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Sokol Abazi
Editor-in-Chief

Dear authors, reviewers, and readers of CIT Review Journal,

On behalf of the Editorial Board, I would like to extend a very warm welcome to the Journal's November Issue 2021.

In 2014, CIT Review Journal was established to serve as the official journal of the University College "Canadian Institute of Technology"(CIT), laying the foundation of today's journal. As the Editor-in-Chief, I have become increasingly acknowledgeable of the way that the Journal has invested significant efforts to advance its profile and worked consistently to promote new and quality research. This year, CIT Review Journal has been indexed to two world's largest indexing of scholarly journals, namely Ulrichsweb™ Periodicals Directory and Citefactor, to improve in terms of competitiveness, internationalization, and online presence. It is within this context, I am encouraged to see very bright prospects for CIT Review Journal to effectively provide a research forum to share the latest developments in knowledge and practice in the field of economy and engineering.

We welcome your contributions for the May Issue 2021, and if you have any questions, suggestions, or concerns, please address them to editorialoffice@cit.edu.al.

Thank you and hopefully you will find this Issue informative.

Prof. Dr. Sokol Abazi

EDITORIAL

EFFECT OF COVID-19 OUTBREAK ON HIGHER EDUCATION INSTITUTIONS

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1.1 Background

The outbreak of the Covid-19 pandemic in late 2019 had considerable disruptions on higher education institutions, affecting billions of students in several nation-states worldwide. Approximately 95 percent of the learners have got disrupted by the sudden and unclear closure of learning institutions globally (Dhawan, 2020). The pandemic also threatened almost every sector of university life, all the way from new admissions, course registrations, and campus activities. This situation has led to substantial alterations and transformations in every part of academic life. Conventional instructional systems have been extensively interrupted by societal distancing and restricted transportation to cope with the pandemic. However, even if the limits get lifted, the reopening of universities will bring in new obstacles. As several revised appropriate procedures get implemented, most universities will need adequate time for actual operation and adaptation (Sharma, 2020).

Numerous researchers have disseminated their findings on education systems in innumerable ways after the outbreak. In most learning institutions currently, face-to-face coaching got replaced by other virtual learning methodologies. There is concern that most universities will have to re-structure their academic calendar to adhere to the changing times and the novel technologies. Modernization and alternative educational systems along with evaluation techniques get instantly anticipated. The diseases outbreak has led to the opening of new prospects of laying the groundwork for learning technologies that will be more appropriate in the future (Aristovnik et al., 2020).

The lack of virtual learning infrastructures, instructors' insufficient familiarity with new virtual teaching methods, a non-conducive setting for home learning, fairness, and educational success in the current education presents future problems in the education docket that needs new resolutions. The influence of the pandemic on educational activities worldwide gets examined in several articles. They illustrate that the contagion has taught the world that the education system needs enhancement to cope with the new norm. Learners and educators should get cultured on exhausting various digital educational approaches for future learning purposes, primarily employing virtual educational technologies.

1.2 Covid-19 in the Albanian HEIs Context

The effects of the pandemic on the HEIs did not leave the educational sector in Albania untouched. The key challenges, strategies, and the pandemic's lessons across Albania's HEIs were similar to what the other institutions globally experienced.
Albanian HEIs have experienced many challenges in dealing with the pandemic. One of the most significant challenges was a lack of awareness and preparedness to deal with the pandemic. Most Albanian HEIs did not have business continuing processes (BCPs) and enterprise resource planning (ERPs), which play a vital role in ensuring that the operations of the HEIs are restored to normal after the occurrence of unforeseen events. Changing the mode of learning and working from home were also challenges faced by HEIs. Shifting the Albanian HEIs education delivery mode from the normal classroom or face-to-face learning into online-based learning introduced significant changes for

both students and instructors to adopt. As such, almost all of the HEIs in Albania transitioned from the regular face-to-face learning environments into online lectures, which was a considerable shift since they had never been there before. For courses that were practical or laboratory-oriented, it was not easy to move directly onto online classes. Again, some students were distracted easily during online lectures as they were tempted to surf the internet while listening to lectures. Lecturers were also not left behind as they were faced a variety of barriers working from home. Therefore, HEIs needed to provide the necessary technological infrastructure to enable lecturers to develop and upload content for the students, increasing their overall operational costs.

Despite the many challenges, Albanian HEIs implemented a couple of approaches to curb the effects of the pandemic. On top of their priority, HEIs Management Boards and Senates closed down the institutions for face-to-face learning and moved to online classes. Also, the decision for most HEIs to tweak their academic calendars and engage in the provision of technical advice to Albania's Ministry of Health on controlling the pandemic was necessary. Lastly, Albanian HEIs engaged in short-term research projects to diversify and earn more income, which is required to sustain their operations since most strongly depended on student fee collections.

The Covid-19 experiences have left behind significant lessons for Albanian HEIs to consider going into the future. Institutions of higher learning should embrace business continuity planning to prepare for similar emergencies in the future. They have learned the need to have well-equipped and established university-level, faculty and academic level business continuity plans to highlight the procedures to adopt online-based learning, all the way from preparations, planning, communication and provision of technical support. Similarly, they have learned that they cannot do without planning and familiarizing themselves with several educational tools and methods to deliver content to learners. Albanian HEIs need to embrace backup plans to meet the students' necessary academic requirements. Of utmost priority, the HEIs should continuously conduct risk awareness programs to identify potential risks and approaches to mitigate the risks during disasters. It is paramount for them to carry out continuous risk assessments to identify risky areas and improve them. Last but not least, HEIs must set aside designated funding to enhance their research and innovations and help during tough times.

1.3 Future challenges in HEIs

The absence of proper proficiency on virtual education equipment is projected to cause additional imperative glitches for pedagogical practitioners, students, and teachers while using or to reference these resources in the future (Palmer et al.,2020). The following are some of the issues that numerous researchers project and anticipate to impact higher education institutions in the future.

Availability,cost,adaptability,classroommentoring, life-long schooling, and school curriculum are all issues with the introduction of virtual learning due to the emergence of the outbreak (Burgos et al., 2021). Numerous communities and nations experience substantial complications in sustaining a steady online connection and acquisition to readily available digital tools. Whereas countless vulnerable students in emerging economies have no access to web-based educational instruments, digital learning upsurges the student's experience to screen-time that poses several health problems. (Lemoine et al., 2020).

Virtual learning, according to studies, poses a considerable problem to future education due to a lack of direction from both teachers and parents. There are practical challenges with virtual learning, such as the lack of physical settings that are satisfactory to varied learning models. Furthermore, due to the reduction of contact hours for teaching and learning and a communication gap with teachers when confronting educational challenges, students' academic success will likely diminish in the future (Lemoine et al., 2020).

In addition, students have to get assessed virtually,

necessities continuous trial and error, and unpredictability and ambiguity among instructors, schoolchildren, and guardians. The method used to conduct virtual examinations varies depending on the ease, knowledge, and experience of the educationalists and the suitability of the students. Due to the enormous student population, numerous academic institutions have yet to adopt specific plagiarism-checking procedures and other technologies; hence, this challenge will significantly affect future education (Palmer et al., 2020).

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EDITORIAL

PANDEMIC GLOBAL SITUATION COVID 19, GOVERNMENTAL, INFLATION AND ECONOMIC POLICIES

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We live from the end of 2019 in a time of global pandemic, where economic decisions are very fragile and to keep inflationary policies under control the main actors and factors are governments and the central bank / s. So, fiscal and monetary policies are those that directly and significantly affect the inflation of any country and economic conditions can guide us to make investment decisions. At the end of each year, policymakers approve forecasts for next year's budget based on government budget requests and fiscal policy results for the coherent year. To maintain long-term economic stability we have the Central Bank that make good use of monetary policy and the government exerts constant influence to maintain the money supply, the exchange rate as well as interest rates.

The government has direct responsibility in transferring payments to citizens such as: social support services, health, education, national defense as well as other services and through the analysis of fiscal and monetary policies is informed about the economic activity of the country.

The government maintains accounts with the Central banks, considering its status as a last resort lender. Under these conditions to influence short-term interest rates, the bank uses drawdowns or redeposits.

In case of drawdowns we are dealing with supply from the banking system of surplus cash available, which leads to an increase in interest rates as we have less money available to lend to consumers and businesses who can not borrow due to high interest rates.

In the case of redeposit, we have an increase in deposits and reserves, which leads to an increase in the money supply and a decrease in the interest rate, in these conditions consumers and businesses are ready to borrow.

Although fiscal and monetary policies appear to be straightforward, governments may face challenges that are less effective in implementing them, such as delays, political goals, expectations for the future, and the impact of international economies, which affect the decision-making for the well-being of the economy, price increases for imported goods, thus causing inflation.

All of the above mentioned are factors that make it difficult to manage inflationary pressures, but in addition to the fact that the world is facing a pandemic situation, we must also emphasize the global commitments to reduce carbon dioxide. Having said that in the upcoming next 10 years we will have a tendency to radically change our way of living, being fully oriented towards renewable energy sources and zero carbon dioxide emissions and all this will lead to an increase in demand for certain products globally. We know that "inflation is a game where whoever spends money first - wins". This encouragement that inflationary pressures make the public spend more, also brings a great deal of good to the economy by creating new jobs. The coming years will present us with new challenges, some of them familiar and some of which will be of a form that is emerging for the first time - that could even change the world of finance irreversibly.

Dr. Albana Demi

ANALYSES OF THE CASE STUDIES FOR THE EFFICIENCY OF PUMPING LEMMA FOR THE CONTEXT-FREE LANGUAGES

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Abstract

In this study, we investigated the pumping lemma for context-free languages and analyzed some case studies in terms of their efficiency. Pumping lemmas play an important role in formal language theory. Context-free languages (CFL) is the set of languages that can be defined by context-free grammars. Context-free grammars are used to define programming languages, natural language applications (such as grammar correctors), machine protocols and many others. The case studies are used to simplify the process analyses of the efficiency of pumping lemma for Context-Free Languages. To prove that a Language is Not Context-Free using pumping lemma for CFL, we created a guideline presented in the fourth section that contains a proposed algorithmic procedure. Pumping lemma for CFL is used to show the existence of non-context free languages. Insights and argumentations were provided in the end of the paper.

Keywords: *Context-Free Languages, Pumping lemma, Intelligent systems, Machine/deep learning, Data sciences*

1. Introduction

Language is a long standing theory and well developed area of knowledge that uses mathematical objects and notations to represent devices that constitute the basis of computation and computer technology.

The collection of languages associated with context-free grammars are called the Context-free languages, abbreviated as CFL (Barthwal, 2014). They include all the regular languages and many additional languages. In formal theory, context free language is a language generated by context free grammar (Pettorossi, 2017). CFLs are very important in formal language theory as well as in computer language processing theory (Amarilli, 2018). Pumping Lemma for context-free languages is used to prove that a language is not context-free. This study investigates through several case study analyses for pumping lemma to prove that a language is not context free. Context-free language is the key in the areas such as programming language analysis, design and implementation. Despite its huge number of results, in the form of notations, which are the base to theoretical computer science and practical computer technology, this area has not received much attention in terms of the formalization and development of fully controlled demonstrations.

2. Literature Review

The theory of CFL was developed from mid 1950s to late 1970s. Context free grammars are used to define programming languages, natural language applications (such as, grammar correctors), machine protocols and many others.

Context-free languages are the set of languages that can be defined by context-free grammars or pushdown automata. Indeed, it has been proved that these two mechanisms are equivalent, in the sense that they represent the same language class - the class of the context-free languages.

The pumping lemma for context free languages was first introduced by Bar Hilell, Perles and

Shamir in 1961. Pumping lemma for context free languages stands that every sentence that has a minimum length, it can obtain a finite number of new sentences that also belong to the language. The minimum length depends on the definition of the language. We use pumping lemma to show that a language is not context-free. Pumping lemma for CFL is used to show the existence on non-context free languages. Pumping lemmas play an important role in formal language theory.

Pumping lemmas are known up to order word languages (i.e., for regular/context-free/indexed languages), and have been used to show that a given language does not belong to the classes of regular/context-free/indexed languages.

Pumping lemmas play important role in formal language theory (Smith, 2014). One can prove that a language does not belong to a given language class. There are well-known pumping lemmas, for example, for regular and context-free languages. The first and most known pumping lemma is introduced by Bar-Hillel, Perles, and Shamir in 1961 for context-free languages (Amarilli, 2018).

Nowadays several pumping lemmas are known for various language classes. Ogden's Lemma, on the other hand, is a stronger version of the Pumping Lemma and, although also not sufficient to fully characterize the context-free languages, can be used to prove that certain languages are not context-free, where the traditional Pumping Lemma fails.

In the sixties, Amar and Putzolu (1965) investigated and analyzed a special subclass of linear languages, the so-called even-linear ones, in which the rules have a kind of symmetric shape (in a rule of shape A → uBv, i.e., with non-terminal at the right hand side, the length of u must equal to the length of v). The even-linear languages are intensively studied, for instance, they play special importance in learning theory as discussed by Smith (2014). Amar and Putzolu (1965) extended the definition to any fix-rated linear languages. They defined the k-rated linear grammars and languages, in which the ratio of the lengths of v and u equals to a fixed non-negative rational number k for all rules of the grammar containing non-terminal in the right-hand-side. They used the term k-linear for the grammar class and k-regular for the generated language class. In the literature the k-linear grammars and languages are frequently used for the metalinear grammars and languages (Rawlings et al, 2020) as they are extensions of the linear ones (having at most k nonterminals in the sentential forms).

3. Analyses of Context-Free Grammar

Context-free grammars are a powerful method of describing languages (Horvath, 2010). CFG can describe certain features that have a recursive structure which makes them useful in a variety of applications. CFGs were first used in the study of human languages. An important use of CFG occurs in the specification and compilation of programming languages. A grammar for a programming language often appears as a reference for people trying to learn language syntax. The main idea is to extend CFGs such that non-terminal symbols can span a tuple of strings that do not need to be adjacent in the input string. In other words, the yield of a non-terminal symbol can be discontinuous. The grammar contains productions of the form $A0 \rightarrow f[A1, \ldots, Aq]$ where $A0, \ldots, Aq$ are non-terminals and f is a function describing how to compute the yield of $A0$ (a string tuple) from the yields of $A1, \ldots, Aq$. (Bole, 2021).

Definition. CFG (Context-Free Grammar is essentially a set of production rules that describe all possible strings in a given formal language, that was invented by the linguist Noam Chomsky, and includes a set of four components, G=(V,S,P,S) where,

- V-set of variables and non-terminal symbols,
- S is the terminal alphabet
- S e N is the start symbol and
- P is a finite non-empty set of rules(or productions rules)

Context-Free Grammar has Production Rule of the form

Af a
where a={V U S }* and A f V

Consider the following five substitution rules:

S f AB
A f a
A f aA
B f b
B f bB

S, A and B are variables, S is the start variable and a and b are terminals. We use these rules to derive strings consisting of terminals in the following manner:

1. Initialize the current string to be the string consisting of the start variable S.
2. Take any variable in the current string and take any rule that has this variable on the left-hand side. Then, in the current string, replace this variable by the right-hand side of the rule.
3. Repeat 2 until the current string only contains terminals.

The string aaaabb can be derived in the following way:

S f AB
f aAB
f aAbB
f aaAbB
f aaaAbB
f aaaabB
f aaaabb

This derivation can also be represented using a parse tree shown in Figure 1.

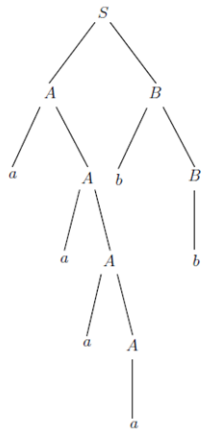


Figure 1. Derivation using a parse tree

The language of this grammar is the set of all strings that

- can be derived from the start variable and
- only contain terminals.

Example: For generating a language that generates equal number of a's and b's in the form a^n b^n, the Context-Free Grammar will be defined as

$G=\{(S,A),(a.b),(S \to aAb, A \to aAb \mid e)\}$
$S \to a\,Ab$
$\to aaAbb$ (by $A \to aAb$)
$\to aaAbbb$ (by $A \to aAb$)
$\to aaabbb$ (by $A \to e$)
$a^3 b^3 \rightarrow a^n b^n$

Let N = {S}, T = {a, b}, P = {S f aSaSb, S f a},then G = {N, T, P, S} is a context-free grammar.
Let N = {S}, T = {a, b}, P = {S f Sa, SS f aba},then G = {N, T, P, S} is not a context-free grammar.

The word to the left of f in the rule SS f aba is not a single element of N. The language L generated by a context-free grammar G is called a context-free language (CFL).

The set of all CFL is identical to the set of languages accepted by Pushdown Automata.

4. Analyses of Chomsky Normal Form

Chomsky Normal Form (CNF) is a simple and very useful form of a context free grammar.

Definition: A context free grammar is in Chomsky Normal Form if every rule of a CNF grammar is in the form:

- $A \to BC$
- $A \to a$

Where „a" is the terminal and A,B,C are any variables except B and C may not be the start variable. There are only two variables on the right hand side of the rule. In addition we permit the rule $S \to \varepsilon$,where **S** is the start variable.

If L is a CFL, then $\exists p$ *(pumping length)* $\forall z \in L$, if $|z| \geq p$ then $\exists u,v,w,x,y$ such that $z=uvwxy$

1. $|vwx| \leq p$
2. $|vx| > 0$
3. $\forall i \geq 0$. $uv^iwx^iy \in L$

Let **G** be a **CFG** in Chomsky Normal Form such that **L(G)=L**.

Let **z** be a „very long“ string in L.

Since z ∈ L there is a parse tree for z.
Since z is very long, the parse tree (which is a binary tree) must be „very tall“
The longest path in the tree, by pigeon hole principle, must have some variable (say) R repeat.
Let *u; v;w; x; y* be as shown in Figure 2.
Every regular language is context free.

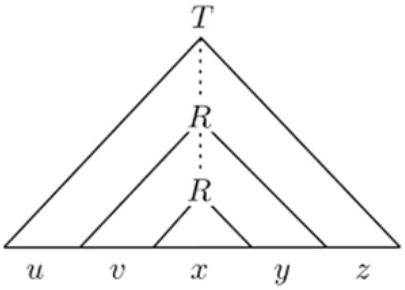


Figure 2. Parse tree

5. Pumping Lemma

For the sake of clarity, we prefer the term fix-rated (k-rated) linear for those restricted linear grammars and languages that were introduced by Horváth, et al (2010). The created linear language class is exactly between linear and normal for all rational numbers in k. In addition to their union, all sets of fixed linear languages are also included in the classes of strictly linear languages. In the special case, if k = 1, you get a linear grammar and language. On the other hand, if k = 0, it corresponds to regular grammars and languages.

Derived trees of the crated linear grammar form the shape of a pine tree. This paper also considers pumping lemmas in these languages. These new pumping lemmas also work for regular languages because all regular languages are linearly crated for all nonnegative rational ks. In this way, regular language words can be pumped in two places in parallel. There are also extensions of linear grammars. A context-free grammar is said to be k-linear if it has the form of a linear grammar plus one additional rule of the form S → S1S2 . . . Sk, where none of the symbols Si may appear on the right-hand side of any other rule, and S may not appear in any other rule at all. A language is said to be k-linear if it can be generated by a k-linear grammar, and a language is said to be metalinear if it is k-linear for some positive integer k.

The Pumping Lemma states that, for every context-free language and for every sentence of such a language that has a certain minimum length, it is possible to obtain an infinite number of new sentences that must also belong to the language.

THEOREM: Let L be a CFL. Then there exists a constant n such that if z is any string in L such that z is at least n, then we can write $z = uvwxy$, to the following conditions:

- $vwx \leq n$. That is,the middle portion is not too long
- $vx \neq e$. Since x and x are the pieces to be „pumped“,this condition says that at last one of the strings we pump must not be empty.
- For all i ≥0, uv^iwx^iy is in L.That is,the two strings *v* and *x* may be „pumped“ any number of times,including 0,and the resulting string will still be a member of L.

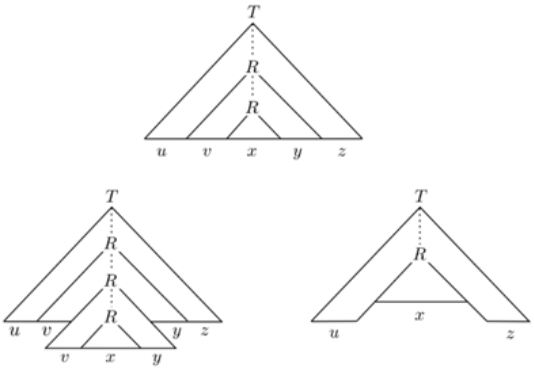


Figure 3. Pumping strings v and x zero times then pumping them twice

If L is a context free language, then, L has a pumping length 'P' such that any string 'S', where S≥ P may be divided into five pieces S=*uvxyz* such that the following conditions must be true:

a) $\boldsymbol{uv^ixy^iz}$ is in L for every i ≥ 0
b) $|v\,y| > 0$
c) $v\,x\,y \leq P$

Lemma: Let G be a context-free grammar in Chomsky normal form, let s be a non-empty string in L(G),and let T be a parse tree for s. Let l be the height of T,l is the number of edges on a longest root-to-leaf path in T.

Then $s \leq 2^{l-1}$

We can start with the proof of the pumping lemma. Let L be a context-free language and let Q be the alphabet of L.
There exists a context-free grammar in Chomsky normal form, G = (V,,R, S), such that L = L(G).

Define r to be the number of variables of G and define $p = 2^r$. We will prove that the value of p can be used as the pumping length. Consider an arbitrary string s in L such that $|s| \geq p$, and let T be a parse tree for s. Let *l* be the height of T. By the lemma we have:

$$s \leq 2^{l-1}$$

And on the other hand, we have

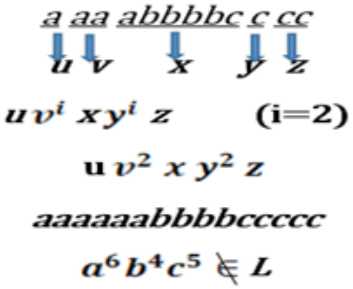
$$|s| \geq p = 2^r$$

By combining these inequalities,we see that $2^r \leq 2^{l-1}$, which can be written as $l \geq r + 1$

Consider the nodes on a longest root-to-leaf path in T. Since this path consists of *l* edges, it consists of l+1 nodes. The first l of these nodes store variables, which we denote by $A_0, A_1, \ldots$, (where $A_0 = S$), and the last node (which is a leaf) stores a terminal, which we denote by *a*.

Since $l - 1 - r \geq 0$, the sequence $A_{l-1-r}, A_{l-r}, \ldots, A_{l-1}$ of variables is well-defined. Observe that this sequence consists of r + 1 variables. Since the number of variables in the grammar G is equal to r, the pigeon hole principle implies that there is a variable that occurs at least twice in this sequence.

In other words, there are indices j and k, such that $l - 1 - r \leq j < k \leq l - 1$ and $A_j = A_k$. Refer to the figure below for an illustration.



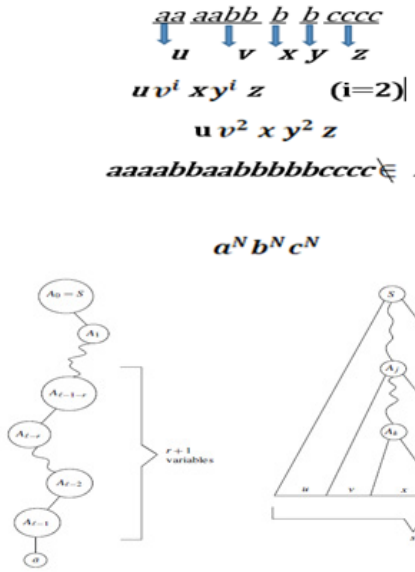


Figure 4. Nodes storing the variables

From the figure above, the nodes storing the variables A_j and A_k partition s into five substrings *u, v, x, y,* and *z*, such that $s = uvxyz$.

To prove that a Language is Not Context Free using pumping lemma for CFL we follow the steps below:

- Assume that L is Context Free
- It has to have a Pumping Length (say P)
- All strings longer than P can be pumped S≥ P
- Find a string 'S' in L such that S≥ P
- Divide S into uvxyz
- Show that $u\, vi\, x\, yi\, z \in L$ for some i
- Consider the ways that S can be divided into uvxyz
- Show that non of these can satisfy all the 3 pumping conditions at the same time
- S cannot be pumped ==CONTRADICTION

Proposed algorithmic procedure

- linear (Lin) grammars: each rule is one of the next forms: A → v, A → vBw; where A, B ∈ N and v, w ∈ V ∗ .
- i-linear (i-Lin) grammars: it is a linear grammar plus one additional rule of the form S → S1S2 . . . Sk, where S1, S2, . . ., Sk ∈ N, and none of the Si may appear on the right-hand side of any other rule, and S may not appear in any other rule at all.
- metalinear (Meta) grammars: A grammar is said to be metalinear if it is i-linear for some positive integer i.
- i-rated linear (i-rLin) grammars: it is a linear grammar with the following property: there exists

a rational number i such that for each rule of the form: A → vBy: |y| |v| = i (where |v| denotes the length of v). Specially with i = 1:

• even-linear (i-rLin) grammars. Specially with k = 0:

• type 3, or regular (Reg) grammars: each derivation rule is one of the following forms: A → y, A → yB; where A, B ∈ N and y ∈ V

Consequences of Pumping Lemma

If L is context-free then L satisfies the pumping lemma. If L satisfies the pumping lemma that does not mean L is context-free. If L does not satisfy the pumping lemma then L is not context-free.

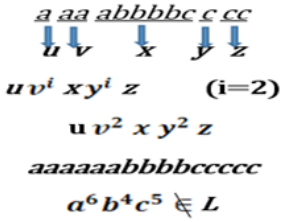
EXAMPLE 1.

Let's show that **L={ $a^N b^N c^N$ | N ≥ 0}** is *not* context-free using the Pumping Lemma

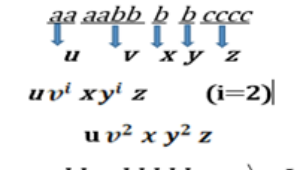
- Assume that L is context free
- L must have a pumping length (say P)
- Now we take a string S such that S=$a^P b^P c^P$
- We divide S into parts ***u v x y z***

Eg.P=4 So, S=$a^4 b^4 c^4$

Case 1. *v* and *y* each contain only one type of symbol



Case 1. Either *v* or *y* has more than one kind of symbols.



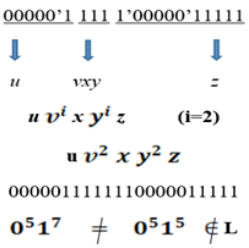
EXAMPLE 2.

Proof. Let's show that ***L={ww/w* ∈{0,1}* }*** is not context free

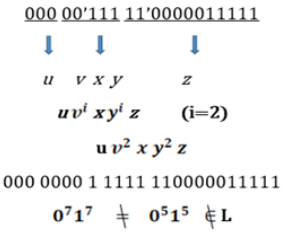
- Assume that L is context free
- L must have a pumping length (say P)
- Now we take a string S such that **S=$0^P 1^P 0^P 1^P$**
- We divide S into parts ***u v x y z***

Eg. P=5 So, S=$0^5\ 1^5\ 0^5\ 1^5$

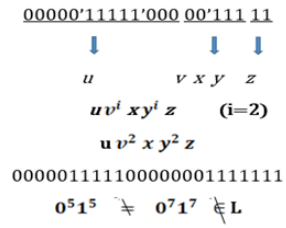
Case study 1. *vxy* does not straddle a boundary



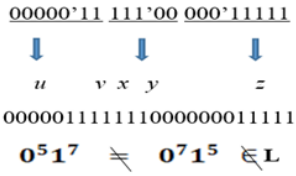
Case study 2a. *vxy* straddles the first boundary



Case study 2b. *vxy* straddles the third boundary



Case study 3. *vxy* straddles the midpoint



Proof: It goes in the standard way: longer rules can be simulated by shorter ones by the help of newly introduced nonterminals.

6. Conclusions

In this study we used several case studies to simplify the process of analyses of the efficiency of pumping lemma for context-free languages to show that the language is not context free. Context-free grammar is a popular tool for defining context-free languages, however not the unique and the most adequate for all cases. The Pumping Lemma for context-free languages is not sufficient to precisely define a context-free language since many non-context-free languages also satisfy the property. In fix-rated linear languages the lengths of the pumped sub words

of a word depend on each other, therefore these pumping lemmas are more restricted than the ones working on every linear or every context-free language. Since all regular languages are i-rated linear for any non-negative rational value of i, these lemmas also work for regular languages. The question whether only regular languages satisfy our pumping lemmas at least for two different values of i (or for all values of i) is remained open as a conjecture. The presented research study reports the ongoing research efforts in order to formalize the classical context-free language theory which was initially based solely on context-free grammar. All-important objects have been described and the basic grammar exit operations have already been implemented. Evidence of the accuracy of concatenation, union and closure operations (both direct and reverse paths) has been established. Various grammar simplification strategies have also been implemented. Evidence of their correctness has been provided.

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A REVIEW OF DEEP LEARNING FOR SELF-DRIVING CARS: CASE STUDY

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Abstract

Deep Learning (DL) is a subfield of Machine Learning (ML) that deals with algorithms inspired by the structure and function of the brain. DL uses complex algorithms and deep neural nets to train a model. It consists of the learning of artificial neural networks that consider algorithms inspired by the human brain by learning how to use a large amount of data. It includes machine learning, where machines can learn by experience and get skills without human intervention. The importance of deep learning is the ability to process a large number of characteristics allowing deep and powerful learning when dealing with ambiguous data. This paper aims to study and analyze to be updated existing papers related to the deep learning field and introduce our contribution. An additional aim of this review paper is to concentrate on the self-driving cars case study and introduce the new approach with high performance.

Keywords: *Neural Network, Architectures, Big Data, Machine Learning, Autonomous Driving*

1. Introduction

We start this study by mentioning an Artificial Neural Network (ANN) is a part of computer architecture or system that is designed to emulate the way information is analyzed and interpreted by the human brain. It is the basis of artificial intelligence (AI) and solves problems that are hard or impossible to be done by human or statistical standards. The main remarkable difference between deep learning and classical machine learning is its execution with a large size of data. When data is few, deep learning algorithms do not proceed well. This is due to deep learning algorithms demanding a large quantity of data to recognize them. We can introduce the most important examples or applications of deep learning as follows: Machine translation, virtual assistants, visual recognition, self-driving cars and drones, robotics, facial recognition, medicine and pharmaceuticals, customer service, fraud detection, news aggregation, digital marketing, natural language processing, colorizing videos and images, military, and health care. The evolutionary history of DL started several years ago.

The limitations of deep learning are data, computational power which has of cores as compared to CPUs, and training times. Artificial Intelligence means enabling the machine to think while ML has the statistical tool that explores and analyzes the data and can be supervised by the past labeled data and considered as a subset of AI, unsupervised clustering, and reinforcement semi supervising. Machine learning was developed from object recognition in essence. It assumes that smart machines should be able to learn and adjust to their climate through experience [1-3]. Deep learning is a subset of ML and creates multi neural networks architecture and has various techniques as Artificial Neural Network, Convolutional Neural Network (CNN), and Recurrent Neural Network (RNN). However, Data Science (DS) technique applies all previous ones and uses some mathematical tools like statistics, probability, linear algebra, and differential calculus. An artificial neural network consists of several interconnected, functional elements, or neurons that perform and process the information by using parallel information-processors, to solve and classify problems by regression method. The idea is to split the feed in data into discrete value or classes that maps inputs to outputs.

DL is based on the functioning of the human brain. Let's understand how a Biological Neural Network (BNT) looks like (dendrite, cell nucleus, axon, and synapse) where Artificial Neuron contains input, nodes, weights, and output. There are several steps to process the perceptron learning model are given as demonstrated in Fig. 1:

• **Step 1** calculating the weighted sum of the inputs.
• **Step 2** passes the calculated weighted sum as in the input to the activation function to generate the output [4-5].

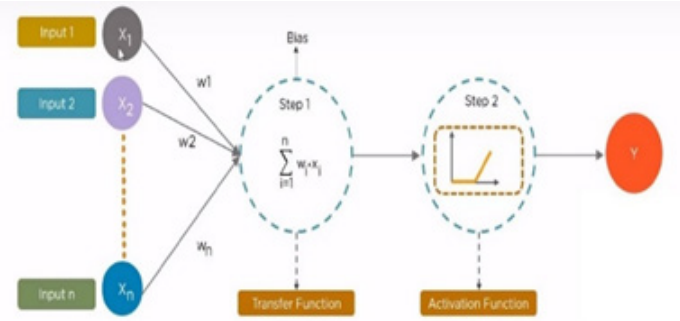


Fig. 1. The Perceptron Learning Model.

The inputs could be pixels values of an image (x_1, x_2, x_3,....., x_n), these values can be 256 or 512 pixels.

• **Step 3** all inputs values are multiplied by the weight (w_1,w_2,w_3..., w_n) and are considered as numeric values and could be any value.

In the transfer function
- The weighted sum sigma is used as a central unit $\sum_{i=1}^{n} = w_i * x_i$

- Then bias is added where the basis is common for each neuron (1 basis/ neuron).

• **Step 4** in the activation function:

The output (step 1) of the transfer function feeds the activation function.
An activation function takes the "weighted sum of input plus the bias" as the input to the function and decides whether it should be fired or not. A standard integrated circuit can be seen as a digital network of activation functions that can be "ON" (1) or "OFF" (0), depending on the input. Several types of activation functions exist, namely: Sigmoid Function, Threshold Function, ReLU Function, and Hyperbolic Tangent Function, and the output differ from one activation function to another. Moreover, the activation function requires nonlinearity. The most used activation function is the Sigmoid Function because it exists between (0 to1). It is used for models where we have to predict the probability as an output. It exists between 0 and 1 as shown in Fig, 2.

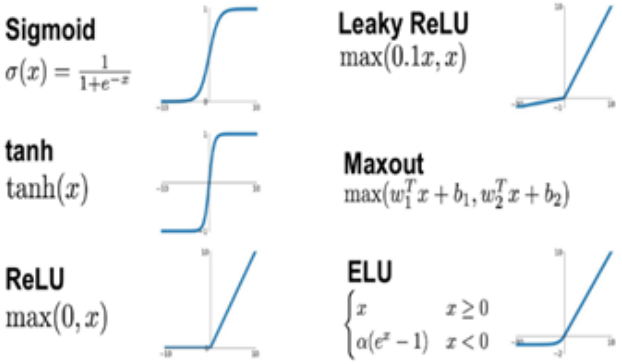


Fig. 2. Activation functions [6].

There are three layers: input layer, hidden layer, and output layer, respectively.
If we compare between traditional machine learning and deep learning algorithms, the last one's performance is increasing the amount of data while the traditional one becomes approximately constant when it reaches the threshold of training data [7]. Top applications of deep learning are in the following fields, namely: in customer support, medical care, self-driving cars (Apple, TESLA, and NISSAN, etc), medical image processing, natural language processing, visual recognition, digital marketing, automatic machine translation healthcare, fraud detection, language translations, and pixel restoration photo descriptions, demographic and election predictions, deep dreaming, and robot navigation. This study will include some of these applications.

DL is growing fast but has some limitations:

- Data: where DL needs a massive volume of data to train.
- Computational power: training and neural network required graphical processes in units which have thousands of cores as computers to CPUs that's more expensive.
- Training time: the time increasing with the

amount of data and numbers of layers in the networks

We need deep learning to:

• Process huge amounts of data: ML algorithms work with a huge amount of structured data but DL algorithms can work with an enormous amount of structured and unstructured data.
• Perform complex algorithms: ML algorithms cannot perform complex operations. To do that we need DL algorithms.
• Achieve the best performance with a large amount of data: As the amount of data increases, the performance of ML algorithms decreases. In order to make sure that the performance of a model is good, we need DL.
• Features extraction: ML algorithms extract patterns based on labeled sample data, while DL algorithms take large volumes of data as input, analyze the input to extract features out of an object, and identify similar objects.

Deep learning approaches are:

• Supervised learning where the input variables introduced as X is structured to the output values that are represented by Y using the following function $Y=f(X)$ [8].
• Unsupervised Learning (UL) analyzes and clusters unlabeled data sets using machine learning methods. These algorithms find hidden patterns in data without the assistance of humans (thus the term "unsupervised").
• Reinforcement learning (RL) is a branch of machine learning that studies how intelligent agents should operate in a given environment to maximize the concept of cumulative reward.
• Hybrid Learning (HL) applies to systems that allow the use of both generative (unsupervised) and discriminatory (supervised) elements.

An artificial neural network is the functional unit of deep learning, using artificial neural networks which mimic the behavior of the human brain to solve complex data-driven problems. Now, deep learning itself is a part of machine learning which falls under the larger umbrella of artificial intelligence. Artificial intelligence machine learning and deep learning are interconnected fields where machine learning and deep learning aid artificial intelligence by providing a set of algorithms and neural networks to solve data-driven problems. Deep learning uses artificial neural networks that behave similarly to the neural networks in the human brain. A neural network functions when some input data is fed to it. This data is then processed via layers of perceptron's to produce the desired output.

2. Literature Review

In recent times many researches have been published toward developing deep learning algorithms. he most reported are shown in [5, 9-20]. The IEEE transactions article developed by Saptarshi Sengupta et al. [5] mentioned that several problems were solved and developed by using deep learning algorithms in the last decade - the automated identification of data patterns; and it can do so with a precision that far exceeds that of human beings. Outside the world of conventional, handcrafted computers, it has solved problems algorithms of learning about aching of patients for practitioners attempting to make sense of the data flow that is now inundating our society.

In the paper developed by Katleho L Masita et al., they discussed some of the most relevant and recent advances and contributions made to the study of the use of deep learning in object detection. In addition, as seen, the results of multiple studies indicate that the application of deep learning in object detection greatly exceeds traditional methods based on handcrafted and learned characteristics [9]. Another paper published by Aman Bhalla et al. [10] illustrated a computer vision model that learns from video data is proposed in this research work. It includes image processing, image augmentation, behavioral cloning, and neural network model convolution. The architecture of the neural network used to detect paths in a video segment, road linings, obstacle positions, and behavioral cloning is used for the model to learn in the video from human behavior.

We summarize some researches published recently on deep learning as demonstrated in Table I.

TABLE I. SUMMARY OF SOME RESEARCHES IN DEEP LEARNING

Involved Authors	Findings & Conclusions	Ref
Saptarshi Sengupta et al	The article introduces an overview of multilayer artificial neural networks that contain deep learning. They also demonstrated some new automatic architecture optimization protocols that use multi-agent approaches. In addition, authors the combined swarm intelligence in Deep Learning approaches and how the influence of one enriches other when applied to real-world problems	[5]
Ben Bright Benuwa et al.	This article studies and analyzes the principles regarding learning algorithms for deep architectures. In addition, this study shows the prior work conducted in deep learning. There still remains a great deal of work to be done in improving the learning process.	[11]
Xiaoxuan Liu	This study explores the diagnostic accuracy of deep learning algorithms versus healthcare professionals in classifying diseases using medical imaging. This paper improved in quality of published previously researches. 58 (71%) of the 82 studies satisfying the inclusion criteria were newly identified in the updated search, suggesting that the past year has seen a substantial increase in the number of studies comparing algorithm accuracy with healthcare professionals.	[12]
Ajay Shrestha, and Ausif Mahmood	The study reviews some optimization methods to develop the accuracy of the training and minimize training time. The authors search into the mathematics beyond training algorithms used in existing deep networks. They tested some state-of-the-art ways to overcome these challenges with different optimization algorithms.	[13]
Antonio Hernández-Blanco et al.	The main objective of this study is to distinguish the educational data mining tasks that have benefited from Deep Learning of recently published research and to illustrate some of the existing state-of-the-art and setting the future aspects of this important field of research.	[14]
Mohamed (Behada) Jamshidi et al.	The main goal of the suggested structure is to enhance the accuracy and hasten recognition and classification of the issues created by the virus by utilizing DL-based methods. The proposed structures and platforms in this study are suitable for dealing with COVID-19 issues. Several methods have been developed, incorporating COVID-19's diagnostic systems, such as LSTM, GAN, ELM, and RNN.	[15]
Jürgen Schmidhuber	This study is reviewed deep supervised and unsupervised learning, reinforcement learning and evolutionary computation, and an indirect quest for deep and wide networks encoding short programs. The main goal of this study is to assign credit to those who contributed to the present state of the art.	[16]
Yann LeCun et al.	The most used form of ML, deep or not, is supervised learning. Authors want to build a system that can classify images that contain: a house, a car, a person, or a pet. The first step is to collect a large data set of related objects, each labeled with a specific category. During training, the machine shows an image and produces an output in the form of a vector of scores, one for each category.	[17]
Reem Ibrahim Hasan et al.	This review paper shows the recently published studies, developed over three years leading up to 2020, for training, increasing, feature fusion and extraction, crop recognition and counting, and plant disease detection. It includes how these techniques can be used to feed deep classifiers and their effects on the accuracy of classifiers.	[18]

During the last decade, self-driving vehicle technology has developed remarkably despite some obstacles encountered, that will be inevitably overcome shortly. The second part of this study will focus on this self-driving vehicle algorithm. This means that we will introduce the recently published studies as related work. Then we will introduce our contribution through the series of simulations we released. The article published by Sorin Grigorescu et al. has introduced an overview of deep learning techniques using autonomous driving. The performance survey and computational requirements serve as a system-level design reference for AI-based self-driving cars [19], where authors started by introducing self-driving AI-based architectures, convolutional and repetitive neural networks, and a deep reinforcement learning model. The method is based on surveyed driving scene perception, path planning, behavior judging, and motion control algorithms. Researchers investigated both standard planning pipeline and perception, where

each method is built using deep learning methods, and End2End systems as well, which directly map sensory information to steering commands that connect sensory information directly to directional commands.

In the article developed by Jelena Kocić et al. [20], a single solution for an end-to-end autonomous driving deep neural network is presented. The main goal of our work was to achieve autonomous driving using a light deep neural network suitable for deployment on compact car platforms. There are many end-to-end deep neural networks used for autonomous driving, where the input to the machine learning algorithm is camera images and the output is steering angle prediction, but these convolutional neural networks are significantly more complex than the network architecture that they proposed.

3. Simulations Results And Discussion Of The Proposed Approach: Self-Driving Car

Series of simulation results are released to show the performance of the proposed approach. Indeed, we concentrated on the following features namely: line lane detection, traffic signs detection, and steering angle. In this subsection, we are going to introduce each feature separately:

A. Lane Line Detection

Detecting lane lines in the road is very important for the car to drive. Using the camera in the front of the car can help to detect the lane line.

To identify the lines in the road, we can use edge detection and gradient. Edge detection is about sharp changes in intensity in adjacent pixels (a sharp color change). Gradient measures the change in brightness. There is a strong gradient (0 to 255 pixel) and a small gradient (255 to 0 pixel). Five steps are required:

• **Step 1:** To convert the image to grayscale; so, in one channel. It is processed faster than a normal image with three channels.

• **Step 2:** To reduce the noise, i.e. converting the colors to be smoothed (blurred).

• **Step 3:** To determine rapid changes in over image. Derivative f(x,y) measures adjacent changes in all directions x and y. There are high threshold and low thresholds. If the gradient is between the low and high thresholds, it is accepted only if it is connected to a strong edge (the rapid changes in brightness). The rapport between the thresholds is 1/2 or 1/3.

• **Step 4:** To create a triangle toward the view of the car, because we know that the lane lines are toward the car. Computing the bitwise of both images and taking the bitwise of each homologous pixel in both arrays ultimately makes the image only show the region of interest traced by the polygonal containing the task.

• **Step 5:** To detect straight lines and mainline. It finds the line which describes the points best.

The image presented in Fig. 3 is converted to grayscale color and smoothed.

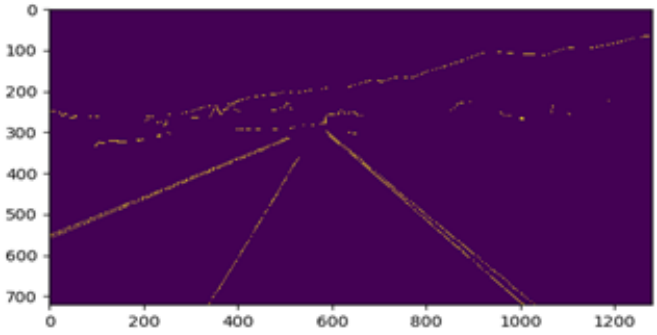


Fig3. Grayscale image.

The region of interest, which shows a triangle in front of the car as demonstrated in Fig. 4

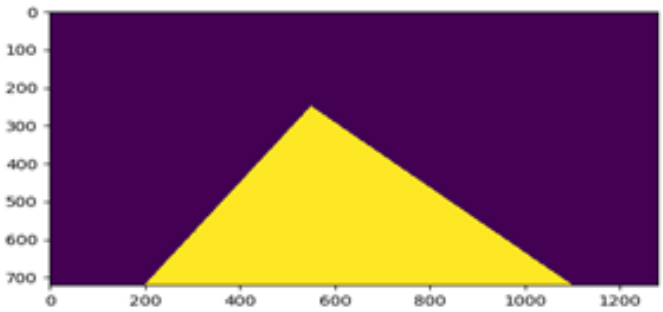


Fig. 4. Region of interest.

The bitwise function called compares by bytes the image and the triangle image and focuses only on the lane lines as shown in Fig. 5.

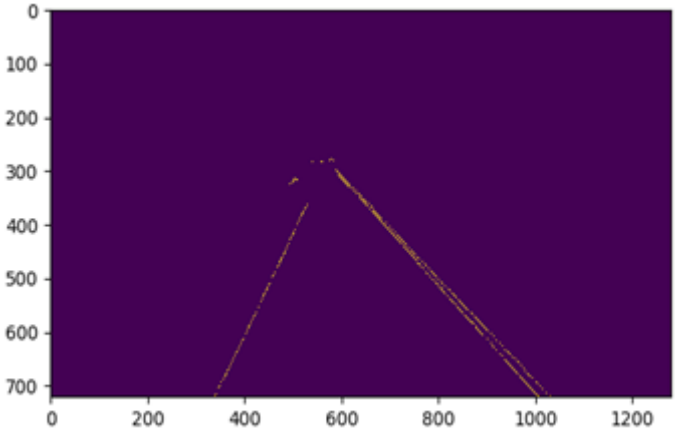


Fig. 5. Bitwise function.

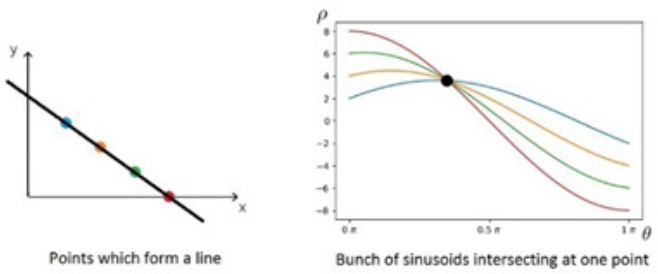
Hough space can detect the line, by representing all the points in lines in the Hough space graph. One point can be represented by one line in Hough space. In this graph, we can see where the lines of the point are nearly each other. Those are represented by m and b values for the line. Therefore, a lane line can be created by using the "(1)":

$$y = mx + b \qquad (1)$$

To avoid the infinitive form "(1)", we change the formula to [21]:

$$p = x\cos\alpha + y\sin\alpha \qquad (2)$$

Figure 6 (a & b) introduces the Hough space: (a) Line created by the point; (b) Points represented in Hough space.



(a) (b)

Fig. 6. Hough Space: (a) Line created by the point; (b) Points represented in Hough Space.

The Hough Space function detects the lane line during road all the time. For finding lane lines, the process just needs to work with pixels as demonstrated in Fig. 7.

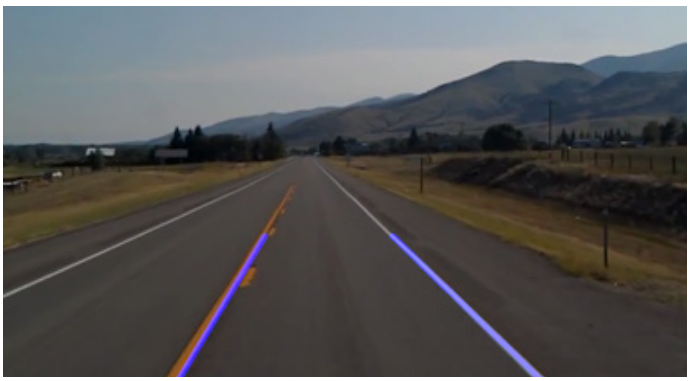


Fig. 7. Detecting lane lines.

B. Traffic Signs Detection

Traffic sign detection can be achieved successfully by deep learning. Convolution neural network is the best for processing data. Fig. 8 shows the distribution of the training dataset.

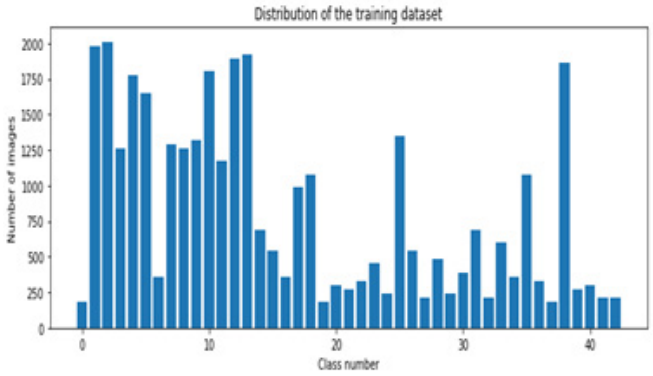


Fig. 8. Distribution of the training dataset.

Due to performance issues and in order to make edges between pixels more visible, the depth of the image is changed from three-dimensional to one-dimensional (change their color to gray) for all the images indicated in Fig. 9.

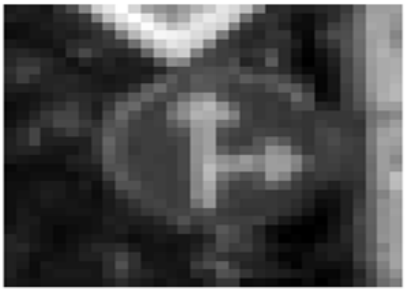


Fig 9. Gray image of a traffic sign

After changing the dimension of the image, for a clearer difference between the edges, we need to equalize the photo as demonstrated in Fig. 10. This helps the model find the features, as the model should focus on the edges of the image and differences of the pixels.

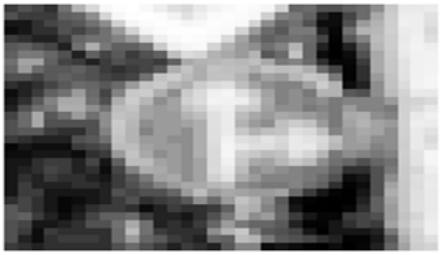


Fig. 10. Equalized traffic sign image

The entire dataset is preprocessed in the same way, before starting the training. A very important part diversifies, is data augmentation. Data augmentation is a widely used technique, which helps expand and diversify your training data, providing an added variety of important features, that the network needs to extract. It gives variety to the data and gives more data for the model to work and generalize the new data that can exist. Some of the training data consist of width shift and height shift (zoomed and rotated). This makes the model learn more and train in different data. We have used Keras for the augmentation of the data. The result is shown in Fig. 11.

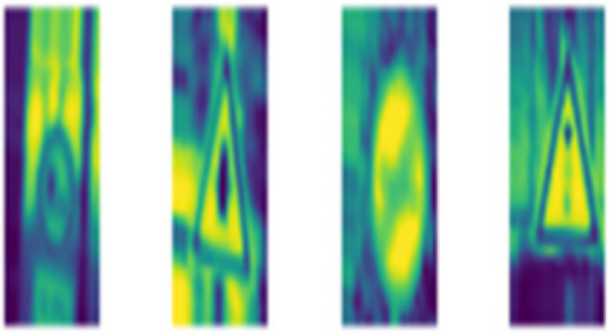
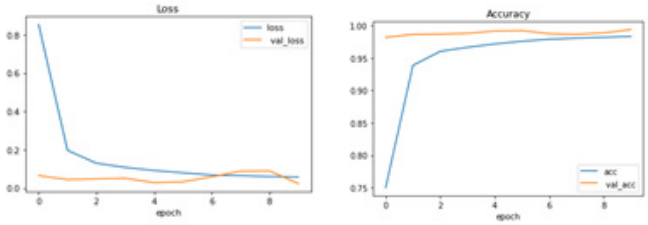


Fig 11. The result of the augmentation process

For the traffic sign, it used the leNet architecture. The input dimensions are 32 pixels width, 32 pixels height, and one depth. LeNet architecture is a convolution neural network structure. Google designed it. It is used in different applications and it is very influential even from the last obtained result. In this model, four convolution layers using the Relu activation function, two MaxPooling layers, and an output layer using the Softmax activation function, as we have a multi-class categorization. Categorical Cross-Entropy is used as a loss function as we need to categorize multiple classes and check for the lowest error. After the data is processed by the model, it is classified into one category as numerical. Each number means a type of traffic sign. Figure 12 shows the progress of the training process. Epochs are the iteration, which is executed on the data. In the last epoch, the accuracy is 0.98 and loss is 0.05 for training data and 0.02 for validation loss, and 0.99 for validation accuracy. Those are very good results. It means that we have used the right model to train the data. It is difficult to find the right number of nodes and hidden layers. The result shows, that it is the best. We have tried a different number of layers until we got the best one.

```
Epoch 1/10
2000/2000 [==============================] - 33s 16ms/step - loss: 0.0530 - accuracy: 0.7505 - val_loss: 0.0652 - val_accuracy: 0.9816
Epoch 2/10
2000/2000 [==============================] - 33s 16ms/step - loss: 0.1968 - accuracy: 0.9385 - val_loss: 0.0442 - val_accuracy: 0.9862
Epoch 3/10
2000/2000 [==============================] - 33s 16ms/step - loss: 0.1294 - accuracy: 0.9601 - val_loss: 0.0479 - val_accuracy: 0.9868
Epoch 4/10
2000/2000 [==============================] - 33s 17ms/step - loss: 0.1079 - accuracy: 0.9663 - val_loss: 0.0513 - val_accuracy: 0.9878
Epoch 5/10
2000/2000 [==============================] - 33s 17ms/step - loss: 0.0917 - accuracy: 0.9715 - val_loss: 0.0284 - val_accuracy: 0.9914
Epoch 6/10
2000/2000 [==============================] - 33s 17ms/step - loss: 0.0796 - accuracy: 0.9756 - val_loss: 0.0328 - val_accuracy: 0.9921
Epoch 7/10
2000/2000 [==============================] - 33s 16ms/step - loss: 0.0678 - accuracy: 0.9787 - val_loss: 0.0588 - val_accuracy: 0.9873
Epoch 8/10
2000/2000 [==============================] - 33s 17ms/step - loss: 0.0648 - accuracy: 0.9804 - val_loss: 0.0880 - val_accuracy: 0.9864
Epoch 9/10
2000/2000 [==============================] - 33s 17ms/step - loss: 0.0599 - accuracy: 0.9818 - val_loss: 0.0892 - val_accuracy: 0.9884
Epoch 10/10
2000/2000 [==============================] - 33s 16ms/step - loss: 0.0578 - accuracy: 0.9831 - val_loss: 0.0238 - val_accuracy: 0.9937
```

Fig. 12. Training process. Screenshot by author.



(a) (b)

Fig. 13. Plots: (a) Loss plot; (b) Accuracy plot.

Figure 13 shows two plots to present the results. We created those two plots to see how the model has worked to the final epochs. It shows if the model is overfed or underfed. As the line loss and validation loss are not too far from each other in the last epoch (iteration), it means that the model is good. Loss and validation loss are reduced along the epochs and accuracy and validation accuracy are raised, it means that the model is learning the features well, as, in the end, this is what I need that the model learns the features of the image and

not memorize them. Gradient descent works on reducing the training error and regularization aim to reduce the generalization error.

C. Steering Angle Detection

For finding a steering angle, deep learning is the best. The model works with the data and leans the pattern from them. Steering Angle Detection is an important part of the self-driving car. It shows the car how to drive on the road. It is used a Udacity simulator. As the car has three cameras in the front (left, center, right), which capture images in every single step. Figure 14 shows an image taken from the application.

Fig. 14. Udacity.

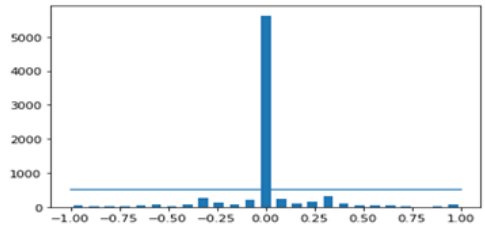


Fig. 15. Distribution of training dataset: No balanced dataset.

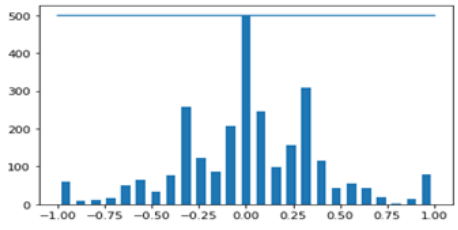
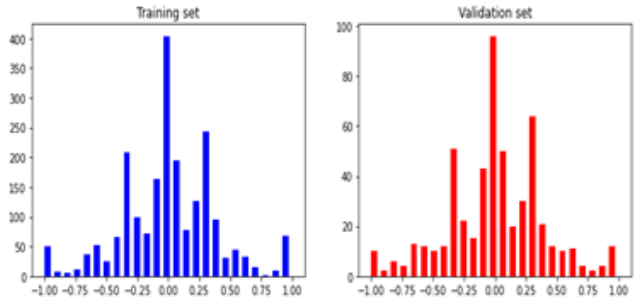


Fig. 16. Distribution of training dataset: Balanced dataset

This dataset Fig. 15 is not balanced, so the dataset, in this case, should be balanced firstly as demonstrated in Fig. 16 and some of the data will be removed.

The dataset should be divided into training dataset and validation set, where 20% is for validation dataset as presented in Figs. 17.



(a) (b)

Fig. 17. Splitting dataset: (a) Training dataset; (b) Validation dataset.

To produce a variety of data and make the model focus on the pattern and not on memorizing the data. Data augmentation helps a generalization of the model. For example, an image can be flipped as shown in Fig. (18 b).

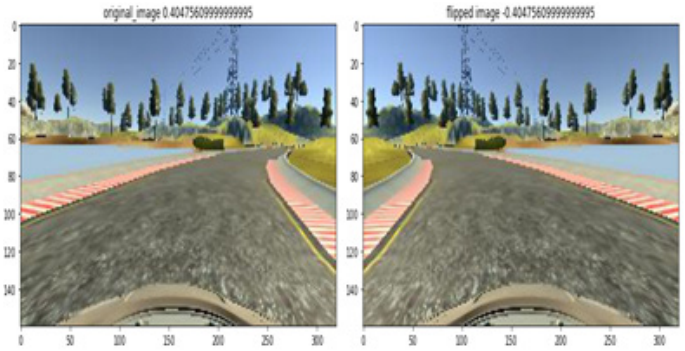
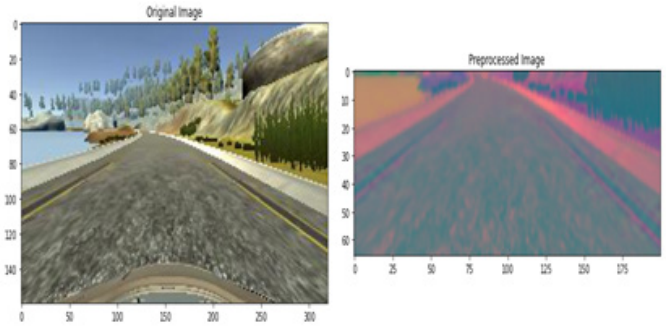


Fig. 18. Augmentation process: (a) The original image; (b) The flipped image.

Afterward, the image should be preprocessed, its brightness should be increased. Also, it should be smoother, with less noise, and resized to focus on the most important features for better performance, see Fig. (19 b).



(a) (b)

Fig. 19. Preprocessed process: (a) Original image; (b) Preprocessed image

```
Model: "sequential_10"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d_46 (Conv2D)           (None, 31, 98, 24)        1824
_________________________________________________________________
conv2d_47 (Conv2D)           (None, 14, 47, 36)        21636
_________________________________________________________________
conv2d_48 (Conv2D)           (None, 5, 22, 48)         43248
_________________________________________________________________
conv2d_49 (Conv2D)           (None, 3, 20, 64)         27712
_________________________________________________________________
conv2d_50 (Conv2D)           (None, 1, 18, 64)         36928
_________________________________________________________________
flatten_8 (Flatten)          (None, 1152)              0
_________________________________________________________________
dense_29 (Dense)             (None, 100)               115300
_________________________________________________________________
dense_30 (Dense)             (None, 50)                5050
_________________________________________________________________
dense_31 (Dense)             (None, 10)                510
_________________________________________________________________
dense_32 (Dense)             (None, 1)                 11
=================================================================
Total params: 252,219
Trainable params: 252,219
Non-trainable params: 0
```

Fig. 20. NVidia architecture.

The model shown in Fig. 20 contains five convolution layers, flatter to change the dimensionality to one for the three fully connected layers, and in the end is one output layer. As in this situation, we should output the predicted steering angle, which is between -1 to 1, we cannot use categorical in this case, but we can use Mean Square Error (MSE). MSE corresponds to how far the actual value is from the estimated value [22]. As we have large data and we need to learn more features from images, NVidia is the best model and a powerful neural network to be used. The NVIDIA DRIVE PX2 driverless car platform can perform 30 trillion deep learning operations per second and can achieve Level4 autopilot. NVidia is proven effective for behavioral cloning and it is implemented in real-life cars [23]. Mean Square Error validates how far the predicted value is from the predicted values. By checking the distance, it can help the model to know how large the error is and it shows the model that it needs more to learn because it is making wrong predictions as introduced in Fig. 21.

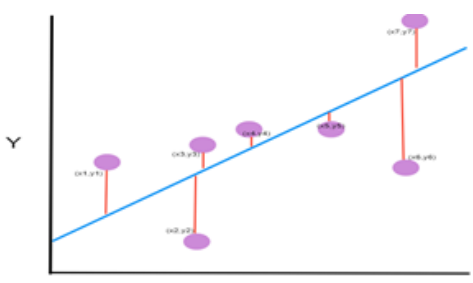


Fig. 21. Mean Square Error.

The formula for calculating the mean square error is [24]:

$$MSE = \frac{1}{N}\sum_{i=1}^{n}(y_i - \hat{y}_i)^2 \qquad (3)$$

Where variable N is several data points, the first y is the actual value and the second y is the estimated value.

```
400/400 [==============================] - 599s 1s/step - loss: 0.1257 - val_loss: 0.0854
Epoch 2/15
400/400 [==============================] - 600s 1s/step - loss: 0.0976 - val_loss: 0.0631
Epoch 3/15
400/400 [==============================] - 588s 1s/step - loss: 0.0846 - val_loss: 0.1089
Epoch 4/15
400/400 [==============================] - 584s 1s/step - loss: 0.0763 - val_loss: 0.0772
Epoch 5/15
400/400 [==============================] - 582s 1s/step - loss: 0.0714 - val_loss: 0.0806
Epoch 6/15
400/400 [==============================] - 581s 1s/step - loss: 0.0666 - val_loss: 0.0500
Epoch 7/15
400/400 [==============================] - 585s 1s/step - loss: 0.0629 - val_loss: 0.0700
Epoch 8/15
400/400 [==============================] - 583s 1s/step - loss: 0.0612 - val_loss: 0.0640
Epoch 9/15
400/400 [==============================] - 584s 1s/step - loss: 0.0584 - val_loss: 0.0714
Epoch 10/15
400/400 [==============================] - 593s 1s/step - loss: 0.0569 - val_loss: 0.0597
Epoch 11/15
400/400 [==============================] - 596s 1s/step - loss: 0.0559 - val_loss: 0.0564
Epoch 12/15
400/400 [==============================] - 595s 1s/step - loss: 0.0537 - val_loss: 0.0503
Epoch 13/15
400/400 [==============================] - 591s 1s/step - loss: 0.0522 - val_loss: 0.0595
Epoch 14/15
400/400 [==============================] - 591s 1s/step - loss: 0.0515 - val_loss: 0.0507
Epoch 15/15
400/400 [==============================] - 594s 1s/step - loss: 0.0499 - val_loss: 0.0515
```

Fig. 22. History of processing the data: Model processing the data.

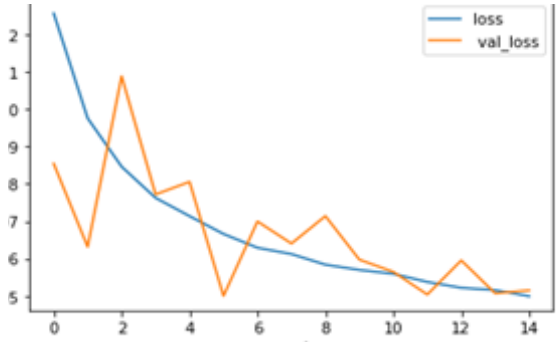


Fig. 23. History of processing the data: The result of the model.

The screenshot shown in Fig. 22 shows that the model is working well and the loss is reducing along with the validation loss. The plot shows that the loss has been reducing all the time in each epoch and validation loss has had an increase in epoch 3, because the model has had an error on not predicting well the inputs, therefore the model learns from this error and updates its parameter. In the last epoch loss and validation, loss is a small number, which means that the model has learned a lot and it has had a good result on predicting. The loss and validation loss are not too far away from each other, so the generalization error is low as shown in Fig. 23.

Fig. 24. Result of self-driving car. Screenshot by author.

The screenshot demonstrated in Fig. 24 shows a part of the self-driving car during the simulator.

4. Conclusion

This study showed the features of deep learning. It helps in solving different problems that an autonomous machine needs. This approach showed how self-driving car has evolved in different fields. The Main companies that used this technique are in the race, which one will be the first to have a self-driving car in the market. We think it will take some more time for perfecting the self-driving car but I think it will be the best invention of the future. All the vehicles have cameras in their cars, which makes creating the dataset easier. Different self-driving test cars are around the world but they have done some accidents. If all the vehicles would be autonomous, from our perspective and from the presented studies it will be a good solution. That would make the cars communicate with each other and make the driving easier and safer. A self-driving car is a future and it should be implemented, as there are many human errors that have caused so many tragic accidents. Deep learning is so near to implementing the level 5 autopilot. Maybe in the future, the best approach would be combining supervised learning and unsupervised deep learning together. Therefore, after the generated model of supervised learning predicts the image, the supervised model comes into play and checks how well the prediction is done and if the car is going in the right direction. Proposed future work is implementing supervised and unsupervised working together and finding if this would work better and trying this model in real life and finding a better technology for sensors as well.

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DETECTION OF TYPES CYBER-BULLYING USING FUZZY C-MEANS CLUSTERING AND XGBOOST ENSEMBLE ALGORITHM

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Abstract

In this study a neural network model (XGB_CTD) that will prediction which type of bullying the users may expose to, through dataset gained by the cyberbullying scale applied to the young internet users is formulated. Extreme Gradient Boosting (XGboost) algorithm, one of the ensemble learning methods is used in this method. There while this model contains 13 input parameters taken from the scale, there exist one output parameter classified one of the 9 outputs. The reliability of the data set obtained through survey is confirmed by statistical methods. Data set has been fragmented with Fuzzy C-Means (FCM) which is one of fuzzy clustering algorithms. Hyper-parameters for the maximum efficiency of the model training have been defined as model, learning and boosting method. Independent variables in data set have been scaled through standard normalization. As a result, the model has yielded % 91,75 accuracy rate in prediction of the classification as 9 different cyberbullying types. The same data set has been trained by different machine learning algorithms. It is seen that the proposed model has reached the highest accuracy when compared to the conventional machine learning algorithms.

This study aims at prediction cyberbullying through the proposed model including different questions without claim by the young users as they were bullied. Similarly, type of the cyberbullying will also be able to be estimated by the help of internet using habits of the young users. Therefore, it is thought that the young can be prevented from experiencing psychological pressure or digital life fear.

Keywords: *Classification, Cyberbullying, Ensemble Learning, XGBoost, FCM, Machine Learning*

1. Introduction

Communication is one of the essential phenomena for the human. People convey their messages including their feelings and thoughts to others or to various targets whether in one or two-way direction (Lowry et al. 2016). Internet has become the most notable media as a result of technological development. Social media is one of communication methods on Internet [2]. The ever increasing and developing technology commonly affects each level of the society as does the young people [3]. Use of new tech products such as computer, tablet pc and mobile phone shows an increase among the young people [4]. It is seen that technology, apart from its positive effects, causes side and devastating effects like cyberbullying [5]. Cyberbullying in general terms, is defined as threatening or humiliating others via information and communication technologies [6]. Increase in the number of the internet users and emerge of different applications creates new cyberbullying areas. [7] Accordingly, ever increasing cyberbullying incidents necessitates cyberbullying detection applications much more than before. [8-9]. Use of Machine learning is of vital importance in developing applications in this sense.

Machine learning is neural network model which deducts from the data through mathematical and statistical techniques [10]. There are many methodologies and algorithms for machine learning models. [11]. In some applications there exists only one algorithm used whereas others contain hybrid algorithms [12]. Learning algorithms when used singularly may yield negative results stemming from the limitations of the algorithm used [13]. In this context, it has become a new approach that more than one machine learning algorithms are used together in the recent studies. One among the new approaches is ensemble learning [14].

Ensemble learning is a method which gathers more than one inductives so as to give a decision in the process of controlled machine learning [15]. Main approach in ensemble learning is to produce many classifiers and regulate the results so as to improve the performance of the classifiers one by one. Feature selection and parameter optimization steps in ensemble learning requires expertise.

When these steps are accompanied by planned learning algorithms, classification performance and parameter optimization in ensemble learning model can be maximized [16]. Studies in the literature show that ensemble learning prove successful results in neural network models such as classification [17], estimation [18], speaker recognition [19], sentiment analysis [20].

Generally, cyberbullying is attempted to be detected in social media activities of the user. The detections include interpretation of comments by the person or made by others on his or her page, shares or emoticons. Unlike other studies in the literature, this study presents an approach which can estimate which type of cyberbullying the internet user did and may expose to through their activities on internet. This approach does not focus only on the social media as does the other studies. Therefore, both type of the cyberbullying could be detected and necessary precautions could be taken

Essential contributions and innovations by this study are as follows:
• It may detect the type of the cyberbullying the user did or may expose to.
• Data set of the model has been formulated as the result of survey for the young people, and are original to this study.
• FCM fuzzy clustering method has been used in fragmentation of the data set.
• XGBoost ensemble learning algorithm which provides high classification performance in training of the model has been used.

In the second part of the study, cyberbullying studies in the study are examined and compared to our study. Motivation in the study is evaluated with a comparison to the other studies. In the method section of the study, the way that data set is gathered through survey, is explained and the reliability test of the data is applied. In the section of formulating estimation model, data to be used in the training and test of the model as well as fragmentation of FCM algorithms thereof and improvement of model through XGBoost algorithms are dealt with. In the ending section, performance data acquired from the model is assessed and compared to machine learning algorithms.

2. Related Work

In the literature, there are two main research branches related to the subject of the study. These are cyberbullying detection and automated word discovery. Automated word discovery efforts provide pre-processing, feature extraction and classification tasks. [21]

In many studies content-based [21,24], sentiment-based [25], user-based [26] and network-based [27] methods are applied to cyberbullying detection. In this methods, full control learning models such as Naïve Bayes, Support Vector Machines (SVM) and Decision Trees (J48) are preferred. It is seen that due to language differences they apply to only one language or country in content-based estimation [24,22-29].

Labeled word in social made shares are focused in literature studies on cyberbullying detection. Shares or tweets extracted from social media accounts (Twitter, Instagram, YouTube and Facebook) constitute the data sets [30]. Applying learning algorithms to these data sets allows cyber-bullying detection. In several cases, age and gender estimation as well as cyber-bullying is made [31 -32].

Raisi and Huang [33] tried to detect cyber-bullying in labelled words by machine learning method. The study detects the level of cyber-bullying through the labelled words in the comment and shares on Twitter. Garcia et.al, [34] offers a word-based detection model applying K-Nearest Neighbour (KNN) and Sequential Minimal Optimization (SMO) algorithms to data set. This model has been trained with Waikato Environment for Knowledge Analysis (WEKA) and 92% accuracy

has been achieved. Balakrishmana et. Al [35] have formulated automatic cyberbullying perception mechanism. Perception mechanism is based on physiological features of Twitter users such as character, sentiment and emoticons. Random Forest, Naïve Bayes and J48 algorithms and WEKA have been used and approximately 91% accuracy has been achieved. Sahay et.al. [36] has applied machine learning and natural language processing (NLP) to data set acquired from UCI Machine Learning Repository for detection of cyberbullying. At the end of training and test of the model an accuracy rate between 75% - 90 % has achieved.

This study is motivated by other studies regarding detection of cyberbullying in the literature. Other studies take social media correspondence as a focus for detection of cyberbullying. Conclusively, for the past incidents cyber-bullying is defined "as it exists" or "does not exist". Moreover, they do not concentrate on the type of the cyberbullying. The study hereby aims at detection of type of cyber-bullying threats to which young internet users did or may expose to. A survey, regarding internet use of the young people has been prepared and data set has been formed. Which type of cyberbullying young internet users did or may expose to and who do not or cannot express of that may also be detected at the end of this study.

3. Principles of Detection Methods

3.1. Data Collection

In order to get data set, Cyberbullying Scale which was developed by Stewart et.al was used [37]. The scale aims at measuring cyberbullying behaviors. As a data collection tool, a Google Form which consists of 15 items analyzing the views of young people about cyberbullying was designed. Then, data was collected online by using this form. During data collection process, no questions about their identity was asked. The created form includes Turkish and English language options.

The first question is multiple choice which ask if he/she is disturbed vie e-mail, video, text message, social communication webs on online platform. The rest 14 questions are measuring individual's exposure to cyberbullying. These 14 questions are composed by using 5 category Likert type scale. On the scale, the levels of exposure to the cyberbullying are designed as; Never (0), Almost never (1), Sometimes (2), Often (3), Always (4) (Appendix 1).

A total of 542 students aged between 18-27 were recruited as a convenience sample. 313 of the participants were aged 18-22, 229 of them are aged 23-27. 291 of the participants were female and 251 of them were male.

The first multiple choice item scaled 0-9 analyzed what kind of bullying the participants were exposed to. The question with no answers was scaled as "0". When the category of "never" and the questions with no answers were considered as "0", the reliability of the scale was calculated as (Cronbach Alpha) 0,919. The calculation was made to test internal consistency [39] and the results in data set were found as reliable.

3.2. Model Development

Extreme Gradient Boosting (XGBoost) is a popular machine learning algorithm which was introduced by Chen in 2014 [40]. XGBoost is a scalable, fragile tree boosting system which used tree-based model serving as weak students and Gradient boosting model [41].

Data set must be classified before the training of the model. The divisions of the internet using behavior of the young people are different here. Dividing data set randomly reduces the consistency of the test and model training. To divide data set, FCM clustering algorithm was used for c=2 according to the scale of the answers of the questions. The membership degree of each answer and which cluster they belong to was calculated via FCM membership degrees and cluster matching are minimized according to Equation 1 and Equation 2 [42].

$$v_i = \frac{\sum_{k=1}^{n} u^{m}_{ik} x_k}{\sum_{k=1}^{n} u^{m}_{ik}}; 1 \le i \le c \qquad (1)$$

$$u_{ik} = \frac{1}{\sum_{j=1}^{c}\left(\frac{d_{ik}{}^{2}A}{d_{jk}{}^{2}A}\right)^{\frac{2}{m-1}}} \quad (2)$$

For FCM algorithm, data set was described as "SZO". The aim of this classification is to make the loss function shown in Equation3 reach the minimum value.

$$J(U,V) = \sum_{j=1}^{N}\sum_{i=1}^{c}(u_{ij})^2(d_{ij})^2 \quad (3)$$

Here, u_{ij} denotes the degree of membership of j. SZO belonging to the i. cyberbullying scale problem, and the degree of membership denotes that j. SZO belongs to the i. question. All classification where FCM was used was shown in Algorithm 1. Before starting algorithm, the number of cluster (c), stop criterion (ε), blur parameter (p) must be described and cluster prototypes ($\boldsymbol{V}(\mathbf{0})$) and initial membership matrix ($\boldsymbol{U}(\mathbf{0})$) must be created.

Algorithm 1 - Pseudo code of FCM clustering algorithm.

Input: Data Set:

$$D_{SZO} = \{SZO_1, SZO_2, SZO_3, ..., SZO_N\}$$

Output: Optimum and answer Level:

$$D_{level} = \{Level_i\},\ i = 1, 2, 3, 4, 5\}$$

Step 1: Clustering number c=2, iteration t=0 and fuzzy value p=2

Step 2: for c <cmax

Step 3: Rise c (c =c+1)

Step 4: Start core for subtractive clustering in D_{SZO}:

$$V^{(0)} = \{v_1, v_2, v_3, ..., v_c\}$$

Step 5: for $|U^{(t+1)} - U^{(t)}| > \varepsilon$

Step 6: Rise t (t =t+1)

Step 7: Calculate (u_{ij})

Step 8: $$U^{(t+1)} == \{u_{ij}\};\ u_{ij} = \frac{1}{\sum_{k=1}^{c}\left(\frac{SZO_i - v_j}{SZO_i - v_k}\right)^2}$$

Step 9: Calculate (v_j)

Step 10: $$V^{(t+1)} == \{v_j\};\ v_j = \frac{\sum_{i=1}^{N}(u_{ij})^2 xSZO_i}{\sum_{i=1}^{N}(u_{ij})^2}$$

Step 11: Calculate Indicator (GD) and Calculate Exit (CD) and c

Step 12: If (GD < CB)

Step 13: assign ($c^* = c,\ U^* = U,\ V^* = V$)

Step 14: back c^* and D_{SZO}

To assess the hitting of the clusters obtained from data set, one of the validity indexes Partition Coefficient (PC) was used (Equation 4) [43].

$$V_{PC}(U) = \frac{1}{n}\left(\sum_{i=1}^{c}\sum_{k=i}^{n}u_{ik}{}^{2}\right) \quad (4)$$

Developed classification prediction model was described as XGB_CTD. XGB_CTD is an operation of determining which cyberbullying class it belongs to according to the answers to the questions on the scale (Figure 1). The XGB_CTD model maps the answers to individuals ' questions involving internet activities according to the types of cyberbullying given in Table 1.

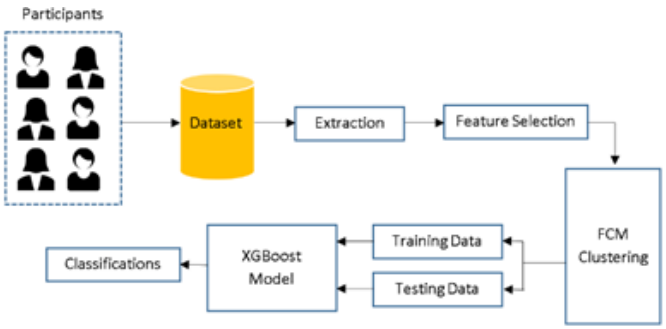

Figure 1- The architecture of the proposed model.

Table 1- Classification output types.	
Explanation	Output Code
E-mail	0
Text message	1
Picture message	2
Instant message	3

Personal Videos	4
Social Communication Webs	5
Chat Rooms	6
Games on virtual platform	7
An insulting website or forum related to the individual	8

In order to create a better classification effect in XGB_CTD, more than one decision trees were integrated. For each decision tree adding iteration, the value of loss function will decrease. Thus, those decision trees which were added are used for powerful classification.

Data set on XGB_CTD is $\{(X_i, Y_i)\}, (i = 0,1,2,...,N)$. $X_i = \{0,1,2,3,4\}$ indicates questions and answers, $Y_i = \{1,2,3,...,9\}$ indicates exit prediction. In XGB_CTD, each tree is optimized by using gradient Boosting. The output of each tree is like this; $f(x) = w_q(x_i)$. Here X, the input vector, and wq is the score of the q. digit in a tree. The output of K tree community is calculated as $y_i = \sum_{k=1}^{K} w_q(x_i)$.

On the t step of XGB_CTD, Equation 5 is used to minimize the j loss function. Here, L is the loss function of training between real y and $\hat{y}$ exit in n number of sampling.

$$j(t) = \sum_{i=1}^{n} L(y_i, \hat{y}_i^{t-1} + f_t(x_i)) + \sum_{i=i}^{t} \Omega(f_i) \quad (5)$$

The start parameters of the model which were obtained for optimum performance in education and their values are given in Table 2.

Table 2- Optimum parameters of XGB_CTD.

Parameter	Value
learning rate	0.05
Gamma	0
Eta	0.3
Alpha	0
n_estimators	500
max_depth	5
Lambda_l1	0.2

4. Performance Evaluation

All figures should be numbered with Arabic numerals (1,2,3,....). Every figure should have a caption. All photographs, schemas, graphs and diagrams are to be referred to as figures. Figures must be embedded into the text and not supplied separately. Figures should be placed at the top or bottom of a page wherever possible, as close as possible to the first reference to them in the paper.

4.1. Environment Setup

In the process of developing XGB_CTD model suggested in the study, Python was used as a programming language. Python language has several libraries for preparing data, preprocessing and developing a model. XGB_CTD, In Spyder software, Scikit-learn, Keras, FCM and XGBoost libraries were used. As hardware, Intel I7-8500H 3.60 GHz CPU and a laptop with a 12GB RAM were used.

4.2. Evaluation Indicator

In order to assess the result in XGB_CTD algorithm, Accuracy (Equation 6) which represents the accuracy rate between the estimated value and the real value [44]. Furthermore, in order to be able to see the error value, Mean Square Error (MSE) was used as it is seen in Equation [45].

$$Accuracy = \frac{FP + TN}{TP + FP + TN + FN} \quad (6)$$

$$MSE = \frac{1}{N} \sum_{i=1}^{N} | y_i - p_i |^2 \quad (7)$$

4.3. Detection Results and Analysis

Initially, the accuracy of clustering was evaluated using FC validity index. Clustering results are shown in figure 2 when clustering number is considered as 2. The validity concept of clustering is open to interpretation. In the clustering study, the number of clustering couldn't be increased as it will be used for model training and test. Moreover, the big size of data set was also blocked this increase. When evaluated over original data set, the result was nearly same as the original structure for c=2.

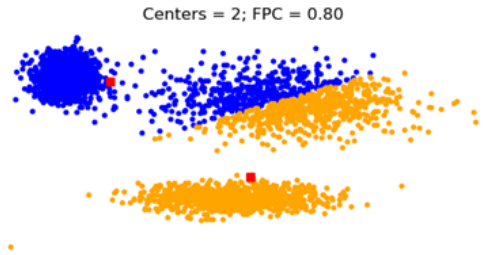

Figure 2- In data set, the results of fuzzy clustering according to the number of clustering for c= 2

It performed in the classification of multiple types of cyberbullying with XGB_CTD in the confusion matrix shown in Figure 3. The answers of the questions in data set shows that there is a relationship between they type of cyberbullying which young people were exposed to and the reason why they use the internet. When the confusion matrix of the model is analyzed, the prediction classification average 91.75% accuracy was obtained. So, it is seen that the incorrect classification of the model is similar to the reasons why young people use the internet. As a result, misclassification shifts are thought to occur mostly in young people who have more internet use purposes.

Additionally, to evaluate the performance of XGB_CTD model, it was compared with other machine learning methods (Gradient Boosting Decision Tree (GBDT), Random Forest and SVM). In this comparison, the model has gotten the best estimate accuracy as accuracy mean. The accuracy performance mean obtained from XGB_CTD and other machine learning and MSE error values are given in Table 3.

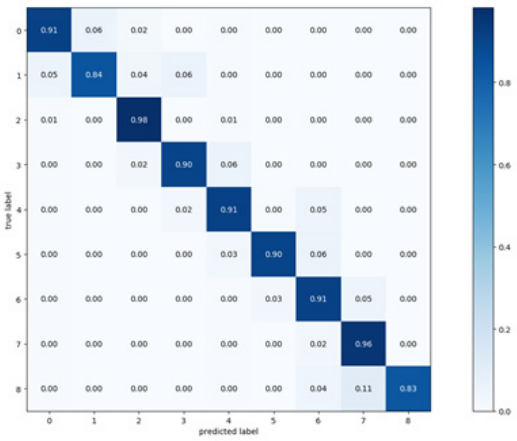

Figure 3- Confusion Matrix which belongs to XGB_CTD classification.

Table 3- The comparison of XGB_CTD and machine learning algorithm

Algorithm	Accuracy(%)	MSE	Training Epoch
XGB_CTD	91.75	0.1250	500
GBDT	89.20	0.1720	500
Random Forest	88.50	0.1805	500
SVM	75,75	0.2475	500

5. Conclusions

In this study, a neural net which provides us to estimate the type of cyberbullying which young people were exposed to and which they can possibly do by looking at their aim of using the internet was developed. It is an XGBoost based method which is one of the model community learning algorithms called XGB_CTD. Cyber security scale which was taken as a sample to create data set was turned into a survey. Data set was created by using the results of the survey which was applied to young internet users. Data set was clustered with FCM by making it normalize. XGB_CTD was trained by determining optimum hyper parameters in order to ensure high accuracy. The average accuracy rate of XGB_CTD is %91,75 when looking at the performance of classification according to nine different types of cyberbullying. In order to see the superiority of XGB_CTD, it was compared with other traditional machine learning methods. As a result, it has been seen that the model has the highest accuracy rate in estimate classification.

In future studies of the XGB_STM model, the dataset will be expanded by including social media shares of young people who are exposed to cyberbullying. As a result of this, it has been expected that the accuracy performance will increase more. The model will be put into practice in the last step of XGB_CTD. Thus, it will be estimated what kind of cyberbullying young people who are exposed to cyberbullying and can't utter this are exposed to by looking at their internet usage habits. At the same time, it will be able to envisage what kind of cyberbullying young people will possibly be exposed to by looking at their internet usage habits.

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TEXT SENTIMENT ANALYSIS USING DEEP CONVOLUTIONAL NETWORKS

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Abstract

The ability to process language is a difficult task. A computer system that can extract meaningful information from raw text data is considered to be equipped with intelligent behaviour. Sentiment analysis is a form of information extraction of growing research and commercial interest, especially because of the exponential increase of data in recent years.

This paper presents a machine learning approach built upon Neural Networks that equips a computer system with the ability to learn how to detect sentiment in a given text and to correctly classify previously unencountered text with respect to predefined sentiment categories. The developed approach does not rely on any hard-coded parameters. Rather, a model is learned through a training procedure performed on raw data alone with the objective of searching to identify patterns and discovering feature predictors that allow the algorithm to classify text into positive, negative, or neutral sentiments, while additionally focusing on nuances such as humorous or sarcastic text.

Experimental validation shows promising results. The learning algorithm is fed with high-volume textual data extracted from the Twitter social media platform. The trained model is then tested on a separate dataset, previously unknown by the model. The classification algorithm is able to predict the sentiment associated with a given text with high accuracy.

Keywords: *text-sentiment analysis, deep learning, machine learning, convolutional neural networks*

1. Introduction

Sentiment analysis is often defined as the study of people's opinions, sentiments, or emotions through the aid of computer agents with the objective of categorizing the writer's attitude towards a particular topic. Sentiment analysis has grown into becoming one of the most active research fields in natural language processing (NLP), as it has wide applications in many different areas such as: data mining, information retrieval, product segmentation and analysis, brand monitoring and market research, among others.

Strong opinionated posts in social medias, blogs, forums, and other mediums of communication have profoundly impacted individuals and organizations, and often, have highly influenced and reshaped behaviour.

Extensive research is focused on developing intelligent computer systems that have the ability of processing large amounts of text data and categorizing the sentiment expressed as either positive, negative, or neutral.
A plethora of machine learning approaches are developed with the objective of training a computer agent in a framework that processes high-volume data with the purpose of learning to efficiently classify textual data that the machine learning framework has not encountered before.

This task poses many difficulties. Though understanding the context of a conversation is easy for humans, teaching a computer agent to achieve the same results presents many challenges, mainly associated with the various nuances of language. Grammar rules are not strict; they leave room for many possibilities of forming a sentence, or interpretations.

In addition, written text, especially on social media and forums, contains a lot of unstructured sentences, abbreviated forms, grammar nuances,

and slangs which contribute to increasing the difficulty for a computer agent to understand text. Moreover, understanding sarcastic or humorous opinions expressed in a written form – without the help of voice tone or body gestures – is difficult for a computer.

To address these challenges, we have developed a machine learning framework that builds upon Convolutional Neural Networks (CNN) with the goal of equipping a computer agent with the ability to predict and classify written text according to the sentiment it expresses. The model for analysing text is not hard-coded, i.e., it is not depended on any rigid tuning of parameters. Rather, the proposed framework learns how to detect sentiment by processing high-volume raw data and searching to identify patterns and feature predictors that allow it to classify text into positive, negative, or neutral sentiments, while additionally focusing on nuances such as humorous or sarcastic text.

The learning algorithm is fed with high-volume textual data extracted from the Twitter social media platform. Twitter feeds are commonly used by individuals and organizations to express opinions.

The proposed model has two main phases. During the training procedure, the learning algorithm receives as input labelled data, i.e., twitter feeds with a categorization of sentiment. The objective is to investigate and identify hidden patterns in the data or features that can be accurate descriptors of the sentiment categorization. To achieve that, the convolutional neural network processes and transforms the input via several layers, each reinforcing a mapping from the given input to the desired output (class categorization). At each step, information back-propagates, allowing the network to adjust the weights that affect its performance, thus improving its performance as more data comes in, or stronger relations are identified in the existing data.

The second phase includes cross validating the accuracy of the learned model. For that purpose, the algorithm is tested on a separate dataset that includes only twitter feeds, but no labelled data. As discussed in more details in section 4, experimental validation demonstrates the effectiveness of this approach. Our framework is able to efficiently classify and categorize the sentiment associated with textual data that is has not encountered before.

The rest of this paper is organized as follows. Section 2 provides a discussion of fundamental background principles of machine learning and convolutional neural networks, in addition to presenting closely related work. The proposed approach is discussed in section 3, while experimental results are introduced in section 4. Conclusions and future work directions are discussed in section 5.

2. Background and Review of Literature

This section provides an overview of fundamental concepts, methodologies and approaches that focus on the task of efficiently using machine learning algorithms for text sentiment analysis.

2.1 Problem Definition

A machine learning task is often defined as: *"a computer program learns from experience E with respect to some class of task Tand performance measure P if its performance at tasks T measured by P improves with experience E."* The computer agent aims to solve the task T,which is, in turn, the learning goal of the machine learning algorithm.

Each representation of the task can be considered as a data point, commonly described by a set of features. A vector $x \in R^N$ has entries x^i representing the set of features. In our example, each twitter feed represents a single data point, described by a set of features *x.* The task of the machine learning framework is to correctly categorize previously unseen textual data and to determine to which of the $k \in N$ categories it belongs (e.g., positive, negative, neutral). To solve this task, the objective of the learning algorithm is to produce a function $f: R_N \rightarrow \{1,...,n\}$ where f outputs a classifier distribution, i.e., it assigns a probability related to the data entry *x* belonging to the category *k.*

The success rate of the learning algorithm is evaluated by the performance measure P – a metric designed and used to measure the learning performance, which can be specifically related to the task T. For instance, in the proposed text sentiment analysis framework, the performance measure is related to a function determining the accuracy of the algorithm in correctly (or falsely) classifying the testing data, as described in more details in section 4.

Finally, given task T and performance measure P experience E is comprised of the training data, the extracted features, and all other relevant additional information that the algorithm will use to learn and therefore to improve its performance. In our approach, we use a convolutional neural network, i.e., a model comprised of multiple learning layers that aims to extract meaningful information from training data and be able to correctly classify previously unobserved images. A detailed description is provided in section 3.

For the learning process to take place, given the performance metric P the algorithm attempts to identify the closest distance between two functions, say $f(x)$ and $f'(x)$ which are determined by a series of weighted values as in: $f'=w^T \cdot x$, where w is a vector of parameters that the algorithm is aiming to optimize, commonly known as weights. Weights determine how the extracted features x_i for $i \in 1...N$ correlate with the output f'. The machine learning algorithm will attempt to find the closest distance between f' and f, thus aiming to predict f from the given data x.

The overall objective is to identify parameters that not only will explain the given data set, but that will also be able to accurately classify sets of data that the algorithm has not observed before. To validate the training process, the algorithm is applied to an independent validation set, say x_{val} with n_{val} data entries that the algorithm does not use for training. The algorithm iterates the training and validation process until the error is sufficiently small, a criterion specific to the task.

2.2. Convolutional Neural Networks

Neural Networks emerged as a learning paradigm that aims to mimic the interconnections of neurons in the human brain. They are composed of several connected layers forming a network. Connections are primarily determined by weights iteratively tuned during the learning phase to equip the network with the ability to correctly classify previously unseen data.

To address our sentiment analysis classification tasks, the learning algorithm is used to identify a mapping function f which maps input x to category y. To achieve that, the algorithm will derive function f' defined by weights w_i that approximates $y=f'(x,w_i)$. In general, the function f can be a composite function of any number of functions f_i defined as: $f' = f_1' \cdot f_2' \cdot f_3' \cdot ... \cdot f_n'$.

This model is known as a network comprised of many layers, where f_1' is the first layer, f_2' is the second layer, and similarly, until f_n' is the last layer. The first and the last layer are commonly known as input and output layers, while the rest as intermediate hidden layers. The number of layers determines the depth of the network and is normally associated with the level of detail that is presented in the extracted features and served as an input to the learning algorithm. Figure 1 provides an illustration.

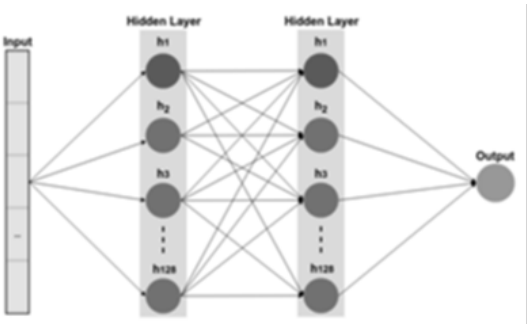

Figure 1: Representation of Layers in a Neural Network

The network will transmit messages from one layer to another through the network weights (Kuntal Kumar Pal, 2016). Each neuron is equipped with an activation potential which determines the ability of the neuron to decide whether a signal should be fired or not depending on the input signal that is received. The network then, propagates (moves forward) these signals through the whole network. The process is repeated until the classifier decides to which class the input belongs to.

The key objective of the training procedure is to minimize the difference between the expected output and the actual output (Kuntal Kumar Pal, 2016), thus minimizing the error and increasing the chance of correctly classifying input data. To achieve that, a loss function is defined and used when the training procedure takes place. This function continuously changes the weights of the network to adapt to the training data and to minimize the loss. Weights are updated because the network sends a back signal, i.e., a signal in the opposite direction (from output to input). This technique is commonly known as back-propagation.

Observe that not all neurons have the same influence over the network. Their role is dependent upon the weights they have. Strictly speaking, given n nodes, to compute the output as an activation function, the network sums the product of all the inputs $x_1, x_2, \ldots x_n$ with their respective weights $w_1, w_2, \ldots, w_n$. To model a statistically sound framework that takes into consideration unpredictable behavior, a *bias* (a value between 0 and 1) is added to each iteration step. Thus, the activation function of a neuron can be computed as:

$$f(b + \Sigma_{i=1}^{n} x_i \cdot w_i)$$

The bias b is an additional input to the neuron structure that makes possible to transition in the graph of the network, depending on the data that are being trained, thus enabling the neuron structure to have more flexibility in creating the required output value. An activation function determines if the neuron should be activated. It introduces non-linearity to the output of a neuron, thus making the overall structure of the network more adaptable and able to respond to complex inputs.

A Convolutional Neural Network is a special case of the generic network presented above. Figure 2 provides an illustration. It consists of at least one *convolutional* layer, in addition to other layers known as *subsampling* and *fully-connected* layers. Each feature of a layer receives inputs from previous layers and can extract visual features information that is used during the training phase. Note that the process of extracting the features is not hard-coded, rather the network updates the neuron weights and the transmission of messages between layers based upon the training data.

2.3. Sentiment Analysis Related Work

Sentiment analysis deals with the problem of extracting information and categorizing it to determine if the writer conveys a positive, negative, or neutral opinion. Extensive research is focused on analyzing text and estimating the sentiments associated with it. Most approaches fall into three main categories: 1) lexicon-based techniques, 2) machine learning techniques, and 3) hybrid approaches.

Lexicon-based techniques aimed to address the task of categorizing sentiment relying on a dictionary or corpus (Salas-Zárate, Medina-Moreira, Lagos-Ortiz, Luna-Aveiga, & Rodriguez-Garcia, 2017). Though statistical analysis is often performed through various clustering algorithms

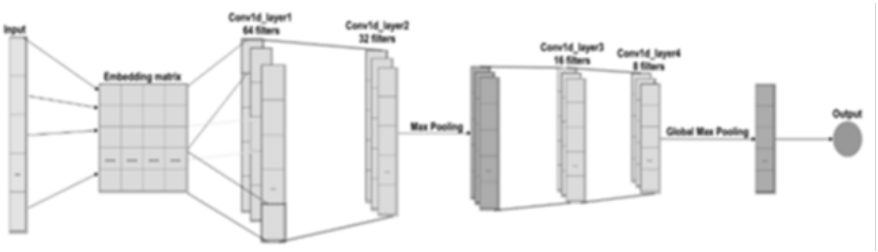

Figure 2: Convolutional Neural Network Architecture

(Huq, Ali, & Rahman, 2017), (Pinto, McCallum, Wei, & Croft, 2003), and (Soni & A, 2015), this family of approaches have not able to adequately adapt to different scenarios.

A wide range of machine learning algorithms have been developed to build flexible and efficient sentiment classifiers. Naïve Bayes classifiers (Zhang & Zheng, 2016), maximum-entropy classifiers (Malik & Kumar, 2018), or support vector machines (Firmino Alves, Baptista, Firmino, Oliveira, & Paiva, 2014) have been effectively used. However, these algorithms rely heavily on an explicit set of features related to text-description, such as lexicons, adjectives, adverbs, and grammar rules. The performance of the algorithms is greatly affected by the quality of features.

To overcome these challenges, deep learning models have emerged as an approach that does not explicitly models features. Rather, it aims to identify hidden patterns from the raw data alone and construct hyper-parameter models that make sense of the (often unknown) features.

For instance, Cai et.al have found that integrating together text and image data can allow for building models that more accurately classify sentiment expressed in tweets. (Cai, 2015). In their work, the authors propose an approach that is built upon the usage of convolutional neural networks and uses to individual architectures for learning textual features and visual features. The two, are then combined as a single input for another neural network that exploits and further investigates the relation between text and image to increase the accuracy of the classifier.

In other work, the task of generating an effective model that captures both the syntactic and the semantic relations between sentences in a text is achieved through the usage of deep convolution neural network (A. Chachra, 2017). The aim is to make better sentiment classifiers by automating the whole process, which otherwise would have been addressed by using natural language processing techniques. This approach analyzes text by considering its context and aiming to identify relations from word level to a phrase level to a document layer. Carefully taking these layers into consideration yields an effective classifier.

The idea of using an integration of neural networks for achieving a higher accuracy has been also successfully implemented by Tang et al. In their work, the authors use two neural networks: one for prediction and another one for ranking the predicted word (Tang, 2016). Their study used a dataset containing twitter feeds. The effectiveness of the approach was based on three levels: word, sentence and lexical.

Another approach was proposed by Chen et.al., to address the same problem (Chen, 2016). It uses the entire document as sentiment level information rather than dealing with local text information. To achieve this task, the proposed approach is built upon a hierarchical neural network modeled to generate sentence and document embedding.

In another work, the authors propose the Recursive Neural Tensor Network (RNTN) architecture, which represents a phrase through word vectors and a parse tree and then compute vectors for higher nodes in the tree using the same tensor-based composition function (Minh-Thang Luong, 2013).

3. Text Sentiment Analysis

The key objective of the proposed framework is to train a neural network with the ability of categorizing as positive, negative, or neutral the sentiment associated with the text of the training data, so that it can be used to efficiently estimate sentiment of text not encountered before. The framework consists of two main phases: a learning phase, and a testing phase. An illustration is provided in figure 3.

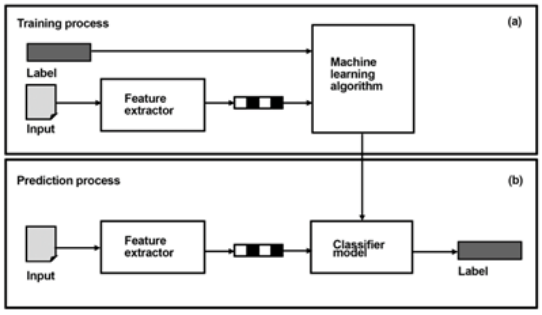

Figure 3: The sentiment analysis framework.
(top) Features are extracted from the raw input and fed to the machine learning algorithm which produces a classification model. (bottom) The classifier is used on new data. It extracts features and runs the model to categorize sentiment, i.e., predict the true labels

During the learning phase raw data consisting of twitter feeds are provided as input. The deep learning model extracts features that can be useful predictors of the sentiment associated with that text. The algorithm is trained using this data with the overall objective of identifying patterns between the extracted features and the text categorization. A classifier model is produced as output. To validate the effectiveness of the proposed approach, this classifier is tested on a separate dataset, previously unknown for the learning algorithm. The model takes as input raw data, and after implicitly extracting features, it estimates the sentiment associated with a given text, i.e., it predicts the true labels of the data.

This work performs sentiment analysis on a sentence level. We consider a three-class classification problem, that is, to classify a sentence as positive, negative, or neutral.

To achieve this task, we perform a pre-processing step of cleaning the dataset before we can feed it to the learning algorithm. Recall that our dataset is composed of twitter feeds. Tweets usually contain punctuation marks, large number of white spaces, non-characters, tags, and other characters that not only do not contain any valuable information for sentiment analysis, but that can affect on the opposite the performance of the algorithm. Our dataset was cleaned using the following steps:

- Cleaning tweets from retweets, tags (such as #) and removing links associated with sentences
- Cleaning all the non-letter characters
- Removing extra white spaces, punctuation, and stop words
- Converting all text to lowercase to avoid categorizing the same word differently
- Converting HTML to plain text

After cleaning the dataset, we apply state-of-the-art techniques such as *word embedding* before feeding the data to the learning algorithm. Word embedding is the process that maps each word to a vector of real values with the objective of representing similarly words that have a similar meaning.

The objective of the learning phase is to minimize the error between the output produced by the network (i.e., the predicted sentiment categorization) and the desired output (i.e., the true categorization of sentiment). More formally, this error can be expressed as follows:

$$E(w) = \frac{1}{K \cdot N} \Sigma_{k=1}^{K} \Sigma_{N=1}^{N_L} (y_n^k - d_n^k)^2$$

In the above equation, y_n^k represents the output produced by the classification algorithm, where K is the number of the input images and the desired output vectors. For each k not larger than the size of the dataset, x_k is the k—th entry, and d_k is the desired output vector.

For the learning to take place, we are interested in computing the gradient of the defined error term by calculating the partial derivatives of the error function with respect to the weighted sums of the input. Algorithm 1 presents the main steps to follow

Algorithm 1: Training algorithm update of weights

Initialize weights W and biases b of the neural network N
do
  for each training example (x_i, y_i)
    p_i = neural-network-prediction (N, x_i)
    Calculate gradients of loss function (p_i, y_i) with respect to w^2
    get δw^2 for all weights from hidden to output layers
    calculate gradient w.r.t w^1 by chain rule at hidden layer
    get δw^1 for all weights from input to hidden layers
    update (w^1, w^2)
until training examples are classified correctly or stopping criteria met
return the trained neural network

As one can observe, the purpose of the algorithm is to continuously update the weights associated with the extracted features used in the training procedure while aiming to minimize the error function. For that reason, gradients of the loss function are calculated from hidden layers to output layers and then back-propagated recursively to adjust all weights between layers accordingly. The algorithm stops if it converges, i.e., the neural network is trained accordingly, or some other stopping criteria is met.

3.1. Layers of the Network

The neural network processes the input data by efficiently applying several steps. First it approaches the input using convolutional layers, and then decreases the dimensions of the input

by down-sampling it through a process known as max pooling. The number of features is increased during this step. Finally, the fully connected layers allow for the network to operate by firing the activation and loss functions. In particular:

Convolutional layer's role is to extract features from the input data that will be used for classification. **Pooling/subsampling layers** are commonly inserted after convolutional layers with the purpose of reducing the dimensions and the spatial size of the input data. This process helps the network to reduce the number of parameters needed to explain the model, thus reducing computational complexity, and decreasing the chances of overfitting (i.e., the learning algorithm performs well on the training data, but poorly on testing data). During this phase, the extracted features are evaluated and checked for patterns, hierarchies or interconnections that can affect the classification. Noise reduction is also an output of this process.

Fully connected layers are often used as the final layers of the network. Their key objective is to validate the model and to ensure that the network will be able to efficiently perform the classification task, at hand. The output of the previous layers is used to determine the relations between parameters and their role in the learning model. Previous layers and their associated features are summed accordingly to determine the class of the target output. The network backpropagates this information and ensures that as more input data arrives, it is considered to enhance the learning experience. An intuitive illustration of these layers is provided in figure 4.

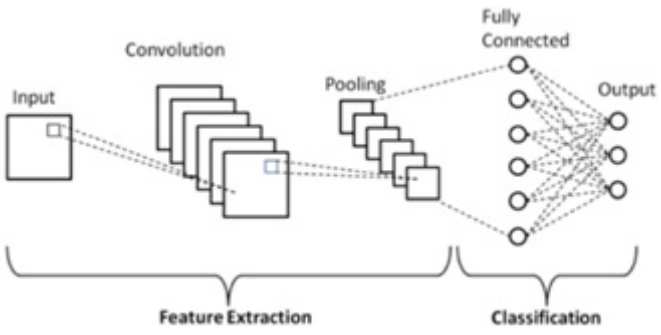

Figure 4: Convolutional neural network layers

Our framework is implemented using the Python programming language and several state-of-the-art libraries that efficiently deal with machine learning tasks, such as Keras (Chollet, 2015) and TensorFlow (Abadi, 2015). Keras is effective in the designing process of the neural network, allowing for smooth implementation of convolutional layers, while working well with raw data. TensorFlow is mainly used during the processes of training the neural network to automatically detect and classify our data. Other libraries such as Pandas (Team, 2020), Numpy (Harris, 2020), and Matplotlib (Hunter, 2007) are used during the pre-processing and visualization steps.

4. Experimental Results

4.1 Testing Environment and Dataset Description

A series of experiments is performed to evaluate the effectiveness of the proposed approach. The learning algorithm is fed a large dataset containing approximately 1.6 million labelled records, where each record is a twitter feed (Go, Bhayani, & Huang, 2019). In addition to that, another dataset (Misra & Arora, 2019) is used to train the model on sarcastic or humorous text. The training data, as described in section 3, are pre-processed, and cleaned from unnecessary parts that do not convey any meaning regarding the sentiment analysis. Expression of emotions through emojis helps to categorize sentiment. Table 1 provides an illustration.

Table 1 – Emoticons labeling and sentiment

Positive emoticons	Meaning	Negative emoticons	Meaning
:)	Smile	:(	Frown
:D	Green	:'(	Crying
:P	Tongue out	:@	Angry

4.2. Performance Measures

To evaluate the performance of the proposed approach, we rely on the standard measures of **precision, recall** and **f-measure** (K.M., 2011). F-measure is a score of a test's accuracy. It is calculated from the precision and recall of the test, where precision is defined as the number of true positive results divided by the number of all positive results, including those not identified correctly.

Recall is defined as the number of true positive results divided by the number of all samples that should have been identified as positive. Precision is also known as positive predictive value while recall is known as sensitivity in diagnostic classification. The F-score is the harmonic mean of precision and recall. In particular:

$$P = \frac{\#TP}{\#TP + \#FP} \qquad R = \frac{\#TP}{\#TP + \#FN} \qquad F = 2 \cdot \frac{P \cdot R}{P + R}$$

where *P,R,F* denote respectively precision, recall and f-measure, while *#TP,#FP,#FN* represent the number of true positive, false positives and false negatives. A combination of these three measures provides a standard and accurate description of the accuracy of the learning algorithm.

4.3. Results

Table 2 provides a summary of the precision, recall and f-score the dataset used in this work, while figure 5 demonstrates a visual representation of the loss and accuracy functions in terms of epochs, i.e., the number times that the learning algorithm will work through the entire training dataset.

Table 2 – Performance of the learning algorithm

Dataset	Precision	Recall	F-Score
1.6 million twitter feeds	94%	85%	89%

As once can observe, the learning algorithm performs with high accuracy both on the training and, most importantly, on the testing data. An increase in the number of echos allows the algorithm to refine further the connections

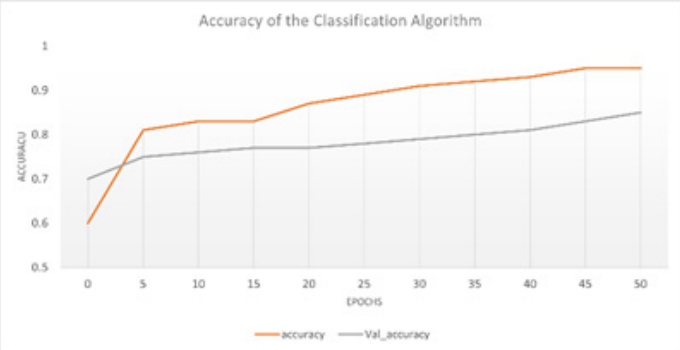

Figure 5: A visual representation of the accuracy function in the training and testing dataset, with respect of the number of steps (echos)

between features and the desired output, thus yielding even more accurate results.

The accuracy of the learning framework increases significantly with the number of iterations, as shown in figure 5. The proposed neural network framework is able to extract the necessary features that serve as predictors of the labelled data and efficiently predicts the sentiment associated with them. The data used during the testing procedure, i.e., for cross validation has a lower accuracy, in comparison. These results are expected considering the difficulties of text sentiment analysis presented earlier, but especially related to sarcastic or humorous text, nuances in written expressions, or the usage of slang-language. To address these challenges, we can further investigate the role that text processing plays in the learning framework, in addition to acquiring other datasets that contain more data in the above-mentioned categories, or to explore the role that various learning models and algorithms can play to achieve higher validation accuracy.

5. Conclusions

This paper presents a framework that addresses the problem of performing text sentiment analysis through the usage of convolutional neural networks. A high-volume dataset containing twitter feeds is fed as input to the neural network which then learns how to classify these feeds according to the sentiment associated with them. This is a difficult task that presents numerous challenges, as discussed through this thesis.

Instead of relying on hard-tuned parameters, in our approach we learn the underlying model through processing it in a neural network with multiple layers. The end-result of the learning phase is to extract features that can predict the labelled training data and to identify patterns that facilitate accurate classification. This model is then evaluated on a separate dataset, so that it can also perform well on previously unencountered environments.

Experimental validation shows the effectiveness of our approach into classifying twitter feeds with high accuracy.

This work opens several possibilities for

improvements. In particular, the importance of an accurate, general, updated dataset is crucial for the accuracy of the trained model. We aim to enrich our dataset by including data from other sources as well and use the trained model to predict the sentiment of text. Another direction to extend the application is the usage of a database to save a history of how a particular word is used over time and what sentiment it is associated. This can be helpful to understand how language, words, and their meaning change overtime as well. The learning framework can benefit from integrating other sources of opinions, such as images, or texts from different sources. In general, enriching the set of features that are used to describe the text, or further investigating the correlations between different parts of the text from a semantic point of view can be another good direction for future work.

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CAPITALISM AS AN ECONOMIC SYSTEM. AN EMPIRICAL ANALYSIS OF THE CAPITALIST FINANCIAL STABILITY DURING CRISIS

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Abstract

Capitalism is a very powerful regime nowadays. Capitalism regards capital as a main factor of production. It supports the capitalist to benefit from wealth accumulation without putting this capital at risk. The mechanism to do so is called interest. This results in the following consequence; Weak competitors who are not able to provide a capital compared to that of a big capitalist are excluded from the competition and put aside. So, the capital is of nature to influence the basic economic decisions like what and whom to produce.

At the state level, governments depend on the capital of capitalists to expend on development. The capital also influences policy making and election campaigns. In other words, the political and social life depends on the market which is in the hands of capitalists.

This article empathizes the problems that accompany the capitalism by conducting an analysis of the financial stability. To achieve this, there are used the profitability ratios for 20 financial institutions in times of different crises that have affected the financial market. This article concludes that; in the todays' economic environment, which is ever changing, the capitalist system might be at risk. It needs either restructuring or reconceptualization in order for the economic system to perform accurately.

Keywords: *Capitalism, Economic System, Financial Stability, Profitability Ratios*

1. Introduction

Capitalism is thought to last no longer anymore. Given all the problems arose nowadays it has turned into a threat for the whole globe. A brief introduction would help understanding it and trying to identify the elements of a SWOT analysis for providing a better alternative to this "old fashion" system.

The essence of capitalism as an economic system is the capital accumulation. The accumulation of capital means to gather as much capital as possible by different means which derive from the use of the ownership. These sources of additional capital, otherwise called as financial return, might be:

- Profit - It comes from the differences in prices
- Rent – It comes from the transfer of the right to use the property, from the owner to the user.
- Interest – It comes from the transfer of the right to use the money.
- Royalty – It comes from the transfer of the right to use the asset for generating profits.
- Capital gain – It is a result of the changes of the value of the asset in the market.

All of these elements are of great importance and need special attention for a deep analysis. This paper aims to analyze the use of the interest as the main element of the capitalism, by emphasizing the problems that it might bring.

What could be an alternative of the interest? Is it possible to totally avoid it without putting the economic system in risk? Can we afford a system which skips the interest and promotes the share of risk, mobilizes people savings and enhances the total welfare? Moreover, how much possible is its implementation in order to increase the financial stability?

To address these questions, the paper will start with a broad overview of the capitalism by emphasizing its advantages and drawbacks.

1.1. An overview to capitalism

Capitalism, as an economic system, is characterized by the private ownership of the production means, and the use of them in generating profit. The basic components composing capitalism there are: accumulation of capital, market competition, a system of prices, rights to private property, salary labor and freewill exchange.

According to Fulcher, James (2004), Capitalism A Very Short Introduction, Capitalism is the decision to invest your own money in return for a profit. In generating this required profit, the capitalist should undertake a considerable amount of risk. Generally, the higher the desired/required return, the higher the risk you should undertake. In this presumable situation it is very simple to calculate the profit. It is the difference in prices between the country of production where there were used all the production means, and the country of exportation which is willing to pay for something of real value. If there was only one producer providing this good, the buyer would only rely on him, resulting in a very huge difference between these prices, so huge profits for the provider. It is the market which diminishes the power of this producer by accepting alternative producers. This way the market gets saturated and the profit for each of the producers is determined by the equilibrium. This results in a fairer price for the buyer. This example refers to the merchant capitalism.

If we talk about the financial capitalism, it generally refers financial markets. Instead of the underlying assets there is used other instruments, called derivatives, to represent the transactions on these assets. Such kind of instruments might be, Future and Forward Contracts, Call and Put Options, Caps, Floors, Collars and SWAPS. These instruments are used for arbitrage or hedging purposes and they rely on the expectations of the customers/ investors. The parties use these contracts in order to avoid the risk related to the underlying assets, based on their expectations regarding the possible movements on the prices and returns of these assets. Such transactions between different parties make up the financial market. The arbitrage technique uses the small differences that result in the prices due to some technical issues between different markets. A smart investor might take advantages by exploiting these opportunities. It is also the stock exchange market which might provide room for such differences to be profitable for the engaged investors who carefully study the market movements. All in all, behind this global structure, it is the consumer expectations which make able the chance to take advantage from the investment opportunities. Sometimes it might cause a non-representative of the real value, price, which is hidden behind the “Good will” or “Mark” terms, and traded for as an added value to the customer, who is the one which will bear this artificial fictional price.

In the light of the recent crisis, we can see the capitalism as modern economic system which is still adapting to the ever-changing world. In the Oxford English Dictionary, capitalism is referred to as “accumulated wealth reproductively employed”. The capitalist system stresses the importance of the private property, the economy based on the market, the importance of the contracts, the innovation driven by the entrepreneurship, the pay for the work provided, in financial terms and for sure the available free credit for investment purpose. That way the modern capitalism is far different in definition, but in functioning as well by the explanation on the dictionary.

It is the credit which stands in the roots of capitalist economies. As McCraw Thomas K said in his book "The Current Crisis and the Essence of Capitalism" (reference here), it is crucially related to the believe in the future. Simply said, only because the capitalist expects a bright future, he is willing to use his wealth today for a higher return in the future. Moreover, it goes eve beyond that. The entrepreneur might be willing to invest even the unreal accumulated wealth for this purpose. Every financial transaction is based on a fake, illusionary accumulation of wealth which is now in the hands of nobody. Banks enter into lending activities with customers by using sources they do not own, and allow themselves to lend more than their available reserves. They do that only because they expect that they will generate interest revenues in the future. Corporations issue bond and stocks to finance their activities and every calculation on the due payment is done by considering the expectations for future income which might arrive

from their assets. Customers engage in trading activities for assets that do not really exist. This is done in the frame of their belief for the better future. They expect the asset to be ready on the due date specified in the contract and with the required predetermined features. In these terms, everything which is traded for today, is based on the future forecast and expectations. This is how does the modern capitalism look like.

Probably, with the missing backing asset it might be the rider of many economic problems, why not even crisis. It might also be an enormous opportunity to take advantages of any good economic opportunities, even with a credit absence. This dilemma will be explained in the continuing sessions by arguing on the advantages of capitalism as an economic system as well as its drawbacks. Moreover, a comparison between capitalism and other economic systems will show up the benefits and weak points.

1.2. Advantages of Capitalism as an Economic system

Tejvan Pettinger (5 October 2019), in his article "Advantages of Capitalism" tells that the capitalism has five advantages. Firstly, he says, there is no better alternative than the Capitalism. According to his explanation capitalism, likewise the Democracy is the best alternative the economists and philosophers might have ever found. Regardless of all its possible disadvantages, there is no any other system that might perform better than capitalism so far. By this attitude towards Capitalism, it is clearly understood that everything else is just the explanation how a good system Capitalism is.

The second advantage according to Pettinger is that Capitalism promotes efficiency. This efficiency lies in both directions, either in the resource's allocation, or in the production efficiency. When we talk about the allocation of the resources, the Capitalism, by the introduction of the free markets and the concept of the invisible hand of the market conditions, makes it easy for any producer or provider of goods and services to freely allocate its resources for such a production anyway in the world. The efficiency here is fulfilled by the competition on these resources. On a free market, the manufacturer is free to choose the best sources and due to the competition, he can achieve that with a low cost.

The production sources, especially when we refer to a manufacturing business, might be classified as direct materials, direct labor and factory overhead. The primary source of production, the direct materials can be easily allocated all over the world and the capitalism makes it easy to provide them in the most efficient way possible. When it comes to direct labor, to which Capitalism allocates the payment in the form of wage, even this source can be easily located in the market with the highest quality for a low price. This makes the use of labor efficient. The last element of the production, the factory overhead might be the easiest sources to be allocated efficiently in the market. The competition for them is even higher and their distribution is wide.

When we talk about the production phase, the transfer of these primary sources in what is called the "Work in process" is then achieved with a high efficiency. The automatization of the processes, the possibility to outsource the operation means, and the phases of operations themselves, makes the production effective and efficient. I would like to go even beyond that. The just in time processes are those who can increase even more the efficiency of production. Everything is allocated, produced and distributed in the most efficient way. Even the feedback comes back immediately and when required. This makes it possible the change and the continuing improvement to happen not only efficiently, but just in time as well. Given that, the practice over time makes it even easier to implement an added efficiency in the future. This can be achieved when the manufacturer gets familiar with these rapidly changing preferences, driven by the ever-changing world. The Capitalism makes it possible for the provider of the goods and services to predict the preferences and the behavior of the customer in the long run, thus being able to even dictate their needs and preferences. At this point in time there are other ethical issues that might rise. If we go beyond that the legitimacy of capitalism might even diminish.

Another advantage of Capitalism according to Pettinger is the freedom to choose. Even though it might be seen as a political and social issue it

is indeed all inclusive. According to Friedman "There is one and only one social responsibility of business — to use its resources and engage in activities designed to increase its profits so long as it stays within the rules of the game". It means that in a free economy, everyone is free to choose whatever he wants. The producer firstly has the total freedom to choose the sources of production, the way of organizing his operations, and the type of the products/services he will be delivering. Moreover, he is free to distinguish between different suppliers of his row materials, in order to deal with the best price and quality. He is also free to choose the customers he would like to serve too. He can decide whether to expand on the entire market, to choose a segment or even a niche. The price he will put on his product is also his choice. Beyond that, he is free to choose the information and promotion channel to achieve his customers.
On the other hand, the counterparties have their freedom too. The supplier is free to choose the design, the price and the quantity of the row material he will be selling to the manufacturers. He is also free to choose which partner to work with.
The employees have a total freedom to choose the company he would like to work too. He is the one who puts the requirements on the wage he will accept, as well as the work conditions he would like to work on.

The customer on the other hand is free to choose between multiple sellers. He is free to require for the best price and the best quality.

In this entire scheme there is a tradeoff between costs and revenues, only if the net revenues exceed the total cost, each party will be willing to collaborate with the other. The profit margin is also an issue which should be taken into consideration. Again, there is needed an analysis of the tradeoffs between costs and profits about the margin that everybody would be willing to accept. In this viewpoint, the only limit to the freedom of each party is the entering in the freedom zone of the counterparty. The government would in this case only interfere as a regulator. This is because, due to the economic freedom, there will not be a need for political enforcement. The economic freedom would be able to provide political freedom as well. Furthermore, the greed to have as many deals as possible, put in place by the equilibrium of the market, and would enforce each party to give the best of him. The result will be a win-win game for all the parties and the effect would be transmitted on the economic progress as a whole.

The financial incentives have been seen by Pettingeras as another advantage of the capitalism. As the father of capitalism, Adam Smith stressed the thrift and savings from individuals, families or even businesses are a very important element which contributes to the development of the entire economy. That takes place especially when these savings are not kept in a bank account but rather when they are invested in the economy. This investment would make it possible for the industry to buy more machinery which might save the labor and improve the innovation. The technological improvement might then be used to increase the total return on the capital invested, which would mean money circulation in the economy. This is translated in higher living standard. The question is: Is the today's capitalism using the savings and thrifts as Adam Smith intended years ago?

Milton Friedman says "The great virtue of a free market system is that it does not care what color people are; it does not care what their religion is; it only cares whether they can produce something you want to buy. It is the most effective system we have discovered to enable people who hate one another to deal with one another and help one another." In this sense, another advantage of the capitalism is the lack of the discrimination. The employer would seek for the best worker who would do his job properly, without thinking of which color, race, culture gender or religion he belongs too. As far as the market is which puts the rules, the only objective would have been to accomplish these rules. Even if the employer would think twice while hiring this worker or not, it would be the market constraining him not to think for longer. This is because the competition is too harsh. There is no time to think twice for one choice, because your competitor might have done it far before than you. At that point you would be constrained to restart the hiring process by scratch, because the employee just flew to the counterparty. However, everyone is aware that this process is too costly and time consuming.

That is why, in the continuous changing world, the winner is the one who thinks and acts the first. Given this, all the possible workers in the market will be equal in the eyes of the employers. The only characteristics differentiating them would be their skills and abilities, something that seems to be fair enough.

The producer on the other hand is in a continuous search for the best provider of the production resources. Neither would he/she see for the color, ethnicity, and gender and so on. His/her only concern would be to find the most appropriate supplier for his/her business. So, all the suppliers in a competitive market are the same. The qualifying element for them will be their quality and price. In this sense the discrimination is died even in this aspect.

Moreover, the final customer has got no race, gender, ethnicity, or religion. The producer is always eager to serve to the highest number of customer possible. His/her only objective is to maximize the profits and he/she can only achieve this objective by reaching the highest number of purchasers. Additionally, he/she will be continuously seeking to keep this customer satisfied for as long as possible, in order for the competition not to take him/her away. In this sense, the discrimination on the customers is extinguished.

It is discussed so far that the employees have got no "color". Indeed, they have all possible colors of the world, but this is not a threat for them. This is neither a source of discrimination. In the light of free market, it is seen as a source of intangible assets that adds value to the company. The differences between them are those which enhance the organizational culture, open new horizons and put the business forward.

The same happens with the suppliers. Their richness in the "colors" is an opportunity for the manufacturers to be exploited. They can offer miscellaneous choices to the business by differentiating it in the competitive market.
The last but most important one is the customer. His multicolor is the source for innovation. There are these differences which might add value to the operation of the companies. The marketing strategies can best be constructed by exploiting these differences. They are the source of deep thinking, innovation and continuous improvement, because in a long battle to fulfill all different needs coming from these different customers, the producers will be facing their opportunity to express their power.

Given that the market dictates equal opportunities for employees, suppliers and even customers, the colors belonging to each party make a whole beautiful picture of the future. The employees can only compete on merit basis, the suppliers can only compete on quality and cost basis, the producers can only compete on quality and cost basis. In a harsh competitive market, the survivors will be the ones who will provide the best. This is the incentive for innovation and continuous improvement. All in all it is the customer who will gain, it is the system, and it is the entire society who will benefit. I still wonder, is really Capitalism being implemented as it was thought?

1.3. Disadvantages of Capitalism as an economic system

"Capitalism is the astounding belief that the wickedest of men will do the wickedest of things for the greatest good of everyone."– John Maynard Keynes
Based on this, Tejvan Pettinger wrote in his article, "Pros and cons of capitalism", published in Economics Help, that Capitalism presents some disadvantages, such as:
the possibility of the firms to exploit the customers by gaining a monopoly power;
these firms can use this power even for the lowering of the wages to the employees;
the possibility to damage the environment by the externalities, especially when they are not controlled, the inequality that comes as a consequence of inheritance and the possibility to cause booms and busts to the economy.
As Branko Horvat wrote "It is now well known that capitalist development leads to the concentration of capital, employment and power. It is somewhat less known that it leads to the almost complete destruction of economic freedom"

The capital concentration in the hands of the richest ones will let the rest of the population

in a huge poverty. The rich people are becoming richer and the poor people are becoming poorer. This will create a huge gap between the rich and the poor as far as the middle class might even disappear. This picture will not last for too much to appear in the new economic and global system. It will merely come because of the concentration of wealth in the hands of some people that might think that they deserve everything. Nowadays more and more entrepreneurs are merging with or even acquiring others. The greed to become even bigger does never end. This will probably lead to a general monopolization of most of the sectors of the economy.

The concentration of the vast amount of money in the hands of very few people will lead to a political power loss as well as a loss of the democracy and economic power for the majority of the population. The economic system will be directed by some greedy corporations with an unlimited power as to influence the government and the syndicates as well. They will become a kind of government where the hierarchies and bureaucracies will kill the free entrepreneurship. Their only driver will be the profit maximization and nothing else will have higher value than this. In this sense they will be the promoters of the degradation of the social welfare. David Schweickart says: "Ordinary people [in capitalist societies] are deemed competent enough to select their political leaders-but not their bosses. Contemporary capitalism celebrates democracy, yet denies us our democratic rights at precisely the point where they might be utilized most immediately and concretely: at the place where we spend most of the active and alert hours of our adult lives"

Franklin D. Roosevelt says that "the liberty of a democracy is not safe if the people tolerate the growth of private power to a point where it becomes stronger than their democratic state itself. That, in its essence, is fascism—ownership of government by an individual, by a group, or by any other controlling private power." In this sense the democratic liberty is put on question as we always see the increasing power of the capitalists which might even not promote any real development even because some of them might have inherited it.

The monopolization is the worst thing that might happen to an economy. Firstly, monopoles will make the exploitation of their employees. Given that the number of the businesses will be very low; these employees will have low alternatives to choose. This is of nature give the existing ones the freedom to lower the wages of the employees to the minimum possible. Not only that but, in an attempt to decrease the costs as much as possible they might also justify the lack of good work conditions. The employees might be constrained to work in poor conditions and with low wages and none of the competitors will be willing to offer something more. This is the worst exploitation ever done to the workers by any form of political or economic system.

Diseconomies of scales are also another threat related to the development of the monopoly. As it is known, the increase of the amount of production can result in economies of scales. This is due to the decrease of the cost per unit as the total amount of production units increases. But on a monopoly situation, the total quantity is believed to increase as much as the production cannot be managed and controlled any more. The average cost would then increase in such dimensions as well. This would cause the inability to control the average cost of this production. That way, the increase of production, driven by the monopoly would cause totally the contrary. The cost per unit would start to increase even more.

The lack of choice is another drawback assigned to the monopoly. Nowadays, consumers do not only buy to fulfill their basic needs. That would be the case of many years ago, when it was more than enough one variety of products to satisfy the consumers' needs. In the hierarchy of needs of Maslow, there are other needs beyond the basic surviving needs of the human beings. Now, consumers are more and more looking on self-actualization and self-esteem, given that the lower levels of needs have been already fulfilled. The lack of choice will be the killer of those needs and wishes for the customers, let alone any psychological problem that they might cause to them.

Inequality is another drawback of capitalism. This is related to the unfair distribution of wealth and

power. The wealth is concentrated on the hands of very little people who rose from the monopolistic system. As Ravi Batra calls it "share of wealth held by richest 1%", it is explicitly shown that the most of global wealth is concentrated on the hands of an almost invisible part of the society. To concentrate that enormous wealth and power only on that little share means to drive the whole economic, political and social system toward destruction. The biggest and most powerful ones will always exploit the rest of small and week people which constitute the majority of the society. It seems like all are living to make this minority satisfied and happy, when it should be the contrary happening. That situation cannot last for longer as far as the people understand their rights and start dictating their power through unions and other types of organizations.

Capitalism promotes market instability as well. As Marx believed, the production in the capitalist system occurs in an irregular way. Any time that a recession occurs, this relates to overproduction, which is a waste in the entire system. This way of production has several contradictions within. On one hand, the capital sphere is on anarchy represented by the free market and on the other hand, it is the industrialism which promotes socialized production in the labor viewpoint. As Marx and Engels said "Society suddenly finds itself put back into a state of momentary barbarism, and why? Because there is too much civilization, too much means of subsistence, too much industry, too much commerce"

2. Methodology

Two methods are used to prepare this research paper. The first part uses a theoretical approach by collecting secondary data from multiple sources of scholars' researches. All this information is condensed in a reflection essay which explains the advantages and the drawbacks of capitalism as an economic system. Moreover, the analysis of the weaknesses shows out the possible areas of improvement. It is also discussed of how to manage the drawbacks in order to convert them into strengths.

The second part of the research is an empirical analysis of the elements that better represent the financial system in the framework of the capitalism. As it is derived by the term itself, the most important element that the capitalism uses is the capital. In order to evaluate the performance in the use of capital different types of ratios are used as they are explained below. Given that the financial services sector is one of the most important and influential sectors of the economy, the analysis of the ratios is done by data gathered from this sector.

There is chosen a sample of top 20 financial institutions to be evaluated for their financial performance. The first sampling technique used is the purposive sample. As this research takes into consideration the analysis of the interest, as a means which is thought to be the major problem of capitalism, the comparison between these institutions' performance better explains the problematic raised by this component.

Then, the number of the variables in the sample is determined by convenience. It is not feasible for this research to use more than 20 institutions from each group. The ranking within the groups is determined by organisms that engage in the ranking of the institutions worldwide. For the conventional sector it used the report of Forbes for "The largest financial services companies by revenue"

The period chosen includes a range of 15 years, starting by 2006 to 2021. This range is chosen in order to highlight the fluctuations on the profitability during and after the financial crisis of 2008 and also during the COVID pandemic.

3. Empirical research

Based on the data gathered from the annual reports of each of the top 20 financial institutions, the analysis consist on an explanation of the profitability ratios as follows.

3.1. ROE

Return on equity is a ratio which expresses the efficiency of the use of equity in generating returns/income. In the sample of conventional

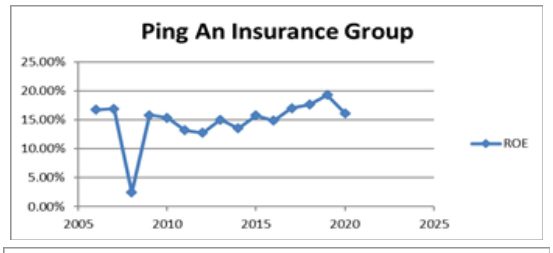
financial institutions, what is obvious, is the fluctuations shown in this ratio during the time. These fluctuations tell about unsustainability in the financial performance of these financial institutions. The only conventional financial institutions with an almost stable return on equity are those of China. Given that in China, the government has an important role in the overall financial conditions, the rules and regulations, as well as the control and support toward private financial institutions helped them to keep the sustainability

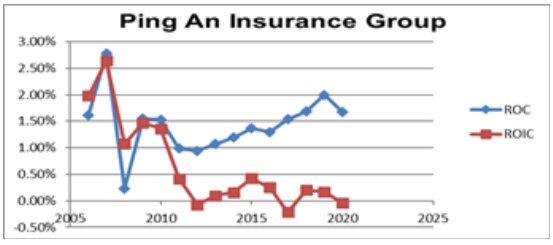
The graphs below show the fluctuations of profitability ratios for the most representative conventional financial institutions.

Berkshire Hathaway is a conglomerate located in the USA. Given that it operates in different industries, the consolidated returns of this multinational company rely on

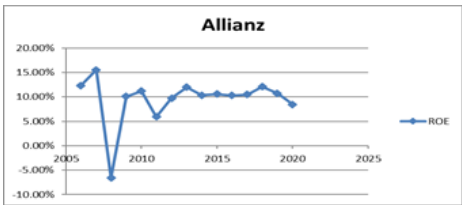
the returns of each of these industries. Its declines are mostly obvious on the crisis of 2008 on 2016 and on the pandemic of Covid 19. Since the crisis have been global and affected almost every industry, it couldn't take advantage of a well-diversified portfolio.

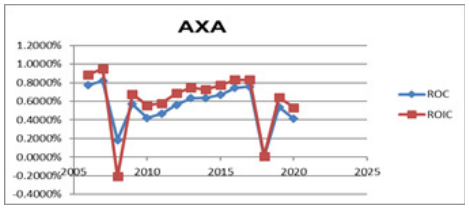
Ping An Insurance Group is an insurance company located in China.

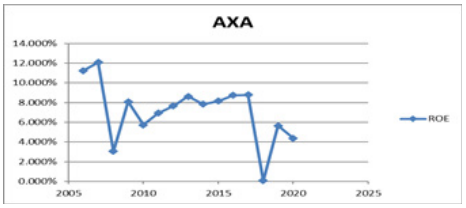




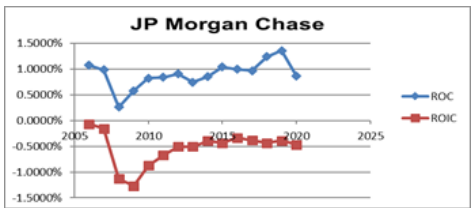
As previously explained the ROE in this company is more stable. A huge decline is present on the years of the financial crisis. It is also shown a decrease in the time of pandemic but this not to huge. In general, the insurance companies did not suffer high loses during the pandemic due to the increase of the number of entities which required to get insured in order to prevent possible future losses imposed by the crisis.





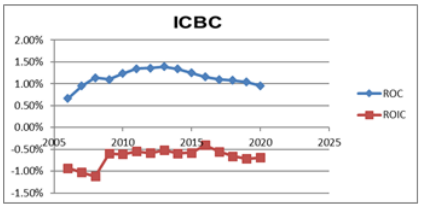


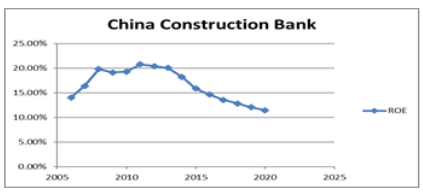
Allianz and AXA are also insurance companies. They operate in the European market, where the influence of the government is not too extended. That is why we observe fluctuations in the return on equity. The behavior during the financial crisis of 2008 and the pandemic are quite the same with other insurance companies.

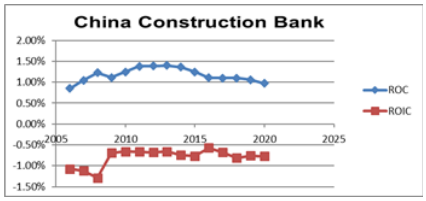


JP Morgan Chase is a bank located in the USA. The financial institutions with higher fluctuations in the return on equity are the banks. This is due to the use of the interest. The interest is the main element which provides revenues as well as imposes expenses to these banks. As such, the net income calculated after all types of revenues and expenses, including net interest income are too fluctuating. It should be mentioned that the main source of operational return in banks is the interests. Given that it is strongly related to the ability of the customers to pay, the behavior of net income is also fluctuating. It is obvious a huge decline on net income and also on ROE during the financial crisis of 2008, for which the main cause was the high interest rate.

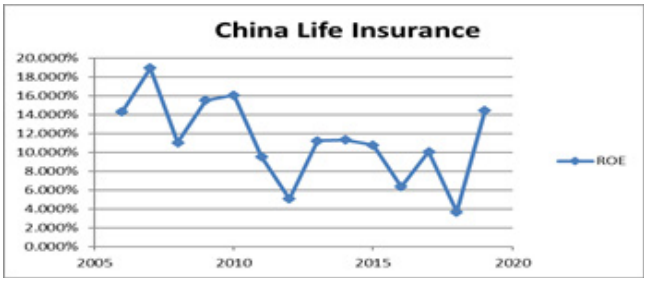
It is also obvious a decrease on the time of pandemic. Like in insurance companies, there has been present an increase in the willingness of the people to make their money as safe as possible due to the fear brought by the pandemic. But, unlike insurance companies, the banking activity was mostly concentrated on saving accounts rather that operations which include interest, which imposes on the other hand a high risk. That is why, the decline of the return on equity is higher in banks compared to the insurance companies.



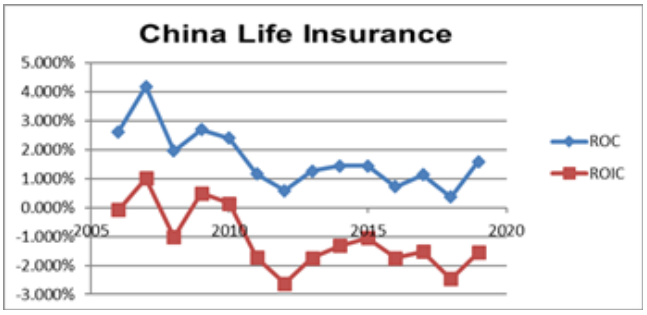




ICBC and China Construction Bank are also banks, but given that they operate in China the role of the government has helped in their smooth transition. The behavior of the return on equity for these financial institutions shows a characteristic shape of the product or business life cycle with no fluctuations.



The life insurance companies have special features,



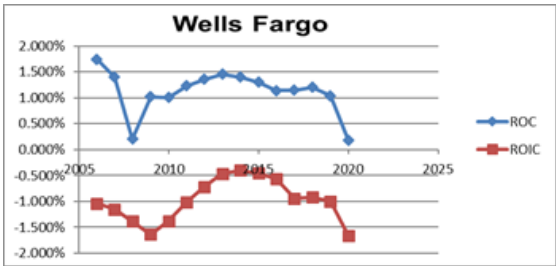
different from other insurance companies. In China, the life insurance companies operate on individual and group basis. Generally, the insurance is done by people for the people, sometimes even from the businesses for their employees. Given that, the returns on this kind of business rely on the peoples' expectations and evaluations of the risk of death. These risks and evaluations defer based on each one living conditions, rather than on macroeconomic conditions. This might be the reason on the fluctuations of the returns on this type of financial institution. What is obvious is the decrease on the return during the financial crisis of 2008, as in all the other businesses. What is more obvious is the huge increase on these returns during and after the pandemic of 2019. This is because of the increased fear of the population for the consequences of the pandemic and for the predicted expenses that the pandemic might cause. Another reason might have been the increase on the number of insured ones to take advantage of the death occurrence of their elderly family members. Given that for most of them the

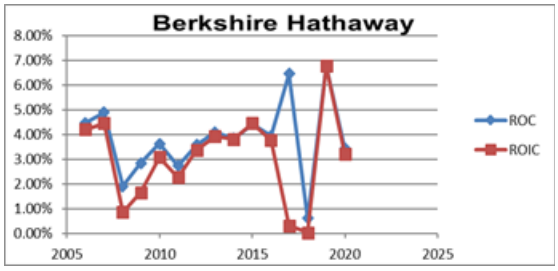
event might have taken place, it is expected for these financial institutions to experience declines in their returns, since they will be obliged to cover the expenses of the insured ones.

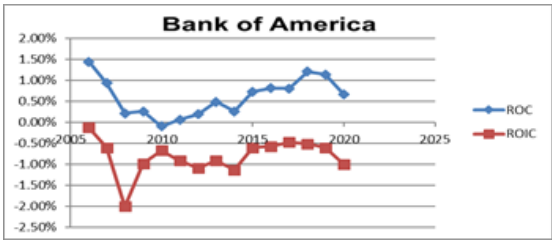
2.2. ROC and ROIC

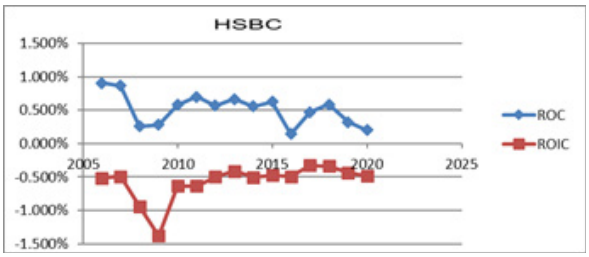
The Return on Capital and the Return on Invested Capital ratios express the efficiency in the use of capital to generate profits. Differently from the return on equity, it doesn't only take into consideration the use of the stockholders' equity but also the use of outside money generated by the third parties. It is referred to as debt. Given that, the return on capital tells about the profits generated by the total capital of a business, not only what belongs to the owners but also what is taken by the others.

The conventional financial institutions take loans or issue debt instruments for financing the operations or their investments. Given that they pay interest in these debt instruments, they face a higher risk related to their investments. That is why we observe fluctuations in the return of capital of conventional financial institutions.









As it can be seen from this sample, the behavior of the return on capital is very similar to that of return on equity. The higher declines are shown during the times of financial crises and the pandemic of COVID-19. What is too important is that the values defer too much. Given that in return on capital, except from the owners' equity is also used the financing from the third parties, this ratio is far low from the return on capital. This occurs mainly because of the cost of the debt. Since the business should pay for the debt that it takes, these expenses decrease the net income for it.

When it comes to the return on invested capital, its behavior is very special for the conventional financial institutions. As it is calculated as EBIT (earnings before interest and taxes) * (1-t), divided by (debt + equity) – (Cash + equivalents) there are some elements that should be taken into consideration in this analysis.

First of all, it only considers the invested capital, so the capital which is used for investment, except from cash and equivalents which are kept for security. Given that, we should be waiting for an increase in the values of the ratio comparable with the return on capital. There is another element, more important that the reserves which has caused a lower value for this ratio, and even negative. Given that the main operations of the conventional financial institutions, and especially banks, rely on the use of interest. As such, we observe that the EBIT in most of the conventional financial institutions is negative. The EBIT is calculated as net income – net interest income because these financial institutions, while computing the net income do take into consideration all the sources of income, one of which is the interest. It is indeed the most important one. All in all, these financial institutions result in negative values on the returns from general operations, because their focus is mainly the hedge and the speculation in

the interest rates. Given that the interest rates on the market are too fluctuating, and especially in times of crisis, the ROIC is fluctuating as well. This tells about the instability of the returns on the conventional financial institutions.

Moreover, the values of the Return on Capital and the Return of Invested Capital for the conventional financial institutions are far different from each other, even though the behavior most of the times is the same. That is why the values of the ROIC lie on the negative plane of the graph mostly, while those of ROC lie on the positive one.

Conclusions

Capitalism is a system, the function of which is put on question nowadays. Many scholars argue that it will destroy itself, it will no longer survive to the changes on global range, it will go against the ones who invented it or it will even destroy the global order.

• Capitalism has had many advantages for which it become too important in the whole economic system. These advantages started with the freedom to offer and take everything on a fair exchange experience. This freedom was extended in all the spheres of the global interchange, starting from the acquirement of the raw to the distribution of the goods and services to the customers. Another advantage was the equality and the fairness. No discrimination could prevent the parties willing to participate in an exchange. All the involved actors of the global market could only compete with their comparable advantages. More over this system used to promote efficiency and effectiveness as far as it was used to achieve the required returns. It was for longer believed to not have a better alternative than capitalism

• The worst feature of this system is the capital concentration on the hands of few people. The rich get richer and the poor poorer. The incentives for efficiency and effectiveness have passed all the limits by sacrificing the added value and the quality. Nothing is traded anymore for the real value; it is traded indeed for a fake goodwill. There are no more incentives for common prosperity. The equality and fairness is compromised and the social prosperity is bypassed. The environmental sustainability is compromised as well.

• One of the main elements bringing the problems of the capitalism is the interest. The speculation on this element has caused financial instability. The crisis times reflect the problems arose by the use of the interest. The deepest declines in profitability are shown during these times. More over there is needed too much time and effort to recover from the recession.

• Due to the use of the interest the profitability ratios show huge fluctuations. This tells about the unsustainability of the financial system in a capitalist regime.

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CYBER SECURITY ISSUES IN ALBANIAN HIGHER EDUCATION INSTITUTIONS CURRICULA

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Abstract

Cybercrime and the phenomena accompanying, currently with international nature, targeting the main sectors of world economy, are main challenges facing individuals, families, societies and states, four main operators in the open market. An appropriate response to cybercrime, having a high and complete cyber security system, employing legal instruments, IT protocols and ISO standards related with this issue, is a priority.

Undertaking this research, a review of curricula and syllabuses of economic, law and IT faculties of public and private higher university institutions in Albania have been done, as well as discussing the issue with lecturers of Cyber Security, Cyber Law and Quality Management discplines on these HUI's too. Aims of this manuscript is evidencing the lack of scientific information about cyber security, cyber law and ISO standards for IT, Economy and Law faculty students in Albania.

The importance of this manuscript is related on improving the current situation of now day's students, which don't have skills, knowledge and competencies to enter in the labour market, when cyber security issues are the main risks of public and private sector operators.

This manuscript rises for the first time, awareness on offering a better curricula and syllabuses on the issue of cyber security in higher education institutions in Albania.

Keywords: *cyber crime, ISO standards, legal instruments, higher education institutions, curricula, syllabus, international agenda, etc.*

1. Introduction

Recently there has been a very large increase in the number of cybercrimes around the world, regardless of the level of development of countries. This has attracted the attention of many specialists in various fields, who have noticed that one of the ways to reduce the number of cybercrimes and cyber attacks is to improve the quality of curricula, programs and syllabi in study programs in educational institutions. high.

During conversations with industry representatives, faculty and students it turns out that information security education is a very important issue.

According to the leaders of higher education institutions, the development of programs, curricula and syllabi of IT protocols, cyber security, cyber security legislation and quality management is very important for the coming years.

There is a growing demand in the country for human resources equipped with full skills, knowledge and competencies in school for cyber security, IT protocols, cyber security legislation and quality management, given that having qualified human resources, knowledge and competence in the field of cyber security is already a matter of national security.

In the first place, educational institutions in general and those of higher education in particular must be careful about cyber security within these institutions, due to due to the protection of students' own data and on the other hand, educational institutions should ensure that their students gain sufficient skills, knowledge and competencies to enter the job market as professionals in relation to IT protocols, cyber security, cybersecurity legislation and quality management systems, to withstand the work pressure they will face when they start work and be able to solve problems that arise in their daily work related to these issues.

They need to have solid skills, knowledge and competencies related to cyber security and

cybercrime to detect, cure and prevent cybercrime. For this, higher education institutions should provide interdisciplinary programs, curricula and syllabi related to IT protocols, cybercrime, cyber security legislation and ISO standards related to cyber security, compared to the current situation where these aspects are addressed separately.

2. Literature review related to cyber crime

2.1 Cybercrime, Infrastructure and Services

The Internet, this social, economic, political, environmental, cultural, sports, legal, etc., space, is one of the fastest growing areas of infrastructure development both in terms of techniques and technologies used. Nowadays information and communication technologies (ICT) have an increasing tendency towards digitalization. The growing demand for Internet services and multiple computer connections has led to the inclusion of technologies that did not exist years ago.

Also, nowadays, the main sectors of the economy such as electricity, transport, agriculture, health, education, etc. as well as public order and military protection services, are almost interconnected and interdependent with the use of ICT (Luiijf/Klaver . 2000) and they require standards to operate, ISO standards included.

Nowadays, for developing countries, not only the establishment of basic information infrastructure is required, but the availability of ICT also, as a main basis for the use and development of service networks, while application and respect of ISO standards is acute demand (Aggarwal. 2009).

Electronic communication has replaced letters, fax, etc. and the use of the Internet in economic terms, seen from the point of view of private operators is very important, because most of the private sector communication is realized through the Internet (Zittrain. 2006). Telephone services through internet networks are becoming more usable than communication via fixed and mobile telephony (Masuda. 1980)

Services provided through ICT by governments are increasing day by day. ICT applications, such as e-government, e-commerce, e-education, e-health and e-environment, etc., are opportunities for development, because through these services facilities are provided even for the most remote areas of country (Ndou. 2004). This helps reduce poverty and improve the quality of life of citizens, based on standards too (European Commission. 2009).

With an appropriate approach, many developing countries have managed to make successful investments in ICT, offering applications that improve the productivity of the economy and continuously improve the quality of products and services offered in a territory provided by market operators in a certain society and this in paralell with ISO standards application and respect. Given the right approach, context, and implementation processes, investing in ICT applications and tools and ISO standards can result in improved productivity and quality (Ceko. 2014, 2017, 2019). The costs of internet services and investments in this sector are already lower than comparable services offered offline. Some online services are already free such as, (1) free e-mail, compared to traditional mail, (2) online encyclopedia, (3) Wikipedia, etc., compared to books, on-line public services, compared to the public administration and the queue in the offices of various institutions, etc. This causes the number of users to increase steadily, including people from all walks of life, from those with the highest incomes to those with the lowest incomes. In the same time, cost of certification with ISO standards around the globe has ben reduced continuosly.

This is also the main reason why online identity theft, the act of seizing credentials and / or personal data, and the use for criminal purposes is today one of the main threats to the existence, to the quality and to further improvement of e-government and e-Business services (Molla. 2004)

2.2 Advantages and risks associated with these developments

The introduction of ICTs in many aspects of daily life and the combination of these services with each other and with other technologies, has led to the further development of the information society, offering even more opportunities for citizens and public and private entities too (Barney 2007). This in paralel wth ISO standards application.

Nowadays, the elimination of barriers to information is also seen as a support for freedom in general and political, economic and social freedom in particular, because information is passed on to stakeholders without filters and outside the control of state authorities.

Today's technology and atandards has brought significant improvement in the quality of life of citizens mainly in aspects of daily life such as the banking sector, online shopping, mobile services, development of television equipment, etc., but it is precisely these developments that are associated with numerous new and serious threats (Kellermann. 2020).

Practically, the supply of raw materials, water, electricity, or various controls such as traffic control, road, air, sea, etc., air conditioning systems, are intertwined with ICT (Comey. 2006). This means that in addition to threats to the individual or natural or legal entity, threats to society and its way of life are also increasing. This further increases the risk of attacks on information infrastructure and Internet services. This brings not only enormous financial damage, estimated at tens of billions of dollars each year, but also enormous psychological damage to our global society (Kellermann. 2020). Globally, it is estimated that each year the benefits of cybercrime are more than $150 billion, competing with drug activity, causing extensive damage to citizens and public & private organizations, damage and loss that for the last years are estimated to be at about $400-450 billion a year. It is already believed among specialists in this field that the costs of cybercrime are greater than the costs of physical crimes.

In the first steps of ICT development, the target of cyber attacks was critical infrastructure, now, nowadays, the target of cyber attacks is any kind of ICT infrastructure. This adds to the importance of taking action against these attacks and against cybercrime (European Commission. 2009).

2.3 Relationship aspects of cyber security and cybercrime

A distinction can hardly be made between cyber security and cybercrime, although in terms of terminology this has been realized. The 2010 UN General Assembly resolution states that cybercrime is a major challenge for cyber security. It is this security that is influencing to a great extent the continuous development and improvement of information technology and internet services.

International acts related to cybercrime and cyber security require in first instance protection of critical and non critical infrastructure, as an essential element for the country's security and sustainable development. Having a safer Internet, aimed at protecting public and private users, has become a priority policy in many different governments (Gercke. 2009, Gercke. 2013).

2.4 Infrastructure protection strategy.

Since cybercrime mainly targets the infrastructure on which almost all the activity of economic agents is built and supported, the fight against this crime is a very important component of cyber security at the national and international level. Cybercrime generally aims to gain access to information. Information can be ordinary and critical. The unauthorized use of ordinary and critical information can have very dangerous consequences globally (Sieber. 2005).

Efforts against cybercrime globally are focused on drafting and enacting appropriate legislation against the misuse of ICT for criminal purposes or other activities aimed at affecting the integrity of common infrastructure and critical national and international infrastructure and building (Dutta / De Meyer / Jain/Richter. 2006), applying and respecting standards, ISO standards included.

At the national level, coordination of actions related to the prevention, preparation, response and recovery from incidents is required by government authorities, while at the regional and global level, this means cooperation and coordination between partners, because it is impossible for a single country or a single government, however capable it may be, to develop technical protection systems or institutions, technologies and standards for educating users to prevent cybercrime, since the perpetrators may engage in criminal activity against a country or government from very long distances. For this reason, transnational cyber security strategies are needed to reduce the risk of cybercrime in a given country.

This is also the main reason why legal, technical and institutional challenges related to cyber security and cybercrime issues are global challenges, which can only be overcome through a coherent strategy, which takes into account the different role of stakeholders in the framework of international cooperation (Gercke. 2009. 2013).

Seen in this light, at the World Summit on the Information Society (ISSIS), in Provisions 108-110, (Tunisia Agenda for the Information Society), an International Action Plan has been defined. Also at the WSIS Summit in Geneva, the focus was on building confidence in the security of ICT use, launching the Global Cyber Security Agenda (GCA), which serves as a global framework for international dialogue, to enhance partnership and cooperation. between governments, industries, regional and international academic and research organizations - to coordinate international action and response, to increase cyber security and information society security globally.

The Global Cyber Security Agenda has five areas of activity:

1. Legal measures
2. Technical and procedural measures, standards
3. Organizational structures
4. Capacity building
5. International cooperation

However, today more than ever it is successful that the fight against cybercrime is not just a matter of a few individuals or a few agencies, but is a very serious issue that requires a comprehensive approach, not just focusing on technical measures, because these measures only and alone, cannot prevent cybercrime, but it is imperative that law enforcement agencies be allowed to investigate and prosecute cybercrime.

This brings us to another challenge, which is the legislative challenge through which we can tackle criminal activities carried out over ICT networks. This requires technical and procedural measures and standards, designed and accepted internationally, technical and procedural measures and standards that promote the adoption of appropriate approaches to improve security and risk management in cyberspace, including accreditation schemes, protocols and standards.

We mention here ISO standards:

- **ISO 20000-1: 2011** - Information technology -- Service management
- **ISO/IEC 27000:2016** - Information technology -- Security techniques -- Information security management systems -- Overview and vocabulary
- **ISO/IEC TR 27019:2013** - Information technology -- Security techniques -- Information security management guidelines based on ISO/IEC 27002 for process control systems specific to the energy utility industry
- **ISO/IEC 27006:2015** - Information technology -- Security techniques -- Requirements for bodies providing audit and certification of information security management systems
- **ISO/IEC 27013:2015** - Information technology -- Security techniques -- Guidance on the integrated implementation of ISO/IEC 27001 and ISO/IEC 20000-1
- **ISO/IEC 27007:2011** - Information technology -- Security techniques -- Guidelines for information security management systems auditing
- **ISO/IEC 27009:2016** - Information technology -- Security techniques -- Sector-specific application of ISO/IEC 27001 -- Requirements

• **ISO 27799:2016** - Health informatics -- Information security management in health using ISO/IEC 27002
• **ISO/IEC TR 27015:2012** - Information technology -- Security techniques -- Information security management guidelines for financial services
• **ISO/IEC 27017:2015** - Information technology -- Security techniques -- Code of practice for information security controls based on ISO/IEC 27002 for cloud services
• **ISO/IEC 27001:2013** - Information technology -- Security techniques -- Information security management systems – Requirements
• **ISO 22301 – 2016** – Business continuity Management System, Requirements

These are the main standards developed by International Standards Organization related to information technology, IT security, etc, which leads to protection against cybercrime and for a better, safe and qualitative cyberspace (Ceko. 2014, Ceko. 2017, Ceko 2019).

At the national, regional and international level, it is necessary to establish and put into full operation the organizational structures, whose work focuses on the prevention, detection, response and management of crises caused by cyberattacks, including the protection of critical systems and not critical information infrastructure.

This requires adequate capacity building that focuses their work on elaborating strategies to build sufficient capacity to raise awareness, transfer know-how, and place the goal of increasing cyber security on national policy agendas.

At the international level, work should focus on international cooperation, dialogue and coordination in dealing with cyber threats.

An important part of the cyber security strategy is also the institutional reform, which consists in the development of a suitable legislation in general and a suitable specific legislation for cybercrime, drafting the necessary material criminal provisions for the criminalization of acts of this nature such as are (1) computer fraud, (2) illegal access, (3) intrusion into the personal data and sensitive data of public and private entities, (4) copyright infringement, (5) pornography with and for children, etc (Wigert. 2012).

Although, in fact, in the Criminal Law / Code of most of the countries around the globe, there are provisions for similar acts committed outside the network and ICT, it does not mean that these provisions can be applied or transactionalized for criminal acts committed through the Internet and ICT (Gercke. 2007). This requires an analysis of the legal framework and standards in action with the aim of identifying potential gaps and filling these gaps with current, contemporary and appropriate legislation for the development of the country, combined with meeting the needs of law enforcement agencies with tools, equipment and appropriate technologies for identifying and investigating cybercrime (Yang, Miao. 2007).

In this regard, it should be borne in mind that perpetrators of crimes of this nature can act from almost any country in the world, taking measures to cover up and disguise their true identity, and in this case it is obvious that the means and the instruments needed to investigate cybercrime are quite different from those used to investigate crimes of a non-cyber nature.

At the national, regional and international level, it is necessary to establish and put into full operation the organizational structures, whose work focuses on the prevention, detection, response and management of crises caused by cyber attacks, including the protection of critical systems and not critical information infrastructure.

This requires adequate capacity building that focuses their work on elaborating strategies to build sufficient capacity to raise awareness, transfer know-how, application and respect of standards and place the goal of increasing cyber security on national policy agendas.

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2.5 Implications for developing countries

For developing countries, finding strategies and solutions to respond to the threat of cybercrime is a major challenge. Building a comprehensive strategy against cybercrime requires legal instruments, advanced technologies, standards and safeguards. Building a strategy is not a matter of time, but the creation and construction of technologies and safeguards requires a lot of time and funding, but it should be borne in mind that the long-term benefits of avoiding the costs and harms caused by cybercrime are very large and far exceed more initial costs for taking safeguards and making investments in advanced technologies and approving and respecting standards ISO standards included (Aggarwal.2009).

The need to protect individuals, families, businesses and governments is a basic requirement that all operators want, but not all of these operators are directly involved in this issue. Mainly directly involved in this issue are governments and through them law enforcement agencies and public agencies providing IT and ICT products and services as well as private IT and ICT operators, which in fact doesn't have any knowledge about ISO standards in this field mostly. This brings difficulties in promoting the activity of businesses in the sector of electronics, internet and online services (Ekundayo & Ekundayo. 2009).

Carrying out grafting on investments in cybercrime protection technologies has resulted in more cost and less effectiveness, compared to making solid and one-of-a-kind investments that result in lower costs, combined with the application of international standards in this field, ISO standards included.

3. Related works to higher education institutions connected with cyber security issues

Recently due to the increase in the number of cybercrime worldwide, regardless of the level of development of countries. This has attracted the attention of many specialists in various fields who have noticed that one of the ways to reduce the number of cybercrimes and cyber-attacks is to improve the quality of curricula, programs and syllabi in study programs in educational institutions. up.

Some of the works related to this issue are listed below:

A paper on the risk that higher education institutions themselves have due to cybercrime emphasizes the importance that these institutions themselves should pay to cyber security due to the violation of student data as one of the biggest sources of risk to higher education institutions. This was also observed in a survey of 154 higher education institutions, 40 of which reported that security aspects became much more important issues during the pandemic period.

The massive shift of the pandemic towards distance work and distance learning increased the risks of institutional security and privacy in many areas.

On the other hand, institutions should also be aware of how they are collecting and using student data, respecting transparent standards of data governance, as students expect their institutions to use their data ethically and accountable, but often do not understand how institutions use their personal data. With a focus on effective leadership and the implementation of technologies and practices to strengthen overall information security, higher education can emerge from the pandemic capable of managing cyber security risks that will undoubtedly continue to surface (Kelly. 2021).

In a book claiming that the technological revolution is not everything for universities, it is argued that the alleged technological revolution in education has not yielded the expected effectiveness and that

the modernization of education is more complex than the modernization of any other product and / or service and does not can be done overnight (Reich 2020)

Another study, which is directly related to the curriculum, syllabi and programs in this field, states that cyberattacks exploit a number of technological and social vulnerabilities to achieve a malicious target. The emergence of new and sophisticated Cyber Threats requires highly skilled operators with solid knowledge about concepts and technologies related to cyber security and cyber security, but this requires agile learning methods, in addition to a highly demanding training process limited by complexity internal technology and wide range of application areas. Although the existing Cyber Security and Cyber Security curricula cover a wide range of training topics and strategies, the content of these programs lacks a specific aspect, such as the depth of education / training and its connection to professional development (Santos & Pereira. 2017).

Another paper states that to address the issue of cyber security there is an urgent need for cyber security professionals with adequate motivation and skills to prevent, detect, respond to or even mitigate the effect of such threats. For this purpose, in recent years, several educational programs have been created both at the bachelor and master level, in parallel with a number of initiatives undertaken in the field of cyber security to assist in the framework of cyber security education by the subjects of administration. public. Due to the interdisciplinary (and sometimes multidisciplinary) nature of cyber security, educational institutions face many issues when designing a cyber security curriculum (Mouheb & Abbas. 2019).

Another paper notes that the cyber security curriculum has improved dramatically over the last decade, from a few years ago to several training courses, now in a comprehensive computer science program at the bachelor and / or master level, making cyber security be already involved in undergraduate programs in computer science, information systems, etc., and, further, in some specific programs for cyber security, but this is not enough. The broad field of cyber security requires more specialized education, because employers require graduates to contribute in their daily work to certain areas and not only in the field of information technology or cyber security (Amin. 2016).

Another paper states that the ability to prevent successful cyberattacks against a nation's critical infrastructure depends on the availability of a skilled and educated workforce, made possible by education systems that can build such capabilities. While it is possible to hire foreign nationals or transfer many operations, this is not a sustainable solution and raises other concerns.

The current literature provides strategic guidance for the development of a national cyber security workforce; however, there has been relatively little research to identify the factors responsible for hindering the development of cybersecurity education in developing economies. Based on the qualitative analysis of data from 28 semi-structured interviews with heads of education from thirteen Ecuadorian institutions of higher education, it has emerged that the challenges faced by local cybersecurity education include: cyber security skills, structural skills, social integration, economic resources and governance capacity (Catota, Morgan, Sicker. 2019)

4. The core of manuscript

Cyber security risks are increasing in number and becoming more and more complex. This requires the public and private sectors to respond quickly, accurately and consistently to meet their strategic, operational vision, mission and objectives.

The pandemic period further encouraged the use of computers, laptops, smartphones, tablets, etc., such as those that are the individual and collective property of various entities such as individuals, families, businesses and government

In this context, public and private entities should take measures to ensure that their work is in line with the use of best cyber security practices.

However, it seems that in higher education things are not moving at the same pace to provide this response to cybercrime. This is not just about modernizing education in the technological field but about improving the curricula and syllabi of subjects related to cyber security, cybercrime legislation and field standards, including some of the ISO standards.

Although in some of the higher education institutions in Albania there are existing curricula and syllabi related to cybercrime, it seems that students studying in the fields of IT, law, economics, engineering, do not have interdisciplinary knowledge about this issue.

Although the existing Cyber Security curricula and syllabi cover many different topics, they lack interdisciplinarity.

Law students study the aspect of cybercrime only in relation to the Criminal Code, the investigation of cybercrime, the types of punishments, the extent of punishments given in such cases, without obtaining any knowledge about IT protocols and related ISO standards with cybercrime.

Students pursuing studies in the field of IT receive only information about IT protocols and receive no information about the legal aspects of cybercrime and nothing about ISO standards related to cybercrime.

Students of the faculties of economics and engineering, in the course Management (Total) Quality learn about ISO standards in general at best in one or two lectures, but learn almost nothing about specific standards against cybercrime and on the other hand do not receive no information regarding the legal aspects of cybercrime and IT protocols.

But, after all, in the labour market, mainly in the professions IT, lawyer, economist, engineer, etc., requires interdisciplinary skills, knowledge and competencies related to cybercrime and not just skills, knowledge and competencies, related only to the narrow field of study that these students have completed.

This requires the provision of curricula and syllabi that integrate aspects of IT protocols, cybercrime legislation and ISO standards related to cybercrime.

5. Analyzing situation related to curricula and syllabuses of cyber security, cyber law and quality management in higher university institutions in Albania.

There has been a real revolution in higher education in Albania, mainly in the field of information technology, a field in which before 1990 - 2000 there was no development that went hand in hand with developments in the international arena.

In the higher education in the country in the period 1990 - 2000 a lot of good work has been done in terms of improving the curricula and programs of special subjects mainly in the field of economics and justice, due to the intention to adapt studies in these fields. with the conditions of the market economy, when previously in these areas the view of the centralized economy and justice within the dictatorship of the proletariat prevailed.

Even in the engineering study curricula and programs a significant improvement was made to adapt the skills, knowledge and competencies of the students to those required by the labor market, given that the principles of these sciences are the same all over the world, regardless of systems.

Specifically, in 2006 with the opening for the first time of private higher education institutions in their programs and curricula, in the faculties of economics, the subject of Quality Management in bachelor and Total Quality Management was introduced for the first time in master (University College "Qiriazi") and further in some other HEIs also the course Management of operations and industrial quality in bachelor (Ismail Qemali University, Vlora), Total quality management in master (University "Aleksandër Xhuvani", Elbasan), Quality Management in Bachelor and Total Quality Management in Master (Professional Business Academy), Quality Management in Bachelor and Total Quality Management in Master (University College "Wisdom"), etc.

Then, over the years and with the emergence of cybercrime issues, in some HEIs, mainly private in the faculties and study programs in the field of information technologies, special subjects for cybercrime were introduced, courses were offered cybercrime training for students and professionals (Canadian Institute of Technology).

In parallel, in some private HEIs in the faculties of law were introduced in special subjects such as Criminal Law, etc., the concepts of cybercrime and then the module "Practical methods of detecting criminal offenses" in the course Practical methods of detecting criminal offenses, (Faculty of Law, University of Tirana, Integrated Program in Law, (Curriculum 2020 - 2021) and a program entitled "Integrated expert in the field of cybercrime (University College" Luarasi (curriculum 2020 - 2021) ".

Even in HEIs that have faculties of information technology in both bachelor and master programs are introduced courses of cyber security profile (Canadian Institute of Technology, University College "Luarasi")

However, in all cases, it appears that:
• Curricula, programs and syllabi of IT faculties do not contain information on aspects of legislation in the field of cybercrime and information related to ISO standards related to cyber security.
• Curricula, programs and syllabi of law schools do not contain information on aspects of IT protocols and information related to ISO standards related to cyber security.
• Curricula, programs and syllabi of the faculties of economics and engineering do not contain information on IT protocols and legislation in the field of cybercrime.

6. Authors contribution

This paper addresses for the first time aspects of curriculum improvement and syllabi of study programs and courses which are directly related to cybercrime, in higher education institutions in Albania, aiming to make these curricula and syllabi acquire a more interdisciplinary nature, including in the study programs of the faculties of IT, law, economics and engineering, in combination with information on IT protocols, cybercrime legislation and ISO standards related to cybercrime.
As the labour market requires a workforce equipped with skills, knowledge and competencies appropriate to the latest developments in public and private organizations, which have as one of their main objectives, security, in general, and security against cybercrime, in particular.

7. Recommendations:

1. Cybercrime and the phenomena that accompany this activity are challenges facing operators in the market, challenges that require appropriate response, for high and complete cyber security.
2. Cybercrime has an international nature, but it is very important that in each country, the responsible bodies create a complete picture of cybercrime phenomena, including descriptions of the crimes committed, aiming at explanations for the most common criminal offenses in the field of cybercrime such as hacking, identity theft, denial of service, cyber attacks, etc.
3. Clarification of issues of investigation and prosecution of these crimes, and analysis of different legal approaches regarding substantive criminal law, procedural law, digital evidence, international cooperation and responsibilities of Internet service providers, including issues of best practices, affect the fair resolution of these criminal offenses.
4. For developing countries, it is necessary and indispensable to pursue the international cyber security agenda, which requires (1) the development of national strategies for the development of cybercrime legislation, applicable and interoperable globally, (2) the establishment of infrastructure and (3) the appropriate legal framework and international standards, ISO standards included, as integral components of a cyber security strategy.
5. Higher education institutions in Albania in the field of IT, law, engineering and economy, have to work hard to prepare programs, curricula and syllabi in the field of IT protocols, cyber security, quality management, in IT, law, economic and engineering faculties and programs to offer interdisciplinary disciplines and modules where

skills, knowledge and competencies related to cybersecurity, cybercrime, cyber law, quality management and especially ISO standards related to cybersecurity should have been integrated.

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AN EMPIRICAL EXAMINATION OF BANK DEPOSIT RATE: THE CASE OF WESTERN BALKANS

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Abstract

The banking system is one of the most important parts of the economy of a nation. It must be a well-developed and based in lawful rules in order to generate trust to the citizens. Based on the trust it raises, households interact in different ways; including having loans, depositing their savings, making transfers etc. The main purpose of this paper is to study the impact of various factors on the average rate of the savings that citizens deposit on the commercial banks, known as deposit rate for Western Balkan countries involving Albania, Kosovo, Bosnia and Herzegovina, Serbia, North Macedonia and Montenegro, which have almost similar historical developments and economic trends during the decades. Here we will carefully study the impact of three different aspects including macroeconomic, bank specific and demographic factors. To achieve this objective, an empirical study is done where the data set is defined as panel data. The model includes five independent variables; population growth, inflation rate, non-performing loans, liquidity ratio and GDP per capita. The data is taken for the 6 countries mentioned for the years starting from 2010 to 2017. The results of this paper conclude that population growth, GDP per capita and liquidity rate are the main determinants of the dependent variable, which is deposit rate. In addition, the analysis points out that the variable with the highest impact on the dependent variable is population growth. In addition, all of the variables have a direct relationship with deposit rate, except liquidity rate which has a negative impact. Moreover, non-performing loans and inflation rate have no effect on deposit rate.

Keywords: *Western Balkans, deposit rate, panel data, GDP per capita, liquidity and population growth.*

1. Main Text

A banking system is one of the main pillars of every country's economy. It plays an important role in economic growth and development. It has a crucial function to prosperity, new opportunities, new job vacancies and the overall welfare of the country. Thus, every citizen which believes in the way this system functions, carries various daily transactions in commercial banks such as; deposit funds, apply for loans, set up accounts according to our needs, use ATMs and much more (Banking System: Definition & Types, 2016).

As one of the ways the commercial banks can have an impact on the supply of the money is through deposits or loans (Tyler Lacome, 2019). A deposit is an important step for every citizen who has some amount of savings and is searching for safe and secure ways to have some benefits on their funds. A bank deposit can be defined as the process when the citizens trust their funds to a financial institution for a period of time and earn a percentage at the maturity date, for choosing this option compared to all the other options available in the market (Kagan, 2021). The percentage earned is known as deposit rate and plays an important role in the financial market (Gavurová et al., 2019). The interest margin is defined as the difference between the interest received and paid, and it accounts for a significant portion of the bank's earnings or in other words, it is the gap between the lending and deposit rate. This interest band has a high impact on the intermediation function of the banks.

Above said, the main purpose of this thesis is to develop a model, which examines the effect of potential indicators on Bank's deposit rate. As such, this research addresses the following research questions:
"To what extend are deposit rates, in Western Balkans, affected by microeconomic and macroeconomic variables?"

To answer the research question, the study will focus on the deposit rates of Albania, Kosovo, Montenegro, North Macedonia, Serbia, and Bosnia and Herzegovina. The reason why these countries are chosen is because their economic traits and historical events are very alike. Moreover, another similarity is that these countries are not part of the European Union and joined the monetary and economic union. The period considered for this research is 2010-2017 (Douglas, 2008).

2. Literature Review

Since 1935, Fisher has published a writing called "The design of experiments" where he mentions the relation between growth rate and saving decisions. In his writing, he states that the level of savings alters by age, thus a difference in population will influence savings as well as interest rates of a market. Moreover, Fisher mentions that interest rates significantly impact the decision of consumers regarding the consumption and their request for funds. In addition, in a research by Park and Peristani (1998), it was stated that GDP per capita and deposit rates have an adverse relation.

In contrast, deposit rate and inflation are most likely to have a positive correlation. This relation derives since it will be necessary for banks to raise deposit rates in order to encourage citizens to trust their funds in financial institutions. In another article, Keynes and Hansen state that a declining population is connected with a decline in consumer spending. The result will be a rise of saving rates and consequently a rise in deposit supply. Overall, they conclude that there is a direct correlation between population growth and deposit rates, since more supply lowers the price. Consequently, a rise in deposit supply lowers the deposit rates.

Additionally, in a study by Berument called "The impact of inflation uncertainty on interest rates in the UK" Inflation and GDP per capita were examined as two of the most essential macroeconomic metrics considered in their research. Every one of them yields the same result. Economic growth, as measured by GDP per capita, is predicted to have an adverse impact on deposit rates, as there will be higher demand for deposits from households.

Furthermore, Masahiro, Yasuaki, & Keiko (2009) and Murata & Hori (2006) state that deposit rate has a positive relation to bank risk in their research. Based on their results, citizens may be concerned about the safety of their savings, and will only incur the risk if the return is substantial. This means, for risky investments, financial institutions should offer higher rates as a return to cover the opportunity cost of investing in a safer alternative. McDermott (2013), in one of his speeches, noted that the reason behind the natural interest rate lowering is the drop-in population growth rates. Based on his research, slower population growth is converted to a smaller labor force, requiring less investment to employ the average worker. Meanwhile, a decrease in investment is converted to decreased interest.

In 2014, there was an argument by Sebastian Westie which suggests that a combination of decreasing and perhaps negative equilibrium real interest rates and a zero lower bound on nominal rates might make full employment hard to achieve. A substantially lower rate of interest is thought to be triggered by reduced population growth (Westie, 2019). Another study shows that the non-performing loans ratio appears to have a direct impact on deposit rates. In their research it is stated that the key explanation for this is that raising this percentage raises the bank's risk and the risk of default (Ojeaga, Paul & Odejimi, Omosefe, 2013). In a study of FK, Salami in 2018, the deposit rate was used as a key indicator of economic market and activity in his research. He looks into the significance of interest rates for the market and underlines the logical reasons for conducting more research in this field. According to Patton, deposit rates have an impact on the economy's level of saving and investment, and also the borrowing costs. The condition of a bank's liquidity is calculated as the financial institutions net excess reserves (NER) with the central bank. Banks' liquidity is a fundamental factor for implementing an effective monetary policy: to have the short-term rates under control and having a significant impact on other rates (Faure, Alexander Pierre, 2014).

Bikker investigates the effects of bank details on deposit rates in his work known as "Determinants of Interest Rates on Time Deposits and Savings

Accounts: Macro Factors, Bank Risk, and Account Features" (2017). Liquidity is expected to have a negative effect on deposit rates, based on his research. Because it has enough cash to deal with short-term liabilities, a liquid bank does not find it necessary to raise rates to entice new depositors. Furthermore, a liquid bank boosts citizens' trust in putting their funds there.

In a research named "Population growth and savings rates: Some new cross-country estimates", (Christopher, 2005) analyzes the movements of population rates and the interest rate trend. To conclude, the research states a rising age of a nation because of a decline in the population growth will cause a raise in savings and loans as well as a decrease in natural rate of interest. Therefore, this will be translated to a decrease of deposit rate.

3. Methodology

Deposit rates are determined by a multitude of elements. In this thesis we are going to study a few of them that we believe are the most important and have the highest effect. The variables considered are inflation, non-performing loans, GDP per capita, population growth and liquidity rate. We will define each variable in this part, as well as the projected influence they will have on our dependent variable. In our study we will carry a multiple regression analysis of panel data for six nations of Western Balkans for the years 2010 to 2017 included in this study. Albania, Kosovo, Bosnia and Herzegovina, North Macedonia, Montenegro, and Serbia are the countries studied. Data was acquired from reliable references, such as, the World Bank, International Monetary Fund, National Bank of Albania, and the Central Bank of Serbia and the Central banks of each of the countries involved. EViews is the statistical platform used to complete econometric analysis where you can easily manage your data, run model simulations, make predictions as well as generate high quality tables and graphs for publication or inclusion in other applications.

3.1. Model Specification

To analyze the relationship among the dependent variable of Deposit rate and the five independent variables; inflation rate, liquidity rate, population growth, non-performing loans and GDP per capita we will conduct various tests including unit root, Heteroskedasticity, Multicollinearity, normality test etc. to make sure that our model satisfies all the determined statistical assumptions to derive conclusions.

Dep rate=f (inflation, NPL rate, liquidity rate, GDP per capita, pop growth)

In this paper, our research question is broken down into the following hypotheses:

H1: GDP per capita is expected to have a negative impact on Deposit rate

H2: inflation is expected to have a positive impact on Deposit rate

H3: Liquidity rate is expected to have a negative impact on Deposit rate

H4: Non-performing loan is expected to have a positive impact on Deposit rate

H5: Population growth rate is expected to have a positive impact on Deposit rate.

4. Empirical Findings

In this section we will see if all assumptions are accomplished and the determinants of the regression model in this statistical analysis are significant enough to provide necessary information regarding the deposit rate. The confidence level used as a benchmark through this research will be 5 percent. It is significant to emphasize that the regression is linear, which satisfies the assumption of the linearity of the regression.

4.1. Unit Root

The evidence taken by the tests using Dickey-Fuller unit root displayed that the non-stationarity problem is present for all variables. The next step we take to solve this issue is to transform all the variables into growth rate by taking the difference of one period before. In models will low observation this method may be an issue as we loss at least one observation but in our case the number of observations is enough huge not to concern about this issue.

The following is the hypothesis that will be tested:

Null hypothesis: Variables are not stationary

Alternative: Variables are stationary

The probability value must be lower than 0.05 so that we can reject the null hypothesis and state that the variables in our model are stationary as we would like them to be in order to have a proper model. The ADF test is used to test the stationary. One by one, the variables will be evaluated.

Table 1: Unit root test for deposit rate

Method	Statistic	Prob.**
ADF - Fisher Chi-square	21.8284	0.0395
ADF - Choi Z-stat	-1.47254	0.0704

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

The probability value is 0.0395 so less than 0.05. So, we can conclude that we reject the null hypothesis and that the deposit rate is stationary. The similar step will be followed for all variables. The results are the following:

Table 2: Unit root test for GDP per capita

Method	Statistic	Prob.**
ADF - Fisher Chi-square	20.8543	0.0105
ADF - Choi Z-stat	-1.3781	0.0421

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Table 3: Unit root test for inflation rate

Method	Statistic	Prob.**
ADF - Fisher Chi-square	23.6742	0.0116
ADF - Choi Z-stat	-1.3682	0.0358

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Table 4: Unit root test for liquidity rate

Method	Statistic	Prob.**
ADF - Fisher Chi-square	25.7642	0.0008
ADF - Choi Z-stat	-1.5681	0.0297

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Table 5: Unit root test for NPLs

Method	Statistic	Prob.**
ADF - Fisher Chi-square	16.3952	0.9912
ADF - Choi Z-stat	1.6983	0.8542

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Table 6: Unit root test for population growth

Method	Statistic	Prob.**
ADF - Fisher Chi-square	19.6795	0.00001
ADF - Choi Z-stat	-1.5736	0.00016

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

We notice that from five variables only the NPL rate is not stationary with a value of 0.9912 which is higher than the benchmark of 0.05. Meanwhile, the other variables are stationary. However, after integrating the variable in the first difference and since in this case it appears stationary with a p-value of 0.0234 we continue to run the regression, after we confirm that all the variables are stationary.

The Hausman test is also known and referred to by statisticians as a model misspecification test. The Hausman test allows to decide whether to choose a fixed effects model or a random effect one, in panel data analysis (data analysis across time for different entities). The best option is random effects, according to the null hypothesis; the alternative hypothesis is fixed effects, according to the alternate hypothesis. (Stephanie, 2020).

The following is the hypothesis that will be tested:
Null hypothesis: Random effects model is appropriate
Alternative hypothesis: Fixed effects model is appropriate

When the required modifications are done, the amount of cross sections is 6, which is the same as the number of independent variables. As a result, we cannot utilize random effect estimates or perform the Hausman Test.

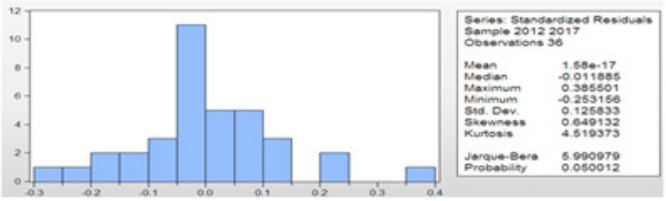
4.2. Normality test

We constructed the residual series just for the independent variables to check for the error-normality terms. The following is the hypothesis that will be tested:

Null hypothesis: Residuals are normally distributed
Alternative hypothesis: Residuals are not normally distributed

Jarque-probability Bera's value is 0.050012, which is slightly more than 0.05. As a result, we will be unable to reject the null hypothesis and will infer that the residuals are normally distributed. However, because the sample size is more than 30, even if the residuals are not normally distributed, this will not be an issue.

Figure 1: Normality test



4.3. Heteroscedasticity Test

The White test will be done using EViews statistical software to see if the assumption of homoscedasticity is met. The following is the hypothesis that will be tested:

Null hypothesis: Variance of the error term is constant (Homoskedastic)

Alternative hypothesis: Variance of the error term is not constant (Heteroskedastic)

The white test used to identify whether the model is homoscedastic or not provided enough evidence to not reject the null hypothesis, showing that the variance of the error term is the same. The result of the F- statistic test showed that the probability is 0.1352 and is more than the significance value of 0.05 applied throughout all this study (0.1352>0.05). The White test concluded that the model is homoscedastic.

Table 7: Heteroscedasticity test

Dependent Variable: RESID01^2
Method: Panel Least Squares
Sample (adjusted): 2012 2017
Periods included: 6
Cross-sections included: 6
Total panel (balanced) observations: 3(

Variable	Coefficient
DEPOSIT_RATE	-0.300102
GDP_PER_CAPITA	0.000802
LIQUIDITY_RATE	-0.002928
POP_GROWTH	0.135808
NPL_RATE	0.018812
INFLATION	0.027668
DEPOSIT_RATE(-2)	-0.015956
C	-3.234812
	Effects Spe
Cross-section fixed (dummy variables)	
Period fixed (dummy variables)	
R-squared	0.695988
Adjusted R-squared	0.408865
S.E. of regression	0.133100
Sum squared resid	0.318881
Log likelihood	33.99445
F-statistic	2.424011
Prob(F-statistic)	0.135250

4.4. Residuals analysis

The following tests are used in this part to establish the absence of heteroscedasticity and serial correlation, in order to approve and trust the regression model's results. The tests show whether the residuals contain any systematic information that could have a major impact on the explanation of the dependent variable but isn't involved in the regression model.

4.5. Auto correlation

The degree of correlation of the same variables between two successive time intervals is referred to as autocorrelation, or as also referred to as serial correlation. The autocorrelation value varies from -1 to 1. Negative autocorrelation is defined as a number between -1 and 0. Positive autocorrelation is defined as a value between 0 and 1. Autocorrelation can be beneficial in technical analysis for the equity market because it provides information about the trend of a set of historical data. Durbin Watson's value in the equation estimate output is 1.879, which is near to 2. This indicates that our model is free of autocorrelation.

4.6. Multicollinearity

Explanatory factors in a numerous econometric regression in some cases can be tightly related to one another, implying that one independent variable can be predicted by another independent variable involved in the regression. This behavior can forecast an incorrect estimator, lowering the total accuracy of the regression significantly. In cases When multicollinearity is detected, the standard error of the coefficients has the tendency to increase, and slight changes in the data found can sometimes amplify the results or change the sign of the coefficients in the model. It is critical to emphasize that the regression model's findings are used in other studies to solve or examine the effect of other economic or social concerns. As a conclusion, imprecise coefficient values might result in incorrect or divergent conclusions, causing responsible people to make poor decisions. Our research paper has a model with five independent variables. Thus, the chances of facing multicollinearity is higher. However, this problem was not part of our model since the results showed that there is no variable which is higher than the benchmark of 0.8. In this way, we can state that there is no multicollinearity in our econometric regression model. Therefore, the null hypothesis which states that there is no multicollinearity cannot be rejected. We can conclude that also this assumption is satisfied.

Table 8: Multicollinearity test

Correlation					
	GDP_PER_...	LIQUIDITY_...	NPL_RATE	POP_GROW...	INFLATION
GDP_PER_...	1.000000	-0.245057	0.400358	-0.175093	0.131859
LIQUIDITY_...	-0.245057	1.000000	-0.436740	0.398230	0.259860
NPL_RATE	0.400358	-0.436740	1.000000	-0.394418	0.193860
POP_GROW...	-0.175093	0.398230	-0.394418	1.000000	0.093429
INFLATION	0.131859	0.259860	0.193860	0.093429	1.000000

4.7. Cross sections dependence test

Cross section dependence can be caused by unobserved (or unobservable) common causes, or it can be caused by spatial or spillover effects. This challenge has been the subject of a lot of recent study on non-stationary panel data. The first-generation panel unit root and co-integration tests were clearly visible.

Null hypothesis: No cross sections correlation in residuals

Alternative hypothesis: There is cross section correlation in residuals

The probability value of Breusch Pagan Ml is equal to 0.2675 which is bigger than 0.05. Thus, we conclude that we do not reject the null hypothesis and conclude there is no serial correlation between residuals. Based on the test results, we can state that all of the economic assumptions predetermined and globally accepted are met and that our econometric model can provide valid estimators. BLUE estimations can be obtained correctly using our model. It has a high degree of precision in measuring the impact of each macroeconomic, demographic and bank features variable examined in this study on the deposit rate.

Table 9: Cross section dependence test

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 6
Cross-sections included: 6
Total panel observations: 36
Cross-section effects were removed during estimation

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	17.90782	15	0.2675
Pesaran scaled LM	-0.564553		0.5724
Bias-corrected scaled LM	-1.164553		0.2442
Pesaran CD	-1.713671		0.0866

Dependent Variable: DEPOSIT_RATE
Method: Panel Least Squares
Sample (adjusted): 2012 2017
Periods included: 6
Cross-sections included: 6
Total panel (balanced) observations: 36

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP_PER_CAPITA	0.002418	0.000456	5.297258	0.0000
LIQUIDITY_RATE	-0.014997	0.005970	-2.511987	0.0212
POP_GROWTH	0.824265	0.306705	2.687484	0.0146
NPL_RATE	0.096791	0.075687	1.278836	0.2164
INFLATION	0.070309	0.098835	0.711384	0.4855
DEPOSIT_RATE(-2)	0.126375	0.137834	0.916863	0.3707
C	-10.68817	2.476509	-4.315822	0.0004

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.971299	Mean dependent var	3.112557
Adjusted R-squared	0.947129	S.D. dependent var	1.888941
S.E. of regression	0.434338	Akaike info criterion	1.475378
Sum squared resid	3.584343	Schwarz criterion	2.223151
Log likelihood	-9.556800	Hannan-Quinn criter.	1.736371
F-statistic	40.18665	Durbin-Watson stat	1.879283
Prob(F-statistic)	0.000000		

The values for the p-value test must be lower than the benchmark of 5% in order to have significant variables in our model.

• The value of probability of GDP per capita is 0.000 which is smaller than 0.05 so we reject the null hypothesis. This means that GDP per capita is significant at 5% significance level and has a positive impact. Meanwhile from the previous studies, we were expecting a negative impact. This may be explained, since during the period studied, GDP per capita has high values for all the countries. For instance, a GDP per capita level, means that citizens will be more willing and able to make investments. Therefore, an increase in GDP per capita will also increase deposit rates, so that the banks can attract more citizens to trust their funds on them and no other options available.

• The value of probability for Inflation rate is 0.4855 which is bigger than 0.05 so we do not reject the null hypothesis and conclude that inflation is not significant at the 5% significance level. It seems that inflation is not a significant as we thought it could be to deposit rate. A reason for this may be the fact that except Serbia, the other countries do not show drastic fluctuations in inflation rate during the period studied.

• The value of probability for Liquidity rate is equal to 0.0212 which is less than 0.05 so we reject the null hypothesis and conclude that liquidity rate is significant at 5% significance level and has a negative impact.

• The value of probability of Non-performing rate is equal to 0.2164 which is bigger than 0.05 so we fail to reject the null hypothesis and conclude that NPL rate is not significant at 5% significance level. In contrary of what we expected, non-performing rate is not significant for the deposit rate. Maybe because the fact that the debtor did not make the payment at the determined time does not affect the deposit rate directly and does not impact as much so that the policy makers make changes on the rate of deposit because of this factor, even though it has a positive effect.

• The value of probability for Population growth is equal to 0.0146 which is smaller than 0.05 so we reject the null hypothesis and conclude that Population growth rate is significant at 5% significance level and has a positive impact as it was expected.

• The value of probability for Deposit rate is equal to 0.3707 which is bigger than 0.05 so we

fail to reject the null hypothesis and conclude that the Deposit rate (-2) is not significant at 5% significance level.

4.9. Coefficient Interpretation

The Coefficient of GDP per capita is 0.0024 which means that for one unit increase in Deposit rate, it will have a direct impact on GDP per capita, which will increase by 0.0024 units, ceteris paribus.
The coefficient of Liquidity rate is -0.0149, which means that for one unit increase in Deposit rate, it will have a negative impact on liquidity rate, which will cause a decrease of 0.0149 units, ceteris paribus.
The Coefficient of population growth is 0.8242 which means that for one unit increase in Deposit rate, it will have a direct impact on population growth, which will increase by 0.8242 units, ceteris paribus.
Thus, we can conclude that the only negative relationship in this model is between deposit rate and liquidity rate. The other variables, as supported by different literature reviews, have a positive and direct relationship, ceteris paribus.

5. Conclusions

The purpose of this research paper is to have a clear picture of the factors which have a significant effect on the deposit rates for the Western Balkans countries for the period 2010-2017. Overall, the tests confirm that our research is a good model since it satisfies all the econometric assumptions. The analysis is conducted in three perspectives including: macroeconomic, demographic and bank features. In addition, each factor is analyzed carefully to have a better understanding of each country's conditions. After giving an overall view for each variable and detailed analysis the following conclusions are derived:

The above-mentioned perspectives are all significant to the deposit rate, which is the dependent variable. Consequently, none of these perspectives can be neglected if it is necessary to study the deposit rate on all of the dimensions it involves. Moreover, from the econometric analysis we notice that the population growth rate is the variable with the highest influence out of all the factors considered. This means that the demographic feature has a higher impact on further changes that may happen to deposit rate compared to macroeconomic and bank features, even though it is a factor whose significance in the economic factors is discovered and involved during the last years in empirical analysis.

In addition, GDP per capita is the variable with the highest statistical influence in our model at all the confidence levels considered. On the contrary, NPL and inflation are two variables that are not considered as having a significant impact on deposit rate according to the empirical analysis. So, we can conclude that these two factors do not have a high influence on the rates of Western Balkans countries. Moreover, four out of five variables part of this empirical analysis have a positive impact on the deposit rate, which means if an increase or decrease happens to them, it will directly affect the deposit rate. On the other hand, the fifth variable, which is the liquidity rate, has a negative effect on the deposit rate.

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THE MAIN FACTORS AFFECTING CREDIT CARD USE IN ALBANIA-THE CASE OF TIRANA

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Abstract

Considering the importance of debt in the economy, this study aims to find out the main factors that indicate the changes in credit card usage in Albania. Moreover, the research is focused on answering the questions regarding the attitude of cardholders and non-cardholders in particular after Covid-19 pandemic. Firstly, specific data have been taken from the Bank of Albania and the information was used to release the position of credit cards in Albania in recent years, by illustrating the total number of credit card payments and the number of issued and active credit cards in years. After that, a survey was conducted through an online questionnaire and personal interviews in order to have a clear picture of the current use of credit cards in Tirana. Data collected and analyzed points out that the majority of citizens have knowledge about credit cards. It is indicated that education and level of income are the main factors that affect credit card usage. The pandemic situation affected also the behavior of customers, making them buy more often with credit cards. The data show that the biggest advantage regarding credit cards is that they are a very practical payment method. However, financial institutions should create other eligibility criteria that could be met by a wider proportion of the population and also they should be more informative. As this research paper is related only to people who live in Tirana, further study is needed to cover other regions of Albania as well.

Keywords: *Credit card, Covid-19, usage, frequency, customer satisfaction*

1. Introduction

1.1 Background

According to Cambridge Dictionary (2021), a credit card is a small plastic card that is issued by the bank and can be used as a method of payment. It allows the cardholder to obtain funds from a credit institution at a rate of interest up to a certain maximum. Instead of the account holder's cash deposits, charges are made against a line of credit. Failure to pay off the debt on time could result in interest charges and late fees. Almost every credit card also comes with a rewards program, in which account users earn points for every amount spent. The first idea about the credit card is given by the author Edward Bellamy in the book "Looking Backward" which was published in 1888. The concept of applying for payment with credit cards began in the U.S. during the 1920s. In 1950, the Diners' Club, Inc. launched the first standardized credit card, which could be accepted by many different establishments. Later in 1970, following the example of Bank of America, a number of financial firms merged the capital to form an Internal Bank Card Association network which is today known as MasterCard.

Electronic payments in Albania's banking system became a component of the banking market only after 2003. This means that Albania can still be considered in the development stages of easily using these electronic payments. Despite an upward trend in credit card usage over the years, the Albanian banking sector is still lagging behind other markets in the Western Balkan countries. This is one of the reasons why the Albanian banking sector lacks advanced credit card application approval systems.

1.2 Relevance and objectives

The main purpose of this research study is to analyze the current conditions of the credit card market in Albania, and find out the factors that lead to an increase in credit card usage and frequency. It will be focused more on the current perceptions and opinions of Albanian citizens with regard to credit cards. The reason behind choosing this topic relates to many factors: firstly credit

cards may be useful for earning rewards, traveling, dealing with unexpected costs, and building a good credit history, secondly by providing businesses with a guaranteed method of payment and customers with a way to bridge the gap between paychecks in times of emergency, credit cards may play an important role in the cycle of increased consumption and production, thirdly to identify what can be done further to increase the number of credit card users in Albania.

2. Literature Review

2.1 Importance of credit cards in economy

Credit and the absence of cash, have become essential to the modern economy, so businesses all around the world rely on credit to pay and receive payments. It also enables people to spend more, which raise the economy's revenue levels. Meanwhile credit cards and electronic payments, on the other hand, make operating trade in a worldwide market a lot easier. This convenience increases long-distance transactions, which boosts GDP and consumption, both of which result in job creation. The increased use of credit contributes to economic growth by reducing transaction costs, increasing transparency, and increasing productivity. For this reason, credit cards are in fact a significant component of household and global activity. The reward system is a significant element in pushing customers to use credit cards against cash and debit cards. In the research paper of Doyle (2018), was reported that as a result of reward programs 40% of credit card holders, mostly high-income consumers, had credit card benefits, while 30% of credit card users, mostly low-income customers, faced expenses because they mainly used credit cards just to borrow. According to Turan (2013) it was determined that there is a positive association between the income level and the credit cards ownership by individuals and businesses. The results also show that the usage of credit cards was at very low rates in Albania at that time.

2.2 The effect of pandemic Covid-19 on the usage of credit cards

The Covid-19 pandemic has made society more hygiene-conscious, and it appears to have influenced people's preferences for cards versus cash. The volume of cash being used in the UK dropped by up to 60% in 2020 while in the US, 28% of people stopped using cash altogether. On the other hand, credit card usage worldwide increased during the pandemic, especially when compared to cash.

Despite the coronavirus outbreak, Americans are using their credit cards daily. Referring to a recent survey by Money and Morning Consult (2020) around 70% of Americans indicated they had no intentions to cancel or deactivate an existing credit card. When it comes to food and self-care products, 29% of credit card users say they're using their cards more than they were before the pandemic.

3. Descriptive Statistics

3.1 Credit Card Market in Albania

At the beginning of 2005, credit cards were still considered an innovation for the majority of the population in Albania. In fact, as a low-income country on average, customers initially felt skeptical about its use.

According to the Bank of Albania, there are currently a total of 12 banks that operate in the banking system of Albania. That is the same number of banks that were in 2019. All the banks operating in the Republic of Albania are licensed as card issuers, while 7 of them are also licensed as card acceptors. This means that cash can be taken from banks using credit cards. The services provided by these banks resulted in a significant increase in the number of POS, representing an 8.5% improvement in the usage of POS compared to 2019. Despite the positive trend in the number of POS terminals being added, their concentration is mostly in Tirana region, at 88.5%.

3.2 Payment made with credit card in years

The total number of credit card purchases in Albania exceeded two million in 2019, a figure that doubles the sum of purchases accomplished in 2015. As a small county still in development, the usage of credit cards in Albania is not at very high levels compared to other countries. According again to the Bank of Albania, the banking system has used technology efficiently, enabling the provision of new and modern electronic payment systems.

4. Methodology

In this research paper cross-sectional analysis of data is conducted, in order to have a clear view of characteristics that exist in the community and to see at what levels is the usage of credit cards, in order to identify which factors mostly affect the usage of credit cards in Albania. This study will be focused more on the analysis of the current position of the credit card market in Albania by taking into consideration some indicators and also the perceptions and opinions of the individuals and that are or not credit cardholders.

4.1 Research Question

This study is going to give responses to the following questions: Which are the main factors that affect the increase of credit card usage in Albania? How Covid-19 has changed the consumer behaviour with respect to credit card use?

4.2 Research Design

Both secondary and primary data are used for this research study. The previous chapter covered secondary data analysis, also known as a literature review. We started our secondary data exploration with research generated by numerous studies, papers, and articles, and then moved on to several documents and reports released by well-known and acknowledged national and worldwide institutions and organizations. All of the secondary data that was collected and evaluated helped to generate a set of questions that was used to guide the study design.

Furthermore, we based our primary data collecting on surveying to make some measures and gather useful and reliable information, as well as establishing a communication approach. We constructed a questionnaire with some well-chosen questions that yielded information that otherwise would be very hard to collect and would take much more effort. We made use of computer-assisted questionnaire through google forms, an interview technique with computer-sequenced questions capable of employing visualization and also by face to face expert interviews. The great strength of the survey, as a method to collect primary data, was its versatility. Because the survey creates a better pattern for the current situation and attitudes of Albanians about credit cards, this flexibility is important. The chosen period was July 2021. The study's major focus is on evaluating the data collected, in which many factors that may indicate credit card usage were examined one by one and then combined to evaluate what effect they have on it. We attempted to explain the link between the factors and the patterns that were created, as well as to arrive at certain conclusions and generalizations.

4.2.1 Target Population

The target population for this research is located in Tirana, Albania. Since Tirana is the largest city in Albania and most importantly the country's major economic, social, and cultural center, the study is concentrated in this city as the results are more significant.

4.2.2 Sampling Design

The research sampling method chosen to be used in this research is random sampling, in order to increase the efficiency. All of the participants live in Tirana, and they are all individuals who may or may not have credit cards.

In order to come up to the conclusions quantitative and qualitative data is gathered and analyzed. The sample size is 130. All the participants in the survey reveal representative information considering the attitude they have toward the credit cards. It was also explained to all participants the necessary terms of privacy before they completed the questionnaire, and it was guaranteed their anonymity.

4.2.3 Questionnaire

The questionnaire has been prepared and was available for the respondents on a web-based. For the construction of the web-based questionnaire, it is used platform of Google Forms. The platform used preserves all the privacy conditions and gives access to the information only to the researcher that constructed the questionnaire. The channel used in order to send the online questionnaire to the participants is by e-mail and social media.

The overall questionnaire contains 32 questions. There are included both open-ended questions (in order to allow the participants to give short answers) and closed-ended ones. Most of the questions are closed-ended with multiple choice

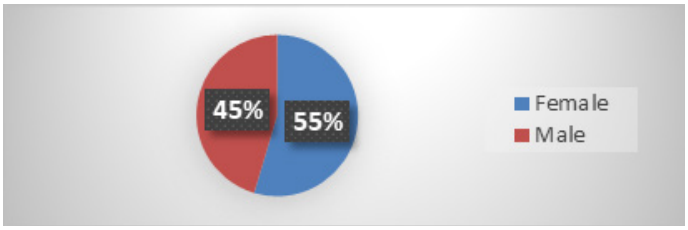
(each question contains 2-6 alternatives). The participants were given the possibility to choose the alternative "other and specify" if their answers were not included in any of the listed alternatives. Most of the multiple-choice questions are created as a single response scale, but there are even some questions that allow the participants a have multiple responses. The close-ended questions are included on purpose because their responses make it easier to get significant results from the survey. Also, the dichotomous and discrete response strategy is used, to give the flexibility of response to the participants and lowering the error scale of responses.

5. Data analysis

5.1 Background of respondents

In the survey participated 130 respondents in total. All respondents that participated in this survey live in the capital city of Albania, Tirana. The following findings were obtained after processing and analyzing the collected information:

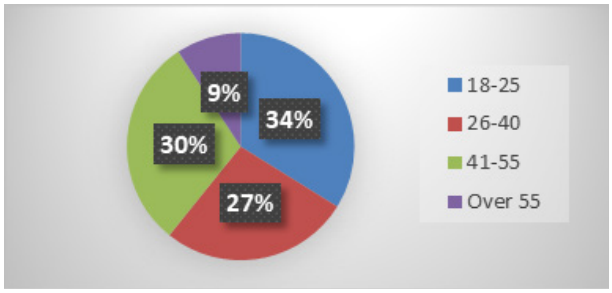
Chart 1: Gender of respondents



Source: Author's calculation

According to Chart 1, in this survey participated respectively 55% females and 45% males. The proportion between the two genders is almost balanced, which makes the data collected more reliable.

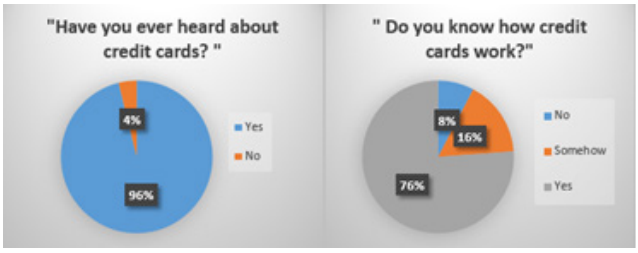
Chart 2: Age of respondents



Source: Author's calculation

Chart 2 shows that young people represent 34% of the survey, while people that are considered as the most appropriate category to fulfill the criteria of owning a credit card, all together, and represent 57%. Only a few elder people participated in this survey. Even though they are not the most representative category of people we still need to consider their attitude toward credit card usage.

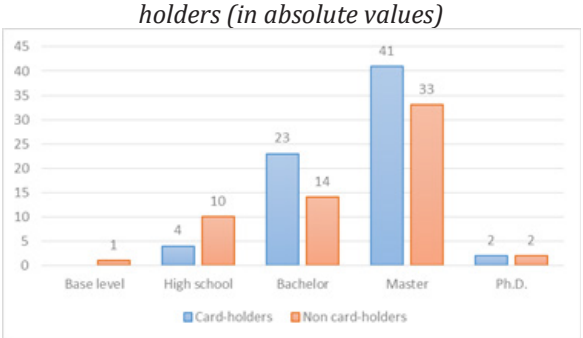
Chart 3: Knowledge about credit cards



Source: Author's calculation

It is clearly shown in Chart 3 that very few respondents have never heard about credit cards at all, so the majority of them have a general idea for at least what represents a credit card. When they were asked if they know exactly how credit cards work, some of the respondents said that they know somehow in general how it works, but not every specific aspect of its functions. Only a small category has no idea at all how a credit card works. But luckily there is no lack of information these days, and whoever makes just a small effort will find easily everything they need to know about credit cards. According to their further answers, only a small portion of people that don't know anything about credit cards didn't even intend to ask or find information about the benefits of using credit cards. This mentality of choosing only cash as a payment method continues to be present especially among elder people.

Chart 4: Education level of card-holders and non-card-holders (in absolute values)

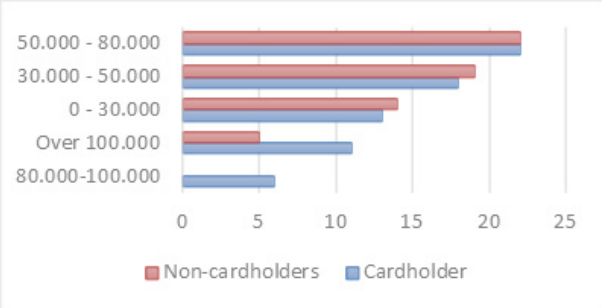


In terms of the level of education, the majority of respondents have a master's degree, specifically 74

of them. Meanwhile, 37 of them hold a bachelor's degree, 14 have finished high school, 4 have a Ph.D. degree and only 1 has the base level of education. As it is shown in Chart 4, there are no cardholders with the base level of education. In the category of people with a high school level of education, there are more people who do not use a credit card than those who do.

Meanwhile, in the category of people that have a bachelor's or master's degree, we notice that there are more cardholders than non-cardholders. For the Ph.D. level, there is the same number of people that hold/do not hold a credit card. Lifestyle is also an indicator of these results. We can understand that the higher the information that people get in many aspects of life, (which come in fact with a higher level of education) the higher is their usage of credit cards as a method of payment. They know better the benefits and choose to take advantage of them. Hence, the higher the level of education, the higher the usage of credit cards. So, it is obvious that education is a factor that indicates the usage of credit cards in Albania.

Chart 5: Income level (in absolute values)



Source: Author's calculation

Chart 5 shows how many respondents within a specific range of income use (or do not use) a credit card. There are only cardholders in the category of people that have an income within the range of 80.000 to 100.000 ALL. We notice that in the category of people who have a level of income over 100.000 ALL there are more cardholders than non-cardholders. At the two lower ranges of income, there are more non-cardholders than cardholders. Meanwhile, at a considerable high range of income (50.000 – 80.000 ALL), there is the same number of people who use and don't use a credit card. This means that people who have less income tend to use other payment methods rather than credit cards, while those people who have a higher level of income make use of them because they want to benefit from the bonuses and other rewards that the credit cards offer.

5.2 Effect of Covid-19 in the ownership of credit cards in Albania

The pandemic of 2020 affected almost every part of the economy and even the most important aspects of everyday life. It also affected how people make their purchases. There are 8 respondents that didn't have a credit card before the pandemic, but they currently use a credit card. Regarding the ownership of credit cards, almost all respondents say that in fact, the pandemic situation didn't affect their decision in owning a credit card, as is shown in Table 1. It is clear that the pandemic didn't urge the ownership of credit cards. For sure the pandemic affects the way people think about the purchases they make and how they manage their time shopping.

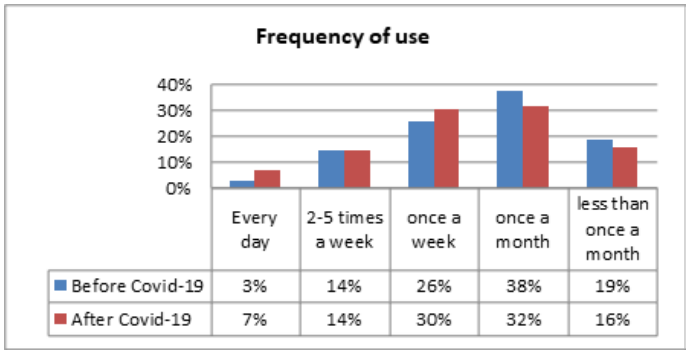
Table 1: Effect of Covid-19

	Yes	No
Did Covid-19 affect your decision to get a credit card?	**1**	**6**

Source: Author's calculation

As mentioned above, the pandemic situation was not the reason why previous non-cardholders decided to use a credit card. The majority of non-cardholders didn't feel the need to use a credit card during the pandemic situation. In fact, Covid-19 was a sensitive situation, because it was directly affecting the health of everyone. It is understandable that the higher concern of people was not to find an optional payment method. So there might be other reasons why people decide to start using a credit card, but Covid-19 was not a factor affecting their decision.

Chart 6: Frequency of credit card usage before and after Covid-19



Source: Author's calculation

The pandemic situation didn't disappear without leaving its mark, so we have to find out, what was the frequency of cardholders after Covid-19 redrawing the usage of credit cards. It is evident from Chart 6 that the usage of credit cards that have been used every day, 2-5 times a week, and also used once a week has increased after the pandemic situation. This means that in fact, people have started to use credit cards more often after the pandemic situation. This comes as a result of a new way of living for a while, which people somehow adapted new ways of purchasing online because of the social distance that was mandatory during the Covid-19 situation.

5.3 Card-holders

Since the usage of credit cards in Albania is increasing as years go by, this level of frequency in the use of these cards indicates that in most cases people use the credit cards for specific reasons. Generally, people pre-think when and where they are going to use their credit cards. This is in fact a good aspect because credit needs to be used wisely. Somehow this shows that Albanian cardholders are pretty careful and smart when it comes to credit card usage, which makes them reliable as cardholders.

The results show that a significant proportion of cardholders own them because they see them as a practical payment method considering as their most significant indicator that led them to become a cardholder. Online purchases are another significant factor that is indicated in the decision of people to become cardholders.

Another factor that led to receiving a credit card is that people need it for everyday purchases. Since everyday purchases can be a little bit tiring and usual, using a credit card makes the activity easier and faster. At almost the same proportion, cardholders say that they have to use a credit card because they need to make some specific payments that only require card payments. Recommendations from others and advertisements/offers seem to have a low effect on their decision to own a credit card. It means that, once people understand how practical credit cards are, they may easily become credit cardholders.

Chart 7: Main reasons why card-holders use credit cards (in absolute values)

Source: Author's calculation

Most of the cardholders use their credit cards to buy online and for shopping, as shown in Chart 7. Most online shopping is made on foreign web pages by using a credit card. This is due to many different reasons, but the most important reason is because some stores offer rewards and bonuses when the customers pay with a card. Incentive makes people buy in stores with their cards in order to have the benefits of using this payment method. Making the payments of the bills is also another reason why people use credit cards because they want to pay those bills on time. In Albania, it is not usual to find restaurants, and especially bars that offer the service to pay with credit cards. Only a very low proportion of cardholders use credit cards everywhere they find the opportunity to make payments with them. By the majority of respondents, the credit card is considered to be mostly an alternative method of payment.

It is clearly shown from the results that the majority of cardholders consider the biggest advantage about the credit card the fact that they can make a purchase even when they don't have cash and

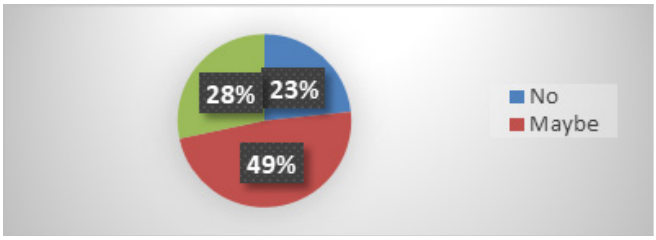
that it is also easy to use. A smaller proportion category of respondents consider it as a loan without interest since they pay in time, or they pay without interest-bearing instalment. Also, they like to benefit from bonuses that the credit card payment method offers. Since hard holders have tasted the experience of using credit cards, all these advantages that they express can be used in order to clarify the benefits of credit card usage to non-cardholders.The majority of cardholders consider that credit cards serve as a good payment method, which means that a significant portion of the cardholders are satisfied with credit card services although there is always room to do better. Only a few of them think is not good at all.

5.4 Non-cardholders

There are also people that don't own a credit card and their opinion or attitude toward the credit card is very important for this study. By their answers, we can see the factors that could affect their decisions to start using a credit card.

The results show that the majority of respondents that don't own a credit card don't like it as a method of payment. It is in our interest to know why respondents think that, and for this reason, we decided to interview some people that don't have a credit card because they don't like it as a way of payment. Non-cardholders have information for this payment method, but they still don't prefer to use it. From their answers, we notice that the majority of people that don't have a credit card don't like to borrow constantly and to pay any possible interest along with that. When asked if they have ever taken a loan, they conducted that the loan is different because it is taken once in considerable amount, paid later, and then it's over. Non-cardholders are less likely to use credit cards because they think that banks have many strict rules and it requires long procedures to become a credit card owner. Some other people don't trust financial institutions and don't like to have continuous relationships with them. Still, the majority would consider using one if banks are more helpful with specific information and its advantages are more considerable for them in the future.

Chart 8: The portion of respondents who would switch to use a credit card in the future



Source: Author's calculation

Moreover, Chart 8 shows that the majority of respondents that don't have a credit card would consider using it in the future but still, they are not sure about that. Meanwhile, there is a considerable close difference between non-cardholders that would be ready to use a credit card in the future and those who won't do so. So there is a higher chance for the majority of non-cardholders to become credit card users. If some aspects are improved to what fits the Albanians lifestyle, then the credit card usage by them may be increased.

6. Conclusion and Recommendations

The total number of credit card payments in Albania has been increased, but cardholders still need the services of credit cards to be provided more widely. The first step to start this transformation has to come from the banks, by increasing the number of POS. When card acceptance hits a certain point and reaches higher rates, many retailers would have to adjust their existing system due to competition.

Youth are the highest category that is ready to use credit cards as their payment method anytime. Elder people, on the other hand, do not have much information about how credit cards work and are not users of credit cards in large proportions. There exists a mentality in Albania of choosing cash as a payment method, which continues to be present in a small category of people, especially among elders.

Data collected by the Albanian National Statistics Institute (ANS) indicated that education level is a very significant factor in credit card usage. The pandemic situation was not a direct reason for making people choose to become cardholders but it affected the increase of the frequency that people use their credit cards. The usage regarding the level of income, on the other hand, indicated

that Albanians now use credit wisely, because people that have low income choose to benefit from bonuses while people with high income just do not need to deal with debt.

People with lower income should have a lower credit card limit, but still be provided with credit cards, according to respondents to a survey by the Bank of England. In this way, more non-cardholders will switch to credit cards in the future and the amount of cash circulating will be reduced. Respondents say banks should be able to have conditions reachable from a wider proportion of the population and also should be more informative.

Banks need to create an application so cardholders can track everything about their card transactions from their phone and keep them informant with new updates. If all the aspects are improved to what fits the Albanian lifestyle then credit card usage will be increased.

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In a snapshot

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