data/information – a quite profitable market.

The cybersecurity concept tries to prevent such crimes, monitors its specific activities, and reacts to attacks. Specialists in this field protect IT infrastructure, including hardware devices, networks, data, and software applications.

In the case of the teleworking activities, with an abrupt increase during the Covid-19 pandemic, the European Union Agency for Cybersecurity recommends a set of items considered necessary for a "cybernetic hygiene". Recommendations to this

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topic are addressed both to employers as well as to the employees which work under such conditions. At international level there are also other highly regarded organizations that emitted their own updated guides for cybersecurity and teleworking, such as the NIST[4].

In order to avoid the negative consequences of the cybernetic attacks the below recommendations are to be considered:

- avoid using technologies and software solutions which do not benefit of current maintenance/development (e.g., Adobe Flash, Java Applets etc.)
- define complex usernames and passwords for a more secure access to IT infrastructures
- make a physical separation between the internal network (intranet) and the external one (internet)
- use updated antivirus/security suites on all devices, including mobile phones
- update the operating systems and applications used for monitoring/supervising the IT infrastructures
- make regular backups of data and store them safely, in a different physical location
- ensure a safe usage of external memory devices, such as CD/DVDs, USB drives etc.
- do not install or operate software without proper licensing and support
- use detection and prevention of intrusions systems (IDS/IPS)
- do not open email messages, and especially attachments from these messages, which are not veridic
- avoid accessing direct links from within email messages if the message itself is not completely legit and traceable
- avoid filling in with personal data in webpages
- avoid using unrestricted access Wi-Fi networks
- it is recommended that users should use unique credentials, with timed expiration preset, when accessing the internal WLAN
- all WLAN networks should use encryption, at least WPA-2 standard.

2. Improving the security of a computer device

Because computers today have a huge role in our day-to-day lives, both professional and personal wise (payments, shopping, e-learning, socializing etc.), it is of utmost importance to improve their security levels so that we can depend upon them and keep our data safe. Among the methods that we deem necessary for such a goal we can mention:

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[4] www.nist.gov

- Router safety, in order to ensure the computer's safe access to networks. The security of the router is based on the user manual of the respective device, by using the web address for its administration interface, which should allow the following: choosing an encryption method for the data circulated through the wireless network (at least WPA2-AES), changing the username and password for accessing the router's administration interface, hiding of the wireless network identifier (SSID).
- Activating and configuring the firewall. Most modern operating systems include a software firewall. Most wireless routers also have a software firewall built-in. A strong password should be used to protect the access to the firewall settings. The firewall offers protection against external cyber attacks by protecting the access to the network/computer from useless/malevolent network traffic. Firewalls can also stop the access to a computer or network from the internet, as well as the access from that item to the internet. Firewalls can be configured to block certain locations (network addresses), applications or ports, while permitting access for legit and relevant data. There are two large categories of firewalls: software and hardware. Even though they do have differences, advantages and disadvantages based on specific scenarios, the decision to use a firewall is much more important that choosing a certain category for it (Securing Network Infrastructure Devices, 2020).
- Installing and using an anti-virus software. Any software / security suite must be continuously updated. Such an application can detect malware (Increased Emotet Malware Activity, 2020) by regularly verifying the memory and the files on the device and looking for known code sequences. These applications use signatures of the known viruses and malware apps. As new malware and viruses appear daily, these signature sets must also be updated continuously. After installing a security suite, you should periodically scan the entire device (Understanding Anti-Virus Software, 2020). All antivirus programs can be configured to run automatic scans of different files/folders/discs in real-time and run full scans at predefined times. All antivirus programs also have the possibility to manually scan a certain file/folder/disc before using them.
- Removal of unused applications. After checking that an application is really not used anymore, removing such applications increase the level of security by removing a potential security risk. Removal should be done only after making backup copies as a safety measure. If possible, keep the physical media from which the application was initially installed (CD, DVD, USB drive etc.), in case you later decide to reinstall it.
- Deactivating non-essential services. Deactivating operating system services is a high-level step and should be done only after a thorough verification and only by experienced personnel. For example, two of the most common services in the Windows environment are those for file

sharing and printer sharing – in case you are sure you will not need them at some point (or make sure you know how to re-enable them) one can deactivate them and thus reduce the risk of an attack by the way of such insertion point.

- Modifying the default features of the operating system. This thing can also translate into a higher level of security by eliminating another set of attack vector. Carefully evaluate the features that are activated by default and stop or personalize them. As in the case of non-essential services, this step requires extensive knowledge in the field. For example, the Auto Run facility in the Windows environment was activated by default at the time of the Conficker virus, a thing that greatly helped the virus spreading. When this feature is activated, it permits the automated running of certain applications when you connect a CD/USB drive to your device.

- Use the device based on the principle of necessary privileges. In order to minimize the impact of malware in case of an infection, it is advisable to currently use a standard user account on your operating system, with basic rights and privileges. The administrator user should be used only when you install new applications or need to make modifications to the specific settings at operating system level.

- Securing the web browser. This step is critical for improving the security today, especially when an ever-increasing number of attacks are based on browser vulnerabilities. The main stage of securing a browser is to deactivate (as much as possible) dynamic code execution (e.g., Java applets, Flash, ActiveX or JavaScript) for new websites or those that you do not trust. Nevertheless, keep in mind that this step, while greatly ensuring an increase in security, might also come with a degraded level of usability for some websites which heavily rely on such technologies. Another similar step would be to deactivate (as much as possible) the cookies usage. This thing might allow an attacker to find out your credentials and replicate your access of a previously legit access to a website (for example, an online banking system).

- Activate the automated security updates. Most software producers offer periodical updates that solve vulnerability issues related to their products. Because wrong doers can exploit such problems to attack an electronic device, the automatic update of all software is an important step in increasing the overall level of security. Most operating system and important applications have the possibility to automatically update. Try to set these automated features on, every time you install a new electronic device or software application. Keep in mind that cyber criminals can create website that look very similar to the original ones, and manually downloading updates from a website might bring home an unwanted and tainted application. It is advisable to use only the producer's website or

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automatic downloads for such operations (Understanding Patches and Software Updates, 2020).

- Carefully use the email attachments or in-message links. Malware is usually transmitted through people opening email attachments or links that trigger the malware. Some malware applications use the infected devices to further spread their messages. Even if an email appears to originate from a known sender, it is possible and in fact very easy for a cyber criminal or an infected device to masquerade as a legit sender name.
- Pay attention to handling personal or sensitive information. Even if it would be much more comfortable to just tell your password to somebody else and ask him to do something in your place this is a very big security breach.
- Use secure passwords. Do not use passwords that can be easily guessed by others, such as birthdates, child name, significant years etc. There are applications dedicated to cracking passwords that will try attacks by using words from dictionaries until your password is found. The lengthier and the more complex the password, the longer it takes for such an application to work. Moreover, when configuring security questions do not select answers which can be found easily on the internet.
- Consider encrypting the emails. This would greatly increase the security level of your correspondence (The small business guide to secure email, 2019)
- Make sure your passwords are secured. Each employee must have his own password for a certain device or email account. This must be changed every three months, and, for a better security, a multi-factor authentication system should also be deployed for the process of password changing. The standard password today should be at least 12 characters long and include a combination of figures, small and capital letters, and symbols. Passwords must not be some evident possibilities but should be easy to memorize.
- Create policies for archiving email messages at preset times (15-30 days) and deleting non-important messages at predefined times.
- In case of using a mobile device (either from work or personal) for sending/receiving institutional emails, employees must encrypt data, keep the device access restricted with at least a password/pin and install approved security software, so that potential cyber criminals could not easily access the shared Wi-Fi networks.

Even now, the world is preparing to change the entire electronic communications paradigm by implementing the new 5G mobile networks. The huge increase in speed and features will bring electronic communications to virtually any new electronic device and in all modern cars. Observing the impact of the cyber security concepts will become a must for all users and producers, as a potential security breach will become a thousand times more important in the future all-linked scenarios.

If a security breach of a home router today is an important issue but (in probably more than 99% of the cases) it is not something critical, think of such a similar breach that would enable a cyber terrorist to take control of a 5G networked car thousands of kilometers away. In the first case the privacy breach might bring some unpleasant personal details under the public scrutiny, while in the second scenario a paranoid terrorist from Iran or North Korea can take control of a bus in New York, drive it into a public square and produce a massacre, all from the safety of its rat hole across the world.

3. The flux of web searches for telework and security

Google Trends is a free tool that allows us to analyze data based on searches made by Google users as well as by using its services, including YouTube.

By using Google Trends, we have analyzed the tendency of searches, for the last five years, of the terms "cyber security" and "teleworking". In Figure 1 and Figure 2 below, we can see a huge increase of the interest in searches for "teleworking", while the general "cyber security" search is more stable.
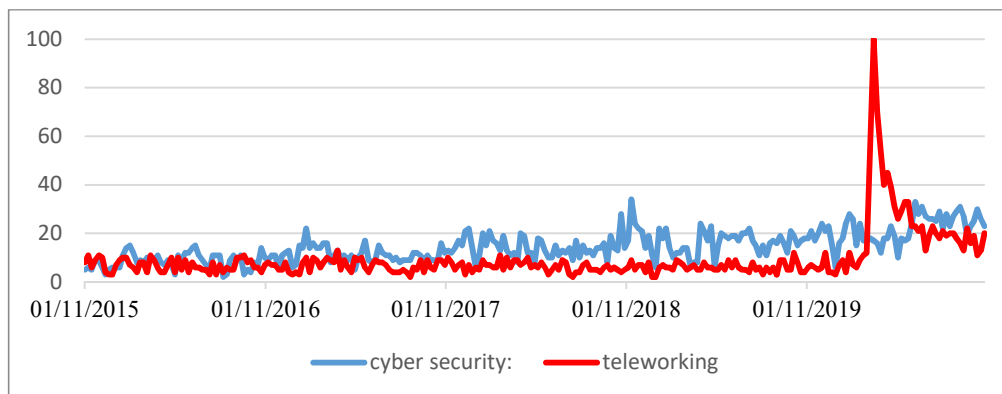
Figure 1. Tendency of searches for the terms "cyber security" and "teleworking" during 2015-2020
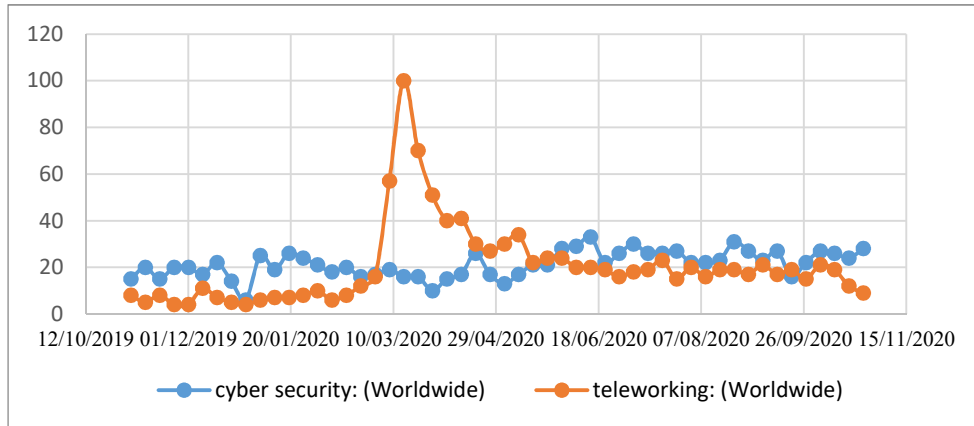
Figure 2. Tendency of searches for the terms "cyber security" and "teleworking" during 2019-2020

The tendency for searches during the last five years of the terms "elearning" and "teleworking" is presented in the Figure 3 and Figure 4 below. By analyzing the images we also see a huge increase for "elearnin" term after march 2020, a phenomenon due to the world health crisis of the Covid-19 pandemic.
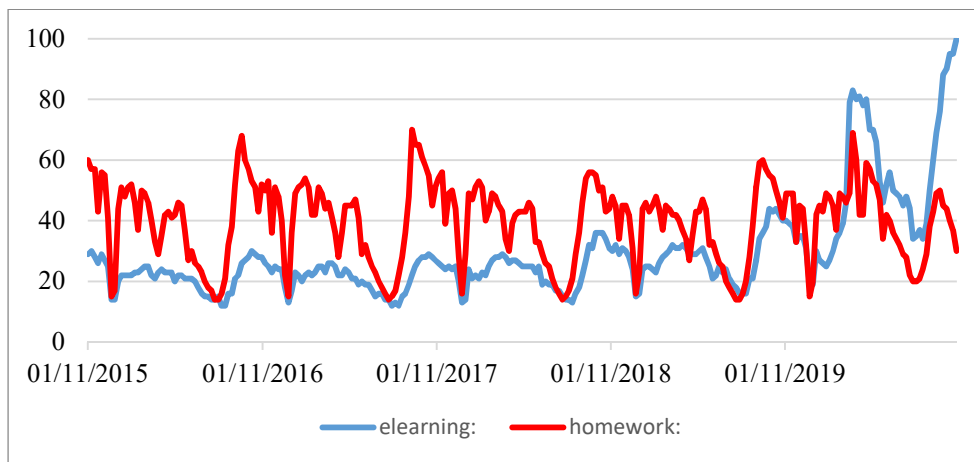
Figure 3. Tendency of searches for the terms "elearning" and "teleworking" during 2019-2020
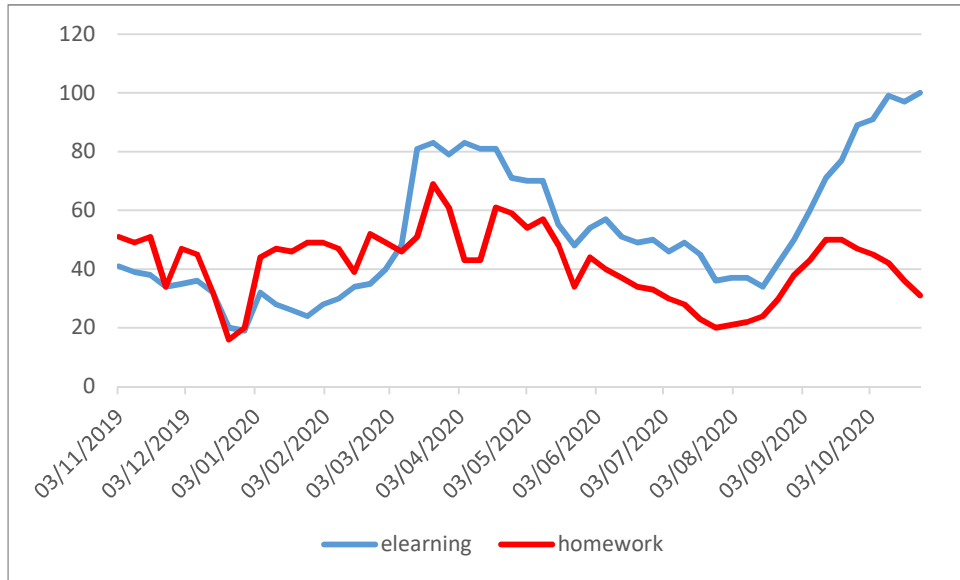
Figure 4. Tendency of searches for the terms "elearning" and "teleworking" during 2019-2020

Going further, we have analyzed the tendency of searches for the topics of "social network", "cyber security", "elearning" and "computer security". The images show that, while the generic preoccupation for the "elearning" existed before, after the start of the current pandemic the world interest for "elearning" spiked exponentially – see Figure 5 and Figure 6 below.
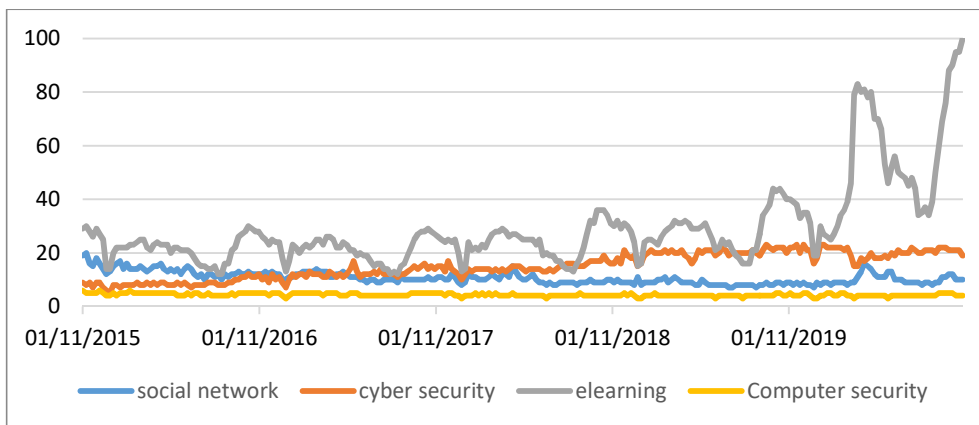
Figure 5. Tendency of searches for the terms "social network", "cyber security", "elearning" and "computer security" during 2015-2020
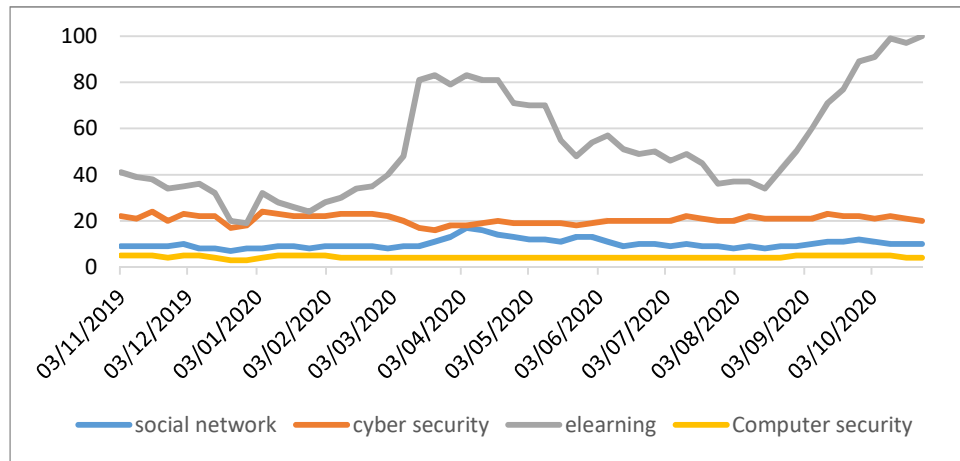
Figure 5. Tendency of searches for the terms "social network", "cyber security", "elearning" and "computer security" during 2019-2020

Comparing all these tendencies, we can accurately sustain that the e-learning and the teleworking activities have greatly increased during the last year. Regardless of the type of activity, e-learning or teleworking, all online processes must make use of an ever-increasing security paradigm.

Our opinion is that even after the end of the current pandemic the developed countries will continue to make extensive use of online activities where it is most suitable. Even in the educational field, although at the present time most actors seem completely fed up with the online options, we think that the future is a carefully balanced mix of online and face-to-face experiences, taking the best parts of every option and creating a new, superior and more secure blend.

4. Conclusion

Even though no individual step will ever be able to eliminate all risks, when all steps are used together these practices will consolidate the security of your online environment and will greatly heal you mitigate and reduce most threats and risks.

In a world where the access to the internet is more and more viewed as a standard right for any citizen (Tăbușcă, 2010), in a world where anybody and everybody is relying more and more on electronic devices and online communications – there is an absolute and permanent need to increase the security levels that define our different activities.

From a malevolent but somewhat harmless Zoom-bomb, where unwanted guests can disrupt a Zoom video-meeting if a certain set of configurations is not put in place (O'Flaherty, 2020), to a journalist taking part into a secret and very high level security meeting (Barigazzi, 2020), from high school pupils connecting to Google Meet and screaming during a lecture up to Microsoft Forms quiz users

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substitutions, all these issues must be addressed by the software producers in order to bring higher and higher levels of security. Moreover, there is also another thing that must be taken into account by the software producers: making an application as best as possible from the security point of view could render it actually unusable for standard usage which probably do not require so many safety precautions. There is a fine balance that has to be kept in order to ensure the safety of the users, of their shared contend, while not degrading the user experience to a level that might provoke the user to abandon the respective software.

References

[1]   Barigazzi, J. (2020, 11 20). *Dutch reporter gatecrashes EU defense ministers' videoconference* . Retrieved from Politico.eu: https://www.politico.eu/article/dutch-reporter-gatecrashes-eu-defense-ministers-videoconference/

[2]   Increased Emotet Malware Activity. (2020, 12 06). *Cybersecurity & Infrastucure Security Agency*. Retrieved from Cybersecurity & Infrastucure Security Agency: https://us-cert.cisa.gov/ncas/current-activity/2020/01/22/increased-emotet-malware-activity

[3]   O'Flaherty, K. (2020, 03 27). *Beware Zoom Users: Here's How People Can 'Zoom-Bomb' Your Chat*. Retrieved from Forbes: https://www.forbes.com/sites/kateoflahertyuk/2020/03/27/beware-zoom-users-heres-how-people-can-zoom-bomb-your-chat/?sh=6f8a7893618e

[4]   Securing Network Infrastructure Devices. (2020, 12 06). *Cyber Security & Infrastructure Agency*. Retrieved from Cyber Security & Infrastructure Agency: https://us-cert.cisa.gov/ncas/tips/ST18-001

[5]   Tăbușcă, S. (2010). The Internet Access as a Fundamental Right. *Journal of Information Systems and Operations Management*, 206-212.

[6]   The small business guide to secure email. (2019, 04 02). *Microsoft 365 Team*. Retrieved from Microsoft 365 Team: https://www.microsoft.com/ro-ro/microsoft-365/business-insights-ideas/resources/the-small-business-guide-to-secure-email

[7]   Understanding Anti-Virus Software. (2020, 12 06). *Cybersecurity & Security Infrastructure Agency*. Retrieved from Cybersecurity & Security Infrastructure Agency: https://us-cert.cisa.gov/ncas/tips/ST04-005

[8]   Understanding Patches and Software Updates. (2020, 12 06). *Cybersecurity & Security Infrastructure Agency*. Retrieved from Cybersecurity & Security Infrastructure Agency: https://www.us-cert.gov/ncas/tips/ST04-006

ON PERFORMING SKEW DETECTION AND CORRECTION USING MULTIPLE EXPERTS' DECISION

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Abstract: *One of the main objectives of image processing algorithms is extracting information. An important class of such algorithms is the one responsible for Optical Character Recognition (OCR). A common problem among OCR systems is the need to work with properly oriented images. The process of finding the skew angle and rotating the initial image by its opposite is known as deskew. This paper presents a voting-based approach to solve the document deskew problem, combining results from different algorithms to cover a wide range of document types. The proposed method proved both precise and reliable, suitable to be integrated into mass-production retroconversion systems.*

Keywords: *skew correction, document deskew, image processing, skew detection, layout analysis*

1. Introduction

A. Problem Motivation

The main purpose of OCR algorithms is to convert documents into digital format for easier manipulation and preservation. They achieve this by matching pixels of detected characters to pixels of known characters.

If the documents are to be retrieved correctly, the images processed by the OCR algorithms should be easy to read, and in the above context, this means that they

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should be straight and not noisy. Because of this, several preprocessing algorithms, such as denoising, thresholding, de-skewing, etc. should be applied to the image to improve the accuracy of the OCR. This paper will focus on skew correction, in order to ensure proper general image document retroconversion and enable correct text line retrieval [14].

B. Previous Work

Hough Transform [4] takes the image from the Cartesian coordinate system to the polar coordinate system. By doing this, each point/pixel (x, y) will have a corresponding sine wave in polar coordinates. If the Cartesian points are collinear, then their corresponding sine waves will intersect, the point of intersection having as one of the coordinates the angle of the line that goes through the Cartesian points.

Another possibility is to use the Fourier Transform [5]. When applying the Fourier Transform on a skewed image, the resulting image will have the same skew. Because of this, the Hough Transform can be used to de-skew images that do not have any lines.

Projection profiling [6] takes place in the Cartesian coordinate system, where the entire image is projected on one of its axes. If the image is a skewed document, the projection on the vertical axis will resemble a uniform distribution. On the other hand, if the image is an un-skewed document, the result of the projection will be a saw-like distribution, its variance being maximal. The algorithm simply iterates through the angles in an interval, looking for the projection with the highest variance.

Again, this algorithm may be used on the Fourier Transform to de-skew images that are not necessarily image documents.

Another approach is to use Machine Learning techniques for skew detection and deskewing. Kassm and Achkar [8] present a model for License Plate Recognition, which uses cascaded layers of Convolutional Neural Networks for detecting a plate, detecting its skewing angle, deskewing the image and using the deskewed image for character recognition.

2. Proposed Method

This paper proposes a voting system that combines the results from Hough Transform, Projection Profiling, and Frequency Domain Hough Transform into one answer. Because of this, a confidence level was added to the output of each algorithm.

Implementation

The steps taken for the Hough Transform algorithm are:

1. Pre-process the image

    a. Threshold the image [10]

    b. Identify contours (letters/groups of letters) in the thresholded image

    c. Generate a new image by placing points at the same coordinates as the anchors of the contours found in the previous step

2. Look for lines using the OpenCV [7] V4.12 function *HoughLines* (the function returns a list of the most voted lines, in descending order of votes).

3. Compute the confidence

    a. The lines that have fewer votes than the most voted one, divided by a constant, are eliminated (different values were given to the constant in order to normalize the confidence values of the algorithms)

    b. Compute the sum of all votes for the lines that are left

    c. Compute the sum of the votes for the lines that have the same angle as the dominant line

    d. Divide the two sums and obtain a number between 0 and 1
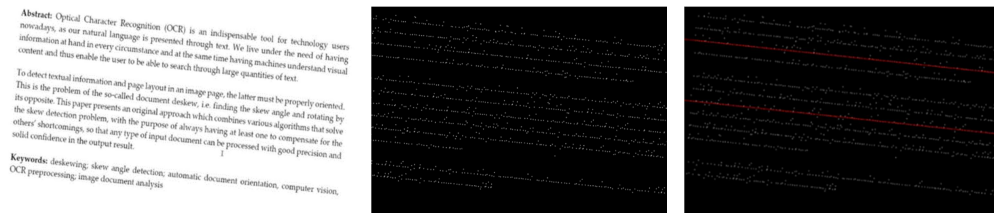
Figure 1. From left to right: a. initial image; b. image with anchor points; c. skew angle detection

The steps for the Projection Profiling algorithm are:

1. Pre-process the image

    a. Threshold the image [11]

    b. Identify contours (letters/groups of letters) in the thresholded image

    c. Generate a new image by placing points at the same coordinates as the anchors of the contours found in the previous step

2. Rotate the image and find the angle for which the vertical projection has a maximal variance

3. Compute the confidence

    a. Divide the maximal variance by the sum of all variances (which was found, empirically, to have values between 0 and 0.5)

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   b.   Subtract 0.5

   c.   Take the absolute value

   d.   Multiply by a constant (to normalize the confidence values of the algorithms)

   e.   Subtract the result from 1

The steps for the Frequency Domain Hough Transform algorithm are:

1. Pre-process the image

   a.   Pad the image so it becomes square-shaped

2. Compute the Fourier Transform

3. Create the image of amplitudes

4. Threshold the image [12]

5. Look for lines using OpenCV HoughLines

6. Compute the confidence (the steps are the same as the regular Hough Transform)

7. Compute the confidence (the steps are the same as the regular Hough Transform)
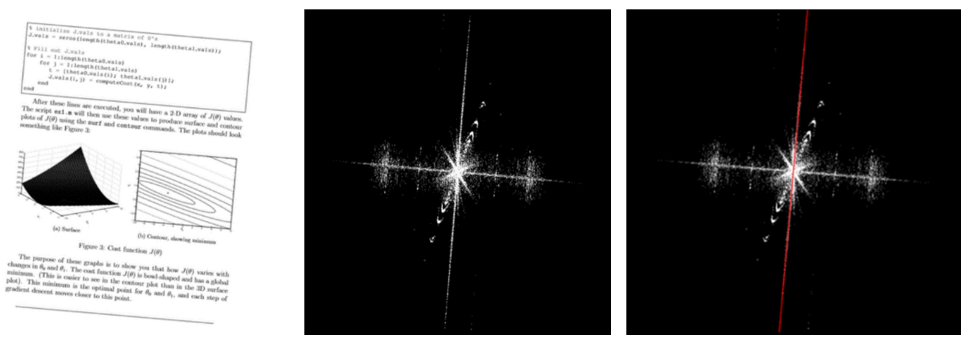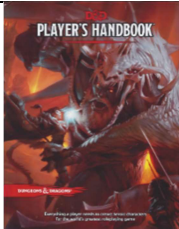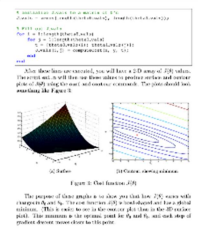
Figure 2. From left to right: a. initial image; b. processed FFT; c. skew angle detection

The voting system combines the angles and confidences resulted from all these algorithms and provides an optimal solution. Three voting mechanisms were approached: best first, unanimous, and weighted voting. The first method picks the result of the algorithm with the greatest confidence, completely neglecting the others. The unanimous voting computes the skew angle as the average of each algorithm's result. The last method, weighted voting works in the same way as

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unanimous voting, but this time a weighted average is computed. Better results can be obtained if the output with a confidence lower than half of the maximum is discarded.

Evaluation

The test sample consisted of 14 images rotated by angles ranging from -5 degrees to 5 degrees with a 0.1° step. The angle search space was also limited to [-5, 5] to save execution time, but the application can perform on any angle. A dataset of 1414 images might seem small, but this paper is just a proof of concept. Larger tests can be conducted if needed. The dataset needs to be as diverse as possible. It includes several classes of images as can be observed in Table 1.

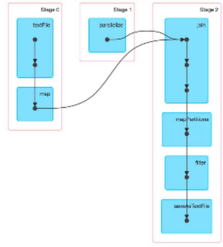| Class	Sample image	Motivation
Simple blocks of text		The most trivial of cases, good for testing the ability to detect rows
Images with little text		Very little information surrounded by as much noise as possible
Scanned documents with blocks of text on different backgrounds		The most common use case
Text with images		Moderate amount of information and noise

Class	Sample image	Motivation
Handwritten documents		These should be harder for spatial domain algorithms, but the frequency domain shouldn't have problems with them
Diagrams, graphs, etc.		A small amount of information with a moderate amount of noise

Table 1. Classes of images included in the skew detection dataset

3. Performance Measurements

Best First Voting produces the best results as can be observed in Table 2.

Deskew Method	Accuracy	Average Error	Average Confidence	Execution Time (ms)
Hough Lines	99.150%	0.085°	0.632	4.473
Projection Profiling	99.523%	0.048°	0.545	131.019
Frequency Hough Lines	99.363%	0.064°	0.481	51.512
Best First Voting	**99.568%**	**0.043°**	**0.752**	**187.004**
Unanimous Voting	99.541%	0.046°	0.616	187.004
Weighted Voting	99.553%	0.045°	0.651	187.004

Table 2. Compared performance indicators for the presented method against candidates

The results are also consistent with the ones presented in [1], where similar accuracies were reported for the voting systems.

Comparison with Existing Techniques

The results of the voting systems are slightly better than the individual results of the voters. On a dataset of 1414 images, the accuracy went up by 0.04%, which might seem like a very small increase. However, the starting accuracy was already above 99% so the increase in accuracy is significant.

4. Conclusions

Spatial Hough transform is much faster than the voting systems and its accuracy is only 0.4% lower. It is hard to justify the existence of the voting system without valuing accuracy much higher than computational cost. Spatial Hough transform is a reasonable compromise between accuracy and computational cost, but when compromise is not an option it is great to have better alternatives accuracy-wise. Out of all the alternatives presented in this paper, Best First Voting seems to be the best.

Future Work

Many future improvements will be carried in the near future:

- The dataset will be further diversified

- The confidence computation for each algorithm will be improved

- More voters will be added to the voting system

- Computation-heavy voters may be discarded in favor of lower-cost alternatives

- Redundancy will be minimized by using specialized algorithms for small image classes instead of general algorithms that work well on the same classes as other voters

- Integration into a larger image retroconversion system using several other voting-based techniques [9][11][13] will also be performed.

Acknowledgement

References

[1] C.A. Boiangiu, O.A. Dinu, C. Popescu, N. Constantin, C. Petrescu, *Voting-Based Document Image Skew Detection in Applied Sciences*, Vol. 10, No. 7, 2020, pp. 2236;

[2] I.P. Gurov, A.S. Potapov, O.V. Scherbakov, I.N. Zhdanov *Hough and Fourier Transforms in the Task of Text Lines Detection*, 11th International Conference on Quality Control by Artificial Vision, Fukuoka, Japan, 2013;

[3] Safonov, I. Kurilin *Deskew for Card Image Scanning*, Proceedings of Graphicon, 2011;

[4] A.S. Hassanein, S. Mohammad, M. Sameer, M.E. Ragab *A Survey on Hough Transform, Theory, Techniques and Applications*, JCSI Volume 12, 2015;

[5] N. Beaudoin, S. Beauchemin *An accurate discrete Fourier transform for image processing*, IEEE, 2002;

[6] Papandreou, B. Gatos *A Novel Skew Detection Technique Based on Vertical Projections*, IEEE, 2011;

[7] OpenCV, *Open source Computer Vision library*, URL: https://opencv.org/, Accessed on May 4[th,] 2020;

[8] G.A. Kassm, R. Achkar, *LPR CNN cascade and adaptive deskewing*. Procedia computer science, Vol. 114, 2017, pp. 296-303;

[9] Costin-Anton Boiangiu, Radu Ioanitescu, Razvan-Costin Dragomir, *Voting-Based OCR System*, The Journal of Information Systems & Operations Management, Vol. 10, No. 2, 2016, pp. 470-486.

[10] Costin-Anton Boiangiu, Ion Bucur, Andrei Tigora, *The Image Binarization Problem Revisited: Perspectives and Approaches*, The Journal of Information Systems & Operations Management, Vol. 6, No. 2, 2012, pp. 419-427.

[11] Costin-Anton Boiangiu, Mihai Simion, Vlad Lionte, Zaharescu Mihai, *Voting Based Image Binarization*, The Journal of Information Systems & Operations Management, Vol. 8, No. 2, 2014, pp. 343-351.

[12] Costin-Anton Boiangiu, Andrei Iulian Dvornic, Dan Cristian Cananau, *Binarization for Digitization Projects Using Hybrid Foreground-Reconstruction*, Proceedings of the 5th IEEE International Conference on Intelligent Computer Communication and Processing (ICCP), Cluj-Napoca, August 27-29, 2009, pp.141-144.

[13] Costin-Anton Boiangiu, Paul Boglis, Georgiana Simion, Radu Ioanitescu, *Voting-Based Layout Analysis*, The Journal of Information Systems & Operations Management, Vol. 8, No. 1, 2014, pp. 39-47.

[14] Costin Anton Boiangiu, Mihai Cristian Tanase, Radu Ioanitescu, *Handwritten Documents Text Line Segmentation based on Information Energy*, International Journal Of Computers Communications & Control (IJCCC), Vol 9, No 1, 2014, pp. 8-15.