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# **A Comparative Study in Predicting Student Final Grade Using Different Machine Learning Algorithms**

## **ABSTRACT**

*Nowadays the trend of learning using electronic devices is on a continuous growth, due to ease of access to information, diversity of information, low-cost, etc. This has led to the traditional classroom teaching being shifted to a virtual environment, without having the limitation of time and place. Different course in different subjects are given using Massive Open Online Course (MOOC) and open education systems like LMS. By the use of these systems it becomes difficult to predict student performance in advance. In this research we will aim to help students to know their performance in advance by using different Machine Learning Algorithms to predict their final average. It will also help students to know what are the topics they have to learn better in order to improve their results.*

## **Keywords:**

*Grade, prediction, linear regression, SVM, random forest, neural network*

## I. INTRODUCTION

In present online education systems predicting student performance in advance is quite difficult. All most all education institutions measure continuously the progress of their students through unit tests, midterms, projects final exams, etc. Main purposes of this continuously evaluation is to measure the level of knowledge and abilities of students and take future measures to improve the performance of students and lectures. In this paper we are going to show and compare the power of some machine learning algorithms to predict the future performance of students in advance. This will enable students and lectures taking proper measures to prevent failures and increase performance before it is too late.

## II. LITERATURE REVIEW

Machine Learning is nothing else than using data and statistics to make meaningful predictions about other data. Machine learning algorithm will look for patterns in existing data or train itself to correlate certain inputs with certain outputs. There are two main families of machine learning algorithms: unsupervised and supervised learning. Unsupervised learning seeks to find structure in existing data. Most often, this is focused on looking for clusters of data points within a data set.

Meanwhile, supervised learning seeks to correlate inputs with outputs to train a model that predicts the output for a given input (Anderson & Anderson, 2017).

Nowadays Machine Learning has very large use in different fields due to large amount of data to be processed and high computation power with very low cost. The usage of Massive Open Online Course (MOOC), Learning Management System (LMS) and other systems have generated a lot of data.

A lot of studies have been conducted in educational domain especially in predicting students' performance based on the usage of online and other systems. Student final grade prediction based on linear regression is proposed by (Patel & Patel, 2017). Authors use univariate linear regression to predict student final grade in particular subject.

An algorithm based on c4.5 decision tree is proposed by (Liu & Zhang, 2010) to predict marks of students. A comparative study to predict student performance is done by (Huang & Fang, 2013). Authors applied different machine learning techniques like multilayer perceptron neural networks,

radial basis function neural networks, support vector machines and multivariate linear regression to predict student performance. Their model was able to get more than 80% of accuracy.

In this paper we are going to customize and compare four different regression algorithms which are Linear Regression, Support Vector Machines, Random Forest Regression and Neural Network Regression in order to increase the accuracy compared to (Huang & Fang, 2013).

#### *A. Linear Regression Algorithm*

Regression analysis is a form of predictive modelling technique which investigates the relationship between a dependent and independent variable. Three major uses of regression analysis are determining the strength of predictors, forecasting an effect and trend forecasting (Shaier, 2019).

We use linear regression when we have continuous values and in order to improve the output we have to remove outliers. Linear regression does not require too much computations, it is comprehensive and transparent.

#### *B. Support Vector Machines*

Support Vector Machine, abbreviated as SVM can be used for both regression and classification tasks. But, it is widely used in classification objectives. Generally, support vector machine produces significant accuracy with less computation power. (Gandhi, 2018). Some of the areas where SVM can be applied are medical imaging (Ren, 2012), (Sharma & Khanna, 2015) time series predictions and financial analysis (Sapankevych & Sankar, 2009), (Chowdhury, Rayhan, Chakravarty, & Hossain, 2017), (Chow, 2017), pattern recognitions (Bernardo, Maia, Quezada, & Munoz-Soto, 2019).

#### *C. Random Forest Regression*

Random forest algorithm is a one of the most popular and most powerful supervised Machine Learning algorithm and it can be used in both regression and classification tasks.

Random Forests are simply an ensemble of decision trees. The input vector is run through multiple decision trees. For regression, the output value of all the trees is averaged; for classification a voting scheme is used to determine the final class (Yiu, 2019).

#### *D. Neural Network Regression*

Neural networks are one of the most beautiful programming paradigms ever invented. It learns from observational data and figures out its own solution to

the problem. Neural Networks are used in computer vision problems, speech recognition and natural language processing (Le, 2018).

Neural Network Regression require a lot of data to achieve high performance and are generally outperformed by other ML algorithms in “small data” cases. Neural Networks are trained using Stochastic Gradient Descent (SGD) and the backpropagation algorithm (Najafabadi, et al., 2015).

### III. DATASET

Our dataset is composed from results of 117 students graduated between 2013 and 2017 from Computer Engineering Department of private university in Albania. The feature vector is composed from StudentID, Graduation Year, and 10 first year courses results.

In total we have 1170 grades. These grades distribution is given in Figure 1

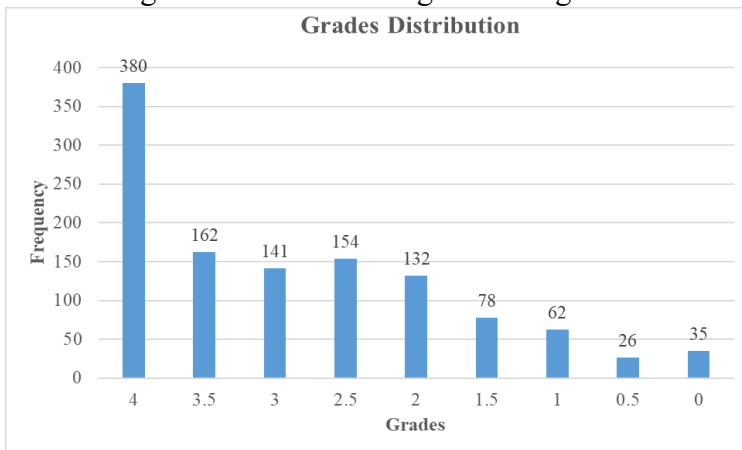


Fig. 1 Grades Distribution of Students

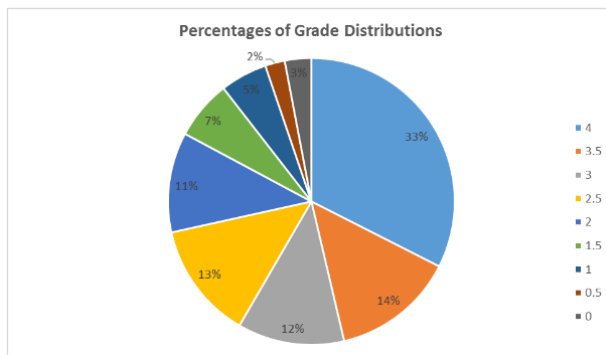


Fig. 2 Percentages of grade distributions



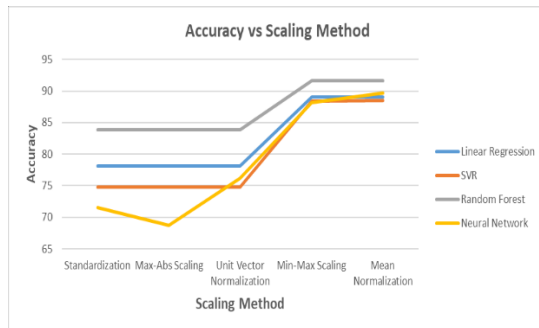
*A. Data Pre-processing*

In order to preprocess our dataset, we have to convert evaluation which is given in letters into numbers to make computations. Letter grades are converted into numbers according to conversion table as given:

*TABLE 1 CONVERSION OF LETTER GRADES IN NUMBERS*

Letter Grade	GPA Value
AA	4
BA	3.5
BB	3
CB	2.5
CC	2
DC	1.5
DD	1
FD	0.5
FF	0
NA	0

In order to scale the features, we used different scaling methods and results for same number of features and attributes with different machine learning algorithms are given as follow:



*Fig. 3 Accuracy of different scaling methods*

As we can identify the best results for all algorithms were taken by using mean normalization scaling:

$$x_i^{scaled} = \frac{x_i - \bar{x}}{\max(x) - \min(x)} \tag{1}$$

Where

$x_i^{scaled}$  : is the scaled value of feature  $x$  for the student  $i$ .

$x_i$  : is the value of value  $x$  for the student  $i$ .  
 $\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$  : is the mean value of feature  $x$ .  
 $max(x)$  : is the maximum value of feature  $x$ .  
 $min(x)$  : is the minimum value of feature  $x$ .

We removed from the dataset 4 students which were transferred from another university because they had only a few marks from first year and StudentID feature.

### IV. RESULTS

This section describes the results and findings of this research. A correlation values ranges from -1 to 1. A correlation value close to 1 indicates that there is a strong positive correlation between two items, a value close to 0 or zero indicates that there is small or there is no correlation between two items and a value close to -1 indicates that there is a strong negative correlation between this two items. A high correlation indicates that there is a linear relationship between variables.

In order to analyze the impact of each course into final CGPA we calculated the correlation between all features of our dataset and the results are as follow:

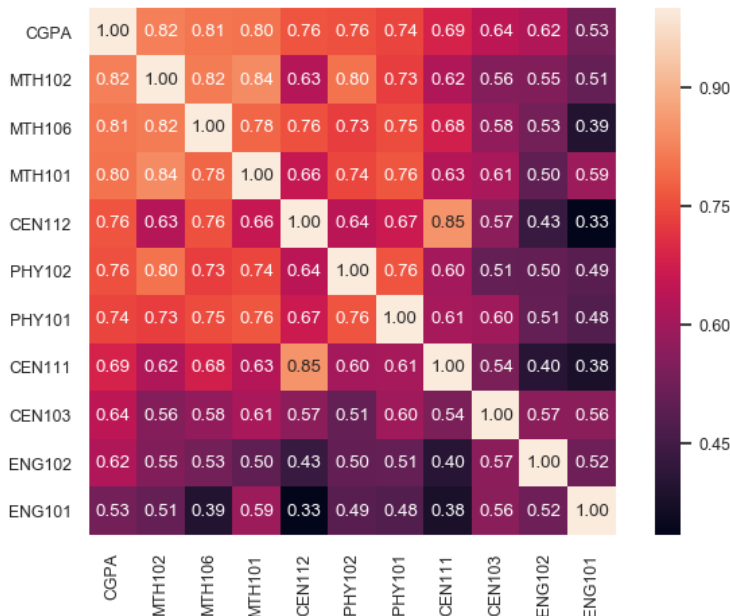


Fig. 4 Correlation Heat Map

From Correlation Heat Map we can conclude that the impact of math courses to final CGPA is greater than English courses, even greater than professional courses because computer engineering courses are very closely related to math and physics.

To perform grade prediction, we applied four different machine learning algorithms which are Linear Regression, Support Vector Machine Regression (SVR), Random Forrest Regression and Neural Network Regression.

Main regression models evaluation metrics are Mean Absolute Error (MAE), Mean Squared Error (MSE), Root Mean Squared Error (RMSE), R-Squared ( $R^2$ ), Adjusted R Squared, Mean Square Percentage Error (MSPE), Mean Absolute Percentage Error (MAPE), Root Mean Squared Logarithmic Error (RMSLE) (Drakos, 2018).

In order to take more real estimations, we applied 10 Fold Cross Validation and evaluation metrics we used are R-Squared ( $R^2$ ), Mean Squared Error (MSE) and Standard Deviation (STD).

MSE is used to measure the average of squared errors. A value of MSE closer to zero indicates that the quality of the estimator is better.

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

Where  $y_i$  is the actual expected value and  $\hat{y}_i$  is the model's prediction.

R-Squared ( $R^2$ ) stands for coefficient of determination, which is closely related to Mean Squared Error (MSE). It is a metrics to measure the proportion of variance for a dependent variable that's explained by an independent variable or variables in a regression model. A value close to 1 indicates a model with close to zero error (Drakos, 2018).

Standard Deviation is a measure of the spread of the data in the dataset. Standard deviation is an excellent way to identify outliers.

$$\sigma = \sqrt{\frac{\sum_{i=1}^n (y_i - \bar{y})^2}{n-1}} \quad (3)$$

Where  $y_i$  is the actual expected value,  $\bar{y}$  is the mean value n is the number of all samples in a dataset. The main drawback of Standard Deviation is that it can be impacted by outliers and extreme values, but our dataset has a predefined range of data and there is not an extreme value (Hargrave, 2019).

*TABLE 2 R2 SCORE, MEAN SQUARED ERROR AND STANDARD DEVIATION OF DIFFERENT MACHINE LEARNING ALGORITHMS*

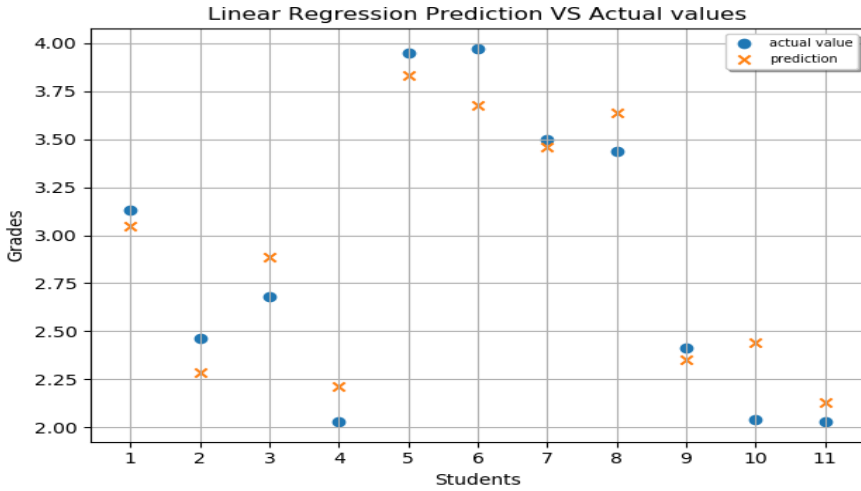
Applied Algorithm	R2 Score	MSE	STD
Linear Regression	75.046 %	0.329	0.096
Support Vector Regression	84.669%	0.252	0.070
Random Forest Regression	82.538%	0.268	0.086
Neural Networks Regression	64.895%	0.378	0.219

From Table 2 we are able to conclude that Support Vector Machine Regressor algorithm is the best algorithm in predicting student CGPA. Using Support Vector Machine Regression model it is able to explain 84.6% of variation in CGPA by the explanatory variables with a standard variation of 0.07.

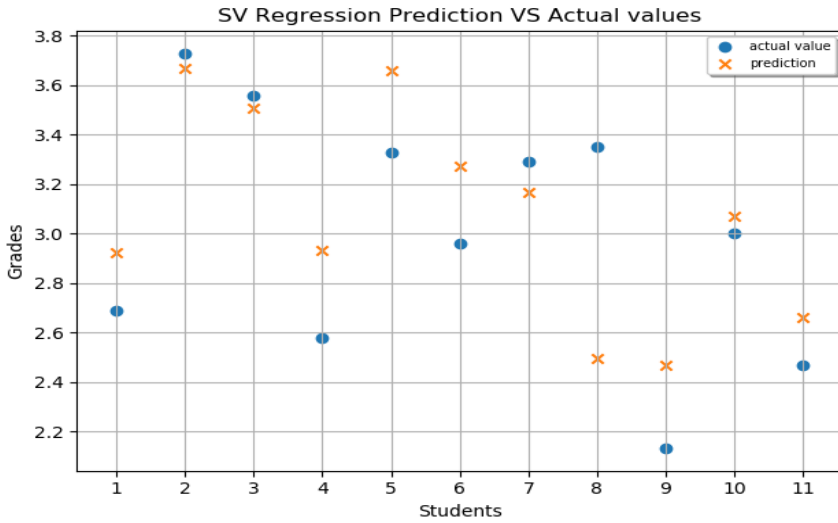
*TABLE 3 PREDICTED VALUES OF DIFFERENT MACHINE LEARNING ALGORITHMS VS ACTUAL VALUES*

Student Nr	Linear Regression	SVM Regression	Random Forest Regression	Neural Networks Regression	Actual CGPA
1	2.528220	2.497899	2.765800	2.580638	2.05
2	2.786554	2.703590	2.782600	2.888219	2.71
3	2.685387	2.563285	2.494600	3.074119	2.25
4	3.384170	3.316695	3.073800	3.542676	2.96
5	3.266354	3.267567	3.375100	3.570569	2.95
6	2.960840	2.830616	2.846800	2.965904	2.54
7	2.679965	2.586249	2.677400	2.535925	2.35
8	3.854962	3.868376	3.930995	4.217727	3.86
9	3.530817	3.569387	3.673300	3.756802	3.51
10	3.070140	3.000869	2.701600	3.504627	2.71
11	3.333885	3.217789	3.240700	3.342877	3.07

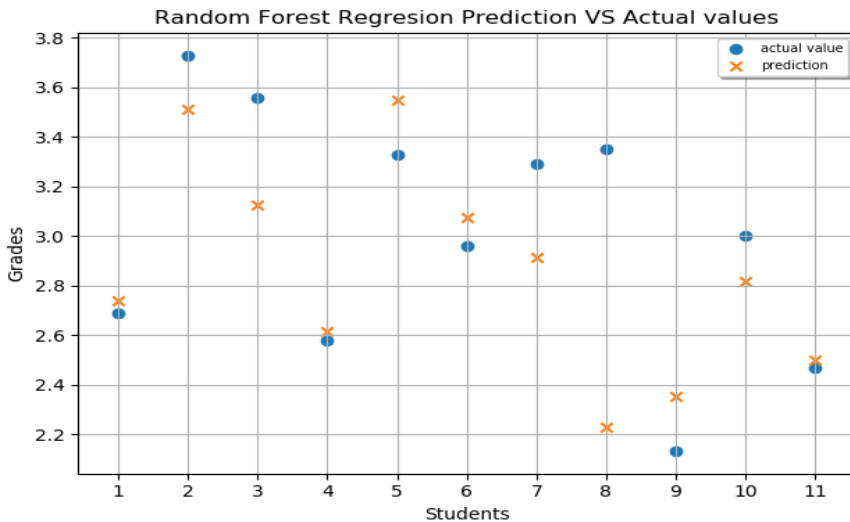
Table 3 displays the predicted CGPA and actual CGPA for 11 students taken randomly after applying 10 Folds Cross Validation. After a close analyse of previous table we can figure out that SVM Regression predicted values are closer to real values.



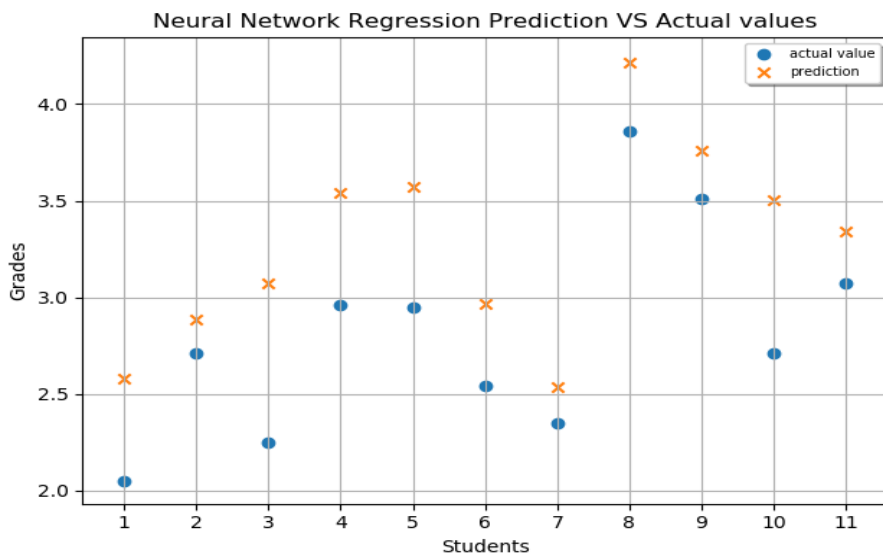
(a)



(b)



(c)



(d)

Fig. 5 Plotting Predicted Values vs Actual Values with Different Machine Learning

To make better evaluation of predicted values vs actual values of CGPA we plotted them on graph for all applied algorithms.

Prediction values shown with (x) and actual values are shown with (•). As closer this points are to each other as highest the prediction is. As we can conclude from Figure 5 Support Vector Machine Regression Algorithm gives

the best prediction for this dataset which is also supported from values shown on Table 1.

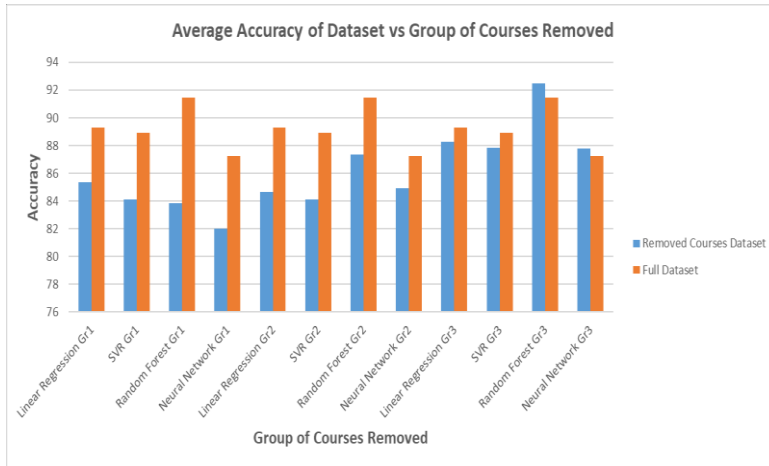


Fig. 6 Average accuracy of Full and Group of Courses Removed Dataset

Fist group is composed of core courses like Calculus I (MTH101), Discrete Mathematics (MTH106), General Physics I (PHY101), and General Physics II (PHY102).

Second group are professional courses Introduction to Algorithms and Programming (CEN111), C and C++ Programming (CEN112), and Introduction to Computer Engineering (CEN103).

Third group are English courses Development of Reading and Writing Skills in English I (ENG 101), Development of Reading and Writing Skills in English II (ENG 102).

Testing dataset size rages from 10% to 17%. From figure 9 we can analyze that when we remove core courses from our dataset average accuracy is the lowest one for all implemented machine learning algorithms, which indicates their impact on future formation of students. When we remove professional courses accuracy is decreased compared to full vector dataset, but not as when we remove core courses, which means that they have an impact on future success of students but not as core lessons. When we remove English courses the average accuracy in most of analyzed models is slightly lower, which indicates that impact of this courses in students’ success is low.

## V. DISCUSSIONS AND CONCLUSIONS

Implementing machine learning in predicting final grade on student is challenging due to high impact of subjectivism of course explanation and evaluation, continuous changes in curriculum constantly changing nature of students.

The results obtained in the field of education highly related with the institution, place and time when they are taken. This means that getting very high percentages of success is often very difficult.

From tests we have conducted we noticed that there is a big impact of different scaling methods in the accuracy of selected models.

Normally in engineering disciplines, subjects like math have a huge impact on future engineer success, which is also shown in the correlation map and on the impact of accuracy shown in Figure6.

Another interesting phenomenon that was observed from the tests was that all models gave maximum results when the dataset was divided into 85% training and 15% testing, regardless of the number of features in the input vector.

Normally, Neural Network gives better results when we have large dataset, but as our dataset is too small and thus accuracy is instable and low as shown in Table 1. To get better results we have to use bigger dataset for Neural Network algorithm.

When we used 10 Fold Cross Validation the values of metrics of evaluations we took into consideration weren't so stable and this is because the size of dataset is too small.

### *A. Conclusions*

Nowadays, Machine Learning in the field of education has gained more interest because the amount of digital data in this field is constantly increasing through the Massive Open Online Course (MOOC) and open education systems such as LMS, online courses, etc.

In this study we aimed to analyze the advantages and disadvantages of some Machine Learning regression models for predicting the success of a student in a particular subject or in all subjects by predicting the Cumulative Grade Point Average (CGPA) that will take at the end of the studies. We strongly believe that this study is great reference point for researchers in this field in the future.

### *B. Future Work*



Comparison of other machine learning regression models, further modification of the features of each model and working with larger datasets will be the focus of our work in the future. We also believe that the use of the ensemble model has to increase even more grade prediction accuracy.

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# **Topic: Conflict Management in Legal Institutions, the Effects and the Need for Training**

## **ABSTRACT**

**This study is oriented towards the need for more in-depth training in conflict management and negotiation, and is particularly focused on legal professionals, who are naturally more exposed to debates and conflicts about professional self-control. The purpose of this study is that in addition to the professional legal knowledge of lawyers, how much is and should be added in-depth knowledge on conflict management and negotiations, aiming to facilitate their work and increase their well-being. As a method for this study was built a questionnaire distributed in the institutions of justice in the city and specifically in the court of first instance of the district, the court of appeal, the faculty of law and some law firms.**

**Keywords: conflict management, negotiations, training programs, stress, work overload, legal institutions, organizational environment.**

## I. INTRODUCTION

Albanian society has constantly faced various socio-economic problems, especially after the 90s, the problems seem to have increased.

The issue of private property still remains a real problem in Albania, the economy and politics do not seem to have managed to create a stable economic and political stability and as a result the increasing number of people leaving Albania is an indicative and debatable fact. In these conditions, it seems that the old tradition of self-judgment has not stopped, where as a result the events with consequences still continue in every corner of Albania. Television, media, soap operas, social networks, etc. seem to have increased the social problems in our society and as a result the number of divorces has been constantly increasing.

Cases like this and many more have led to an increase in the number of unresolved cases and conflicts before the courts. On the other hand, the prolongation of the vetting process over the years has made the relationship between representatives of law and criminal and civil cases increase the burden on justice institutions.

A part of the representatives of the justice bodies are waiting to pass the vetting, a fact that makes the stress and overload of work even more present. Waiting for a long time for these representatives whether or not they will pass the vetting seems to have had a direct impact on increasing stress and problems arising from stress and uncertainty about job prospect and the future.

By nature, the peoples of the Balkans are known as hot-tempered peoples and as a result the problems and conflicts are in considerable numbers. Faced with these facts, the representatives of the justice institutions seem to be dealing with cases of conflicts, debate sessions which have very large dynamics of daily work.

Without question the above factors directly affect the reduction of individual and organizational performance, in addition to this on the other hand the presence of stress and overload at work increases the pressure which turns into conflict, contrary to the professional mission. The profession itself in its nature has to deal with conflicts and unresolved issues or issues that have been resolved by force. Meanwhile, if we add to the panorama the above-mentioned reasons, the issue takes on another dimension and makes more urgent the need to be treated with attention and professionalism. On the other hand, in the

monitoring and research of recent years in Albania, publications on conflict management and negotiations seem to be insufficient.

Verifications made on the curricula in legal programs show that courses and programs on conflict management and negotiations seem to be very few or non-existent, or only in international law or European law there are subjects that deal with interstate and cross-border issues, but interpersonal and organizational conflict is not involved.

## II. LITERATURE REVIEW

The Japanese scholar and physician Kazuhiko Yamamoto(2001) in his work "The ethical structure of the Kanun" published by the Center for Justice and Peace in Shkodra 2001, trying to study the Kanun ethics in Albanian lands on page 5 states: "Since the Kanun clearly states that bloodshed must be avenged, it is understood that revenge is inextricably linked to the concept of "Blood"; a fact that shows that our society is a society that in its past has blood feuds and revenge according to non-institutional Kanun, is self-judgment. In such a society conflicts and clashes are evident and problematic.

According to the scholar Xhemal Meçi(2019) in his work "Kanuni i Leke Dukagjinit Varianti i Pukës"; Çabej Publications Tirana in the first part of the social order of the canon in chapter 1 Article 1 states: "Gjak e fis janë të gjithë ata që brez pas brezi i përkasin një katragjyshi prej kohësh që s'mbahen mend" ("Blood and tribe are all those who, generation after generation, belong to a great-grandfather for a long time not to be remembered "); As it is clearly seen in the foreground in perception, the mentality is preceded by blood, blood feuds, revenge, self-judgment, facts that show the traditional and cultural orientation of society.

A society where the figures on blood feuds and revenge still remain high and problematic, where often the initiatives for the forgiveness of blood feud are initiated by the state through associations or groups of blood feud reconciliation. If we talk about such a society, of course, the conflict in organizational environments for emotional and substantive issues is natural. We are listing some of the causes of conflicts: Personality, status and role, culture, attitudes and prejudices, emotionality in communication, lack of empathy, ethics, work overload, hierarchy and organizational structure, technological changes, other changes as political.

If we think about legal professionals in the Albanian reality where vetting lasts for several years and these individuals feel under stress due to vetting and due to the overload created by the gap created by those failing vetting, it seems that organizational conflicts increase. The stress and insecurity created by the vetting has made the situation even more problematic, and in verbal interviews with lawyers they claim, imagine now a prosecutor with several years of career who has investigated structured criminal groups and comes out in professional release without any kind protection and security.

There have been many cases when there have been violent acts against representatives of justice such as attempted murder, etc. These individuals in these organizational environments therefore spend quite a bit of time with conflict as a phenomenon, but conflict produces stress and stress produces conflict.

If we analyze the groups of interest in the legal cycle, we see judges, prosecutors, judicial police officers, lawyers and parties to the conflict who may be among the most difficult to communicate and the most problematic in criminal offenses. Prejudices and attitudes, appearance, provincial origin, etc., especially in our society, seem to be the cause of conflicts.

Conflict studies show that they consist of several perspectives, among which it is worth emphasizing first the traditional perspective which sees the conflict as a damaging, destructive situation. Second, the perspective of communication and human relations sees the conflict as a normal and inevitable situation, but which must be turned into a constructive situation. Third, this perspective sees conflict as a situation that needs to be analyzed and managed down to theories of negotiation.

Conflicts are associated with consequences and the consequences of conflicts can be divided into individual, organizational consequences and in the case of public institutions have both consequences and public costs.

1. At the individual level, the consequences of conflicts can produce stress, lack of desire to work, reduced individual performance, impacts and problems of well-being and health as a result of stress, increased use of addictive products, etc.
2. At the organizational level, poor functioning of the organizational structure, poor communication, failure to achieve objectives and significant reduction in organizational performance.
3. In the field of justice institutions, conflicts have a great impact because by postponing the hearings, the costs and expenses for the state increase, the image of public institutions is damaged.

In the questionnaire distributed in these institutions consisting of 34 closed and a free question is given for comment: How do you think conflicts can be minimized and the situation improved, where out of 44 respondents this question was answered by 54% of which 62.5% of this 54% require training and qualifications on conflict management and negotiations, while 37.5 % of these respondents seek understanding, cooperation and in other words empathy. It is worth mentioning the fact that although in question 24 do you think that a cycle training program on conflict management should be included, to which over 90% answered "yes", again in the question with the comment they felt the need to re-emphasize the trainings.

We should know that these types of programs and trainings help both individually and organizationally in every link and element to improve the situation, thus creating a more successful organizational environment and a more enthusiastic and positive individual for work, family and any other social place.

### **III. METHODOLOGY**

This study is oriented to work conflicts as a field of organizational psychology and aims to highlight in a self-assessing form the level of work conflicts in justice institutions, also aims to highlight the need for training and qualifications in one of the most important professions and fields of society which is justice. Seen in this light, the study is organized in the form of a questionnaire, with answers YES and NO.

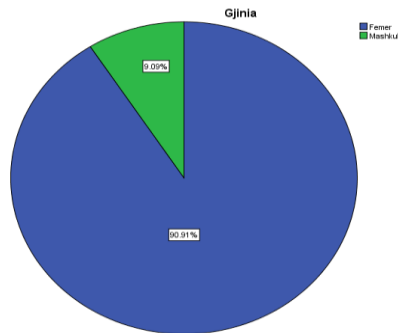
The data analyzed in this study were collected from the questions included in this research instrument designed for this study.

### **IV. RESULTS, DESCRIPTIVE ANALYSIS, RESEARCH PROCEDURE**

By work and the environment where they work. I have selected a sample of 44 people who have given their opinions. The respondents are from the District Court of Shkodra, the prosecution, the Faculty of Law at the University "Luigj Gurakuqi" Shkodra and from several law firms in Shkodra.

General sample data:

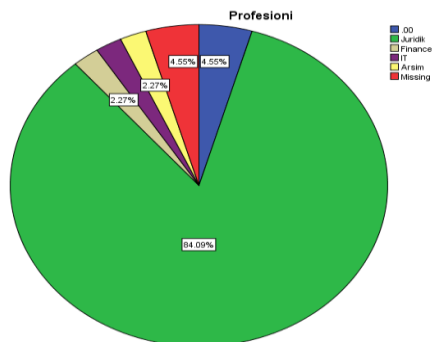
<b>Gender</b>		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	40	90.9	90.9	90.9
	Male	4	9.1	9.1	100.0
	Total	44	100.0	100.0	



In our sample of respondents on the topic, the majority, about 91% are female, so we can not make a differentiation of opinions based on gender, but we can conclude mostly with the perception of female persons regarding the self-assessment of the conflict in work.

<b>Profession</b>		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	2	4.5	4.8	4.8
	Law	37	84.1	88.1	92.9
	Finance	1	2.3	2.4	95.2
	IT	1	2.3	2.4	97.6
	Education	1	2.3	2.4	100.0
	Total	42	95.5	100.0	
Missing	System	2	4.5		
Total		44	100.0		





As we can see from the table, 84% of the respondents are lawyers by profession, so the profile of our respondents are female lawyers, with secondary or higher education mainly, based on the data on education as follows.

Education degree					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High school	5	11.4	11.4	11.4
	University	16	36.4	36.4	47.7
	Master	15	34.1	34.1	81.8
	PhD	8	18.2	18.2	100.0
	Total	44	100.0	100.0	

Only 8 of the respondents hold the degree "Doctor", and only 5 or 11% of respondents have secondary education.

Statistics			
		Age	Experience working (years)
N	Valid	37	17
	Missing	7	27
Mean		36.9730	11.5882
Median		35.0000	10.0000
Mode		30.00 <sup>a</sup>	3.00 <sup>a</sup>
Variance		141.749	58.757
Minimum		.00	1.00
Maximum		57.00	25.00

a. Multiple modes exist. The smallest value is shown

In terms of age, the average age of respondents is 37 years old, while the most common age is 30 years old. Also, out of 44 respondents, only 17 people have

given years of experience in work, and among them we can say that the average experience is 11.5 years of work.

### **Processing of data related to the self-assessment on the conflict and its relation to the environment where they work.**

Out of the 34 questions related to research on the impact of the work environment on conflict and its consequences we have these results:

#### Question 1

<b>Do your work debates increase personal stress?</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	4	9.1	9.1	9.1
	YES	40	90.9	90.9	100.0
	Total	44	100.0	100.0	

Out of 44 respondents, 90.9% think that work debates affect the increase of personal stress, while 9.1% of them do not.

#### Question 2

<b>Do you think that stress from work debates has implications and consequences in your private life (including the consequences of stress related to health).</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	6	13.6	14.0	14.0
	YES	37	84.1	86.0	100.0
	Total	43	97.7	100.0	
Missing	System	1	2.3		
Total		44	100.0		

Out of 44 respondents, one person did not respond, and 86% of people think that yes, work stress affects their private life, while 14% do not think so.

#### Question 3

<b>Do you think that your organizational managers make enough effort to resolve organizational conflicts?</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	19	43.2	44.2	44.2
	YES	24	54.5	55.8	100.0
	Total	43	97.7	100.0	
Missing	System	1	2.3		
Total		44	100.0		

The questioning shows that 44% think that managers try hard enough to resolve organizational conflicts, while 56% think that these efforts are not enough or do not exist.

#### Question 4

<b>Do you think that your profession is associated with debates in organizational environments</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	12	27.3	27.3	27.3
	YES	32	72.7	72.7	100.0
	Total	44	100.0	100.0	

72.7% of respondents think that their profession (where 91% were lawyers) is associated with debates in organizational environments.

#### Question 5

<b>Are debates frequent in your organization?</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	30	68.2	71.4	71.4
	YES	12	27.3	28.6	100.0
	Total	42	95.5	100.0	
Missing	System	2	4.5		
Total		44	100.0		

Despite the above opinion where 72.7% think that their profession is associated with debates, 71.4% of respondents think that debates are not frequent, and only 28.6% of them confirm that they are frequent.

#### Question 6

<b>Is your performance affected when there are organizational debates or conflicts at work?</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	16	36.4	36.4	36.4
	YES	28	63.6	63.6	100.0
	Total	44	100.0	100.0	

63.6% of respondents think that their performance at work is affected by organizational debates or conflicts.

**Question 7**

<b>Do you know what a tunnel vision is?</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	39	88.6	90.7	90.7
	YES	4	9.1	9.3	100.0
	Total	43	97.7	100.0	
Missing	System	1	2.3		
Total		44	100.0		

Out of 43 people who answered the question, only 4 confirm that they know the term tunnel vision, and only 3 have defined it as follows:

- Narrowing attention in case of conflict
- You are not able to fully focus on what is related to the work
- Tunnel vision is a phenomenon that affects the ability to perceive stimuli from the environment when we are in a state of pronounced psycho-physiological stress.

**Question 9**

<b>Do you know what the BATNA concept is</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	40	90.9	90.9	90.9
	YES	4	9.1	9.1	100.0
	Total	44	100.0	100.0	

Out of 44 respondents only state that they know the concept BATNA, defining it as follows:

- Negotiation
- Problems that need solutions, help is analyzed, solution
- Statement of problems-analysis-help-performance

**Question 11**

<b>Do you know what the ZOPA concept is</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	41	93.2	93.2	93.2
	YES	3	6.8	6.8	100.0
	Total	44	100.0	100.0	

Also, regarding the ZOPA concept, only 3 people say they know it, describing it as:

- Giving, solving and performing a job

- Giving a job-solution
- An area of possible agreement benefiting both parties (win to win)

**Question 13**

**Do you think that many debates that turned into conflicts could have been easily resolved?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	5	11.4	11.4	11.4
	YES	39	88.6	88.6	100.0
	Total	44	100.0	100.0	

88.6% of respondents agree many debates turned into conflicts could have been easily resolved, while 11.4% of them think not.

**Question 14**

**Are you empathetic in cases of debate**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	22	50.0	50.0	50.0
	YES	22	50.0	50.0	100.0
	Total	44	100.0	100.0	

Very interesting is the result regarding empathy in cases of debates, where half of the respondents say that they are not empathetic while the other half are.

Regarding the concept of empathy, 9 people have given their definitions as follows:

- Listen to colleagues 'problems put yourself in their position
- Emotional and cognitive (3 persons)
- Emotional and memorial
- Emotional empathy
- Behavioral empathy compassionate empathy affective empathy
- Understanding
- Sensitivity

**Question 16**

**Are your colleagues empathetic with you in cases of debate**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	19	43.2	48.7	48.7

	YES	20	45.5	51.3	100.0
	Total	39	88.6	100.0	
Missing	System	5	11.4		
Total		44	100.0		

Out of the 39 respondents, 51.3% think that colleagues are empathetic, while 48.7% think that colleagues are not empathetic.

#### Question 17

<b>Forgive the mistakes of others</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	10	22.7	23.3	23.3
	YES	33	75.0	76.7	100.0
	Total	43	97.7	100.0	
Missing	System	1	2.3		
Total		44	100.0		

76.7% of the 43 respondents say that they forgive the mistakes of others, while 23.3% do not.

#### Question 18

<b>Do you worry too much in cases of work disputes</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	18	40.9	40.9	40.9
	YES	26	59.1	59.1	100.0
	Total	44	100.0	100.0	

59.1% of the persons say they are very worried about work disputes, while 40.9% do not.

#### Question 19

<b>Do you think that your managers in case of problems at work try to find fault with others</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	19	43.2	43.2	43.2
	YES	25	56.8	56.8	100.0
	Total	44	100.0	100.0	

56.8% of respondents say that their managers in case of problems try to find fault with others not with themselves, while 43.2% deny this alternative.

**Question 20**

<b>Do you think your colleagues or managers easily produce conflict with staff?</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	25	56.8	56.8	56.8
	YES	19	43.2	43.2	100.0
	Total	44	100.0	100.0	

About 57% of respondents think that managers easily produce conflict with staff, while 43% of them do not think in the same way.

**Question 21**

<b>Do you think that stress at work affects the well-being of life.</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	5	11.4	11.4	11.4
	YES	39	88.6	88.6	100.0
	Total	44	100.0	100.0	

An overwhelming majority of 88.6% of respondents think that stress at work affects the well-being of their lives.

**Question 22**

<b>Do you think conflicts produce stress?</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	3	6.8	6.8	6.8
	YES	41	93.2	93.2	100.0
	Total	44	100.0	100.0	

93.2% of respondents claim that conflicts at work produce stress.

**Question 23**

<b>Do you think that some addictions such as smoking and alcohol consumption are the cause of not coping with stress at work</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	21	47.7	47.7	47.7
	YES	23	52.3	52.3	100.0
	Total	44	100.0	100.0	

52.3% of respondents think that addictions such as cigarette or alcohol consumption are consequences of not coping with stress at work, while 47.7% do not think so.

**Question 24**

<b>Do you think that a training program (or cycle of lectures) on conflict management should be included in your educational programs</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	7	15.9	16.3	16.3
	YES	36	81.8	83.7	100.0
	Total	43	97.7	100.0	
Missing	System	1	2.3		
Total		44	100.0		

A significant part of the respondents 83.7% think that a cycle of lectures or training program on conflict management should be included in educational programs, while 16.3% of them think that it is not necessary.

**Question 25**

<b>Do you think many debates or conflicts are emotional and not substantial</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	10	22.7	22.7	22.7
	YES	34	77.3	77.3	100.0
	Total	44	100.0	100.0	

77.3% of the sample think that debates or conflicts are mainly emotional and not substantial, while 22.7% think differently.

**Question 26**

<b>Do you have information on the types of negotiations</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	34	77.3	77.3	77.3
	YES	10	22.7	22.7	100.0
	Total	44	100.0	100.0	

Also, 77.3% of respondents state that they do not have any information on the negotiations.

Out of the 22.7% who have information on negotiations, 9 have listed the following types:

- Conversation
- Conversation, discussion on problems (4 persons)
- Compromise, reconciliation, forgiveness
- With compromise with competition
- Integrative negotiation collaborative negotiation contradictory negotiation competitive negotiation



- Depends

**Question 28**

<b>Do you have information on the National Chamber of Mediators in Albania</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	20	45.5	46.5	46.5
	YES	23	52.3	53.5	100.0
	Total	43	97.7	100.0	
Missing	System	1	2.3		
Total		44	100.0		

46.5% of respondents state that they have no information about the National Chamber of Mediators, while the rest know it.

**Question 29**

<b>Are the peoples of the Balkans hot-tempered?</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	6	13.6	13.6	13.6
	YES	38	86.4	86.4	100.0
	Total	44	100.0	100.0	

86.4% of respondents think that the peoples of the Balkans are hot-tempered, while 13.6% of them do not think so.

**Question 30**

<b>Does anger increase conflict?</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	4	9.1	9.1	9.1
	YES	40	90.9	90.9	100.0
	Total	44	100.0	100.0	

Only 9.1% of respondents say that conflicts do not increase because of anger, while the rest think so.

**Question 31**

<b>Do you think that in the Albanian reality the management of conflicts in the organizational environment should be treated in more detail</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	6	13.6	13.6	13.6
	YES	38	86.4	86.4	100.0
	Total	44	100.0	100.0	

86.4% of respondents think that conflict management in the organizational environment should be addressed more broadly and 13.6% of them do not think it is necessary.

### Question 32

<b>Do you think that such trainings have a positive effect on minimizing conflicts in your work and daily life?</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	6	13.6	13.6	13.6
	YES	38	86.4	86.4	100.0
	Total	44	100.0	100.0	

86.4% (similar to% above) think that trainings on conflict management at work and in everyday life will have a positive impact on minimizing them, while the remaining 13.6% do not think the same.

### Question 33

<b>Do you think that the debates in the political arena are too much?</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	6	13.6	13.6	13.6
	YES	38	86.4	86.4	100.0
	Total	44	100.0	100.0	

### Question 34

<b>Do you think that the debates in the media arena are too much</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	5	11.4	11.4	11.4
	YES	39	88.6	88.6	100.0
	Total	44	100.0	100.0	

The respondents show that they perceive that the debates in the political and media arena are more than necessary, describing the media arena more, where 88.6% of them affirm this compared to the political arena whose debates affirm 86.4 %.

## V. DISCUSSIONS CONCLUSIONS

It seems that this study needs to be expanded nationally to be more accurate with the evaluation of the study and the importance and consequences of conflict management.

However, looking at the results and if we single out some of the answers and specifically start with the question 4 **Do you think that your profession is associated with debates in organizational environments** 72.7% of them answer YES indicating that these types of institutions are characterized by work with conflicts, a fact that the qualification in terms of conflict management is conditioned. Another question results with interesting data and specifically question 13 **Do you think that many debates that turned into conflicts could have been easily resolved?** 88.6% of respondents think that many debates turned into conflicts could have been easily resolved, giving a different meaning to the treatment of conflict management in these organizational environments. Interesting percentages also come from the answers to question 25. **Do you think many debates or conflicts are emotional and not substantial** 77.3% of the sample thinks that debates or conflicts are mostly emotional and not substantial, making the study even more interesting.

Passing to the next question 26 if they have information on the negotiations and 77.3% say no, interesting is the fact that these structures of justice, about 46.5% of them do not know and do not have information on the National Chamber of Mediators in Albania. In question 29 if the peoples of the Balkans are hot-tempered, 86.4% of them say yes, continuing with question 30 if hot-temperedness increases conflicts 90.1% of them think YES.

According to them, 86.4% of them think that in the Albanian reality the management of conflicts in the organizational environment should be treated more extensively, the next question with 86.4% If the conflict management training and negotiations have a positive effect on minimizing conflicts in the organizational environment and in everyday life.

The last two questions on the perception of media and political debates

Do you think that the debates in the political arena are too much we have, 86.4% Yes, showing the perception on the political level.

A good suggestion is also for the media in Albania where in the question: Do you think that the debates in the media arena are too much, it results 88.6% Yes.

Regarding the questions related to some concepts of conflict management and negotiation such as BATNA or ZOPA, it turns out that over 90% of them do not know them at all as concepts.

## **VI. RESEARCH LIMITATIONS**

The study was conducted only in a city like Shkodra and did not include other cities in Albania. The study did not include police and community policing structures. Limitations in the literature and similar studies are another shortcoming.

## **VII. RECOMMENDATIONS**

The respondents themselves seem to have responded about recommendations. These structures state that they have great dynamics of conflicts at work. These structures need to be trained and qualified in conflict management and negotiation. They do not have enough information on conflict management and negotiation concepts and theories.

In conclusion, it seems that conflict management in justice institutions as well as in many sectors and areas in the Albanian reality remains an important need to be addressed more broadly to improve organizational environments as well as the well-being of individuals in these organizations

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# **The Need for a Reform of the Research Work in Albanian Universities**

## ***ABSTRACT***

*The purpose of this study is to provide a number of ideas, which would contribute to the debate surrounding a proposed reform in the field of research in Albania. An overview of this aspect shows that the research in Albanian universities is characterized by an adverse status and mismanagement. Therefore, it is imperative the adaptation, recognition and implementation of the European research models. Based on the French model the study provides a list of implications for the university system in Albania. The study concludes with a couple of recommendations, which would contribute to the improvement of research situation.*

***Keywords: research, universities, reform, project.***

## I. INTRODUCTION

It's a well known fact that each country has defined and established its higher education system in consistence with the country's tradition, needs and perspectives of development. In most western countries, including France, functioning of higher education institutions are based on two main pillars, those of teaching and research. The main purpose and duty of the research communities is to generate new knowledge, which would serve both the universities and respective societies, namely, for upgrading and modernizing their teaching process and for the country and society's needs.

Albanian universities and university colleges are supposed to function according to the similar scheme, which is mainly dictated by Bologna's Agreement. But the big question is: Do these institutions justify the purpose, for which they are established. Why these institutions are ranked, on the bottom level, either regionally or wider? More specifically, much of today's public discourse is related to the issues, such as: (1) Why Albanian higher education institutions are in such a bad shape regarding the research component? (2) Are the bodies that monitor, guide and evaluate this component working responsibly? (3) Is the research work in consistence with the university and society's needs? (4) Is the budget dedicated to research strictly planned and are the researchers rewarded in relevance with their research quality and quantity?

Although these issues need to be analyzed and addressed by a holistic organization arranged by the Albanian government and specialized agencies some authors tend to believe that research in our public or private university colleges and universities is characterized by the lack of strict organization, experience, motivation, and budgetary means (*Shaska, T. 2009*). In order to add some contribution to this discourse, I begin with a review of the current trends that outline the work for research carried out by western universities, in general, and in France, in particular. Then I state some ideas that address the four issues stated above. Finally, I propose something similar to the French organization that leads to high efficiency of research work in universities.

## II. TRENDS OF RESEARCH EFFICACY IN FRENCH UNIVERSITIES

In western countries the concept of research has to do with the production of knew knowledge intended to serve the actual or perspective needs of societies

where universities operate (Röhrs, H. et. al 1987). Today the term “research” doesn’t mean any more the pure theoretical research aimed at upgrading teaching or belongs to so called “ivory tower” Langlois-Berthelot M(2007). In recent years the concept of “doing research” implies and endeavor for balance between freedoms of the “ivory tower”, traditionally implemented in Western European universities, and the efficacy of the entrepreneurial models, a characteristic of American universities (Rüegg, W 2004). The European governments worry that avoidance from this balance may lead to incentives in the entrepreneurial model, and consequently leading, in the long term, to a complete corporatization of universities (Rapport de la Commission pour la Libération de la Croissance 2008). Therefore, pure theoretical research, on one side, and practical trends, nourished by the hungry for technological progress and innovations, on the other side, are establishing the balance between entrepreneurial model and the retention of academic freedom.

In the case of France, the research work is shifting towards the importance of the contact with the private sector (Rapport de la Commission pour la Libération de la Croissance 2008). Since 1980 higher education institutions are undertaking steps in this direction. Presently the French system is undergoing a flow toward enhanced productivity and performance, a system which attempts to reflect the required research balance. More specifically, it is moving toward four main directions: autonomy, flexibility, evaluation, and funding (Rapport de la Commission pour la Libération de la Croissance 2008). Being consistent with the four issues of debate around the research in Albanian universities, mentioned earlier in this article, these directions would be a good guide for avoiding the existing chaotic and insufficient research work.

In France, when it comes to the Research Form “the contact between universities and the government are limited to budget, which would come in a yearly installment” (Kok, W. 2204). In the aspect of flexibility, the academic experience would be paramount. Instead of a rigid division of work between research and teaching, faculty would be able to adjust their emphases according to the institutional needs. “The faculty and academic staff, prominent to their ability in specific directions of the academic work would be allowed to spend more time on what they are best at” (The European Commission 2006). In terms of evaluation, academic work is rather difficult to evaluate, due to its long-term nature. For the time being under consideration is the suggestion for the creation of a national evaluation agency. The funding of French research has seen a very gradual evolution from permanent funding dependent on the position, toward funding based more and more on the



activity and performance (project based) (Langlois-Berthelot M.2007). It is exactly this evolution in France the cause of creation of the National Research Agency, which awards projects based on proposals.

### III. A SIMILAR RESEARCH REFORM IS NEEDED IN ALBANIA

Actually, the Albanian higher education system is missing governmental orientation and necessary funding, either from government and respective owners. It ranks last in Europe on all relevant and available indicators of quality and performance (Thelwall, M 2009). In its research component the system follows a traditional ivory tower model characterized by a bad quality. The lack of funding, combined with the exodus of academic capacities, has led to a research product tightly controlled by a privileged political caste (in the public institutions) and mere businessmen (in the private institutions), whose interest is making financial profits for themselves and their families. The very low intensity and quality of scientific activity in Albanian universities thrives as a result of the dominance of loyalty's criteria, obedience and conformism.

With rare exceptions today the faculties of our universities simply teach without any serious scientific activity. Some sporadic governmental initiatives intended to return in Albania the qualified specialists educated in western countries, is being compromised by refraining large national universities from opening and running doctoral programs. Presently, serious scientific articles written by Albanian faculties or students and published in international journals are barely found in internet, even those authored by staff with "professor" title. Academic and scientific journals of universities now have ceased to appear or, at the best, suffer from formalities and mediocrity. The lack of genuine academic publishing and scientific conferences and workshops is creating a fearful devastation for the future of the system (*Hasimja, E. 2006*). The system by which one is promoted to the academic hierarchy is carefully controlled, with purpose of ensuring the perpetuation of the system of values based on loyalty and obedience.

Guided by the four previously mentioned directions we saw how the French system has implemented a drift toward enhanced research productivity and performance. This is what Albania needs to adopt, given, of course, that we do not have the luxury of gradual adaptation, over several decades.

What follows are simply some ideas from which policy makers can pick and choose those considered feasible in the actual situation.

#### IV. SOME IDEAS FOR IMPROVEMENT

The majority of faculty members at Albanian universities today have a very weak or non-existent research activity. They concentrate on teaching to such an extent that most academic staff work simply as teachers. In actual situation, where institutions lack qualified staff with academic titles and grades I propose their grouping into two categories: (1) research staff (RS) and (2) teaching staff (TS). Faculties of the first category would operate in two tracks: research and teaching tracks. Aligned with an earlier proposal of Hasimja (2006) (Hasimja, E. 2006), the research track would be organized around institutional research centers, which would employ only staff of at least doctoral level. They'd have moderate teaching loads.

The research track must be organized, monitored and evaluated by research centers of universities, which have to be culminated to Albanian Research Agency (ARA), similar to its homologue in France. ARA may be public or private and funded by the Albanian Ministry of Education. Academic staff who work in this track are supposed to be financially covered for their high standard research work, including domestic and international research related activities. This coverage would be an added value to their regular salaries.

Faculty members of both teaching and research tracks must constitute departments within universities. In particular, departments must train, guide, monitor and evaluate TS. It is imperative for universities to introduce and implement the tenure system for the newly recruited staff. Tenure staff must significantly distinguish from no tenure staff in both financial terms and academic promotion Röhrs, H. et.al.(1987).

Novice faculties have to start out in the teaching track. In order to start a career on the research track one would first have to win a project from ARA. From that step the new lecturer becomes a candidate of RS. In this transition period this individual would work under the supervision of departments and research centers within universities. In order to obtain a permanent research position, a researcher would need to accumulate a certain number of points. The points are given by ARA, in accordance with his/her research progress.

Salaries for research permanent positions are proposed to be significantly higher than those of TS. In public institutions, they must be settled by the ministry of education and would evolve based on seniority and quality of

research and teaching activity. RS engaged in national level projects must receive additional bonus and rewarding, all this depending on the project importance, research group size and the researcher's role within the group.

It must be pointed out that the importance of research centers within universities doesn't shadow the role of departments. These basic units are supposed to coordinate their work with centers and obtain all feedback from them in the process of monitoring, evaluation and organization of the personnel's teaching and research load. In addition, the departments have different roles as part of universities and university colleges. In these latter ones teaching must be the primary focus of departments. When it comes to their research part, departments must encourage TS to engage in small, regional and entrepreneurial projects that may serve directly university colleges themselves and businesses around them.

Any effort towards the reform should be designed to be in consistence with the existing law of higher education. This means that steps toward research reform should be taken gradually, with the intention of not causing professional and financial harm to the academic staff. "The reform should endeavor to bind their undeniable teaching experience for the best result and in the most constructive possible way" (Kok, W. 2004).

## V. CONCLUSIONS

Based on the French experience this article is meant to provide ideas for a suggested reform in the research field. These ideas are thought to add material to the actual debate around improvement of research work within universities and university colleges. Discussion is focused around the role of research centers, their cooperation with departments and financial reward improvement for the academic staff engaged in research work. In the center of this discussion is the idea that research work must reorganized and properly rewarded. Of course, the proposals are incomplete; their purpose is to bring a personal viewpoint from an experienced lecturer.

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# A Comparison of Machine Learning Techniques for Predicting Android Malwares

## **ABSTRACT**

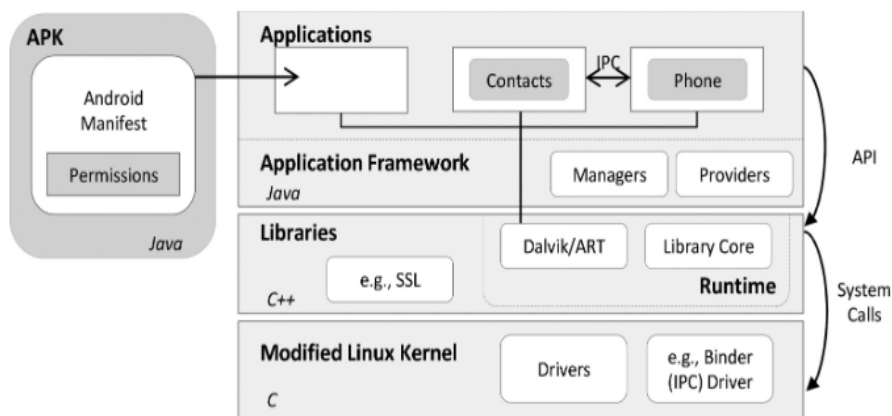
*Android applications are very popular nowadays. More and more programmers are learning and programming how to build android apps. At the same time, there are increasing also the malware attacks to android apps. This paper aims to predict these attacks based on some prior data that is known. Logistic Regression, Naïve-Bayes Classifier, K-Means Classifier, Decision Tree Classifier, Random Forest Classifier, Support Vector Machine and XGBoost Classifier are used for this purpose. After analyzing and comparing accuracy metrics, we concluded that Random Forest Classifier and XGBoost Classifier are the best techniques for predicting android malware attacks based on our public data. Python 3.9 was a great tool for these analysis.*

*Keywords: Android malware, python 3.9, machine learning techniques, accuracy metrics, evaluation.*

## I. INTRODUCTION TO ANDROID

Android is an operating system and programming platform. It is developed by Google useful for mobile phones and other mobile devices, such as tablets. It is an open-source-based on WebKit and Linux. Android Operating System is becoming very attractive for cybercriminals.

In the figure below it is illustrated the Android Operating System Architecture. As we can see, the application framework used to develop the android app using SDK is java. On the other hand, each app has its runtime library. Android is based on the Linux Kernel. By using the Linux Kernel, it is adapted to the security features of Linux. Based on the fact that the Android App is distributed in different ways on your devices it is exposed to cybercriminals.



**Fig 1.** Android Operating System (OS) Architecture(T.R. Reshmi, 2021)

As soon as malware is installed, they can use privilege escalation attacks to destroy Android OS or kernel vulnerabilities. When successful, the malware gains root access to the device. These attacks provide the malware with access to the lower, higher-privileged, and architectural layers. Malware often leaks data about the device, owner, or both of them as soon as it is compromised. Similarly, malware is known as spyware spy or monitors a target by exploiting mobile devices. Spying malware is also often bots, as they are controlled remotely via a command and control server. However, any malware can be one of many bots as long as there is a network of compromised or malicious devices. These bots can also be used for denial of service (DoS) attacks by rerouting traffic to a specific address(es).

## II. ANDROID MALWARE

Android Malware is one of the most dangerous and serious threats in recent years. (<https://doi.org/10.1016/j.jjime.2021.100013>.) Since there is a high increase in android attacks, many different sectors are affected. It includes businesses like banking, government, e-commerce, social media, healthcare, and so on. As we mention in the previous chapter, Android is an open source based on open-source technologies such as WebKit and Linux. By being an open-source it is susceptible to the latest attacks.

On the other hand, Android Malware is malicious software. Its target are all the smartphone devices that use the Android operating system. Android Malware is also referred to as mobile malware. The main objective for the attackers is to perform illegitimate activities by writing a code to harm a device and steal all the data.

Some kind of mobile malwares are banking malware, mobile ransomware/spyware/adware, and SMS Trojans. In banking malware, the attackers try to steal the data which includes currency transactions and payment services. Mobile ransomware detects the most important data by encrypting all the information, while mobile spyware monitors all the activities in the device and records all the sensitive data for e-commerce. Adware is another dangerous malware in which the attackers create malicious code by infecting the root of the device. Another way to corrupt the data is also the SMS Trojans. Cybercriminals infect the devices with text messages. In this way, through a text message, you can do much easier for the attackers to steal all your information about your financial accounts. To protect the datasets is necessary to have a landscape of Android Malwares and also a deep analysis of the malware families. The result is shown that machine learning provides high accuracy for the malware sample.

To prevent detection, Android malware encrypts an APK file which must be valid.

In the static analysis approach, the code is usually reverse-engineered and examined for the presence of any malicious code. Dynamic analysis, on the other hand, is referred to executing applications in an environment which is controlled such as a sandbox, virtual machine, or a physical device to trace their behavior. Several automated dynamic analysis systems detect suspicious behaviors from Android applications.

There are several android malwares groups: adware malware, backdoors, scareware, PUA, riskware and Trojan. The first one is adware. Adware Malware mostly occurs in web services. It steals all the personal data and attempts to encrypt all the data in the devices. Backdoors are secret ways into a smartphone that goes undiscovered. In other words, backdoors allow an attacker to bypass a device's identification and raise permissions, able to access the device at any time. A Scareware Malware attacks information by installing malware on GPS. PUA is another malware that is packaged with legitimate software. File Infector infects APK files and the virus runs. Riskware is malware that collects data from devices by sending the users to malicious websites.

There are different categories of detecting android malware such as machine learning and signature-based. A signature-based detection detects a malware signature in the library of an Android sample. As for machine learning-based detection, it makes the prediction to detect the malware. In the source code analysis, we have three categories static, dynamic, and hybrid analysis. They are the most used techniques in Android malware analysis. Based on the practical aspect, by using dynamic analysis we achieve faster results than static analysis.

### III. METHODOLOGY AND DATA

#### A. Machine Learning Techniques

*Logistic Regression* or known as *logit model* is a statistical model which is used to model a binary depended variable. Mathematically, a binary logistic model has a depended variable with two possible values, such as true/false or in binary codes 0/1 and some independent variables which can be both categorical or numerical variables. The equation for logistic regression is

$$p(x) = \frac{1}{1+e^{-(\beta_0+\beta_1x)}} \quad (1)$$

Huang Xiaojun and Li Suhuan (2019) presented logistics regression as an important model for Android Malware Detection.

*Naïve-Bayes* model uses Bayes' Theorem and is one of the supervised learning machines that considers self-reliance features statistically (Koucham O.2015). The Bayesian method uses two probabilities, 'prior' probability



which refers to past experience and ‘posterior’ probability which predict the future. The Bayes formula is as follows

$$P(A/B) = \frac{P(AB)}{P(B)} = \frac{P(B/A)*P(A)}{P(B)} \quad (2)$$

$P(A/B)$  means the probability of happening event A when it is known that event B happened before and this is called Bayesian machine learning. Sharfah Ratibah Tuan Mat (2021)

has proposed a Bayesian probability model for Android Malware Detection.

*K-Means* (Lloyd, 1957; MacQueen, 1967) is one of the most used clustering methods. ( Jin X. et. al 2011 ) The basic idea is: Given an initial clustering that is not the optimal one, relocate each data point to its new nearest center and update the clustering centers by calculating the mean of the member points. This procedure relocating the data points and updating the clustering centers is repeated until convergence criteria are satisfied. In this paper we have used Euclidean distance to find the nearest center. Let’s consider that  $X$  and  $Y$  are two points with coordinates  $(x_1, x_2)$  and  $(y_1, y_2)$ , then Euclidean distance is calculated as follows:

$$d(X, Y) = \sqrt{(x_1 - y_1)^2 + (x_2 - y_2)^2} \quad (3)$$

*Decision Tree Classifier* which is explained in details at (Kotsiantis 2013) takes into consideration all features of an object. The model that this classifier build is a tree-like structure with the purpose to predict the future data. Decision Tree can also be used for numerical data and in this case it is referred as Decision Tree Regression. In our case we are considering only the Decision Tree Classifier as our depended variable is a logical variable.

A decision node contains two or more branches where each of them represent values for the attribute tested. The value of leaf nodes presents the mean of the observations falling in that area. In addition, if a new unknown data point falls in that area, we predict it by using the mean values.

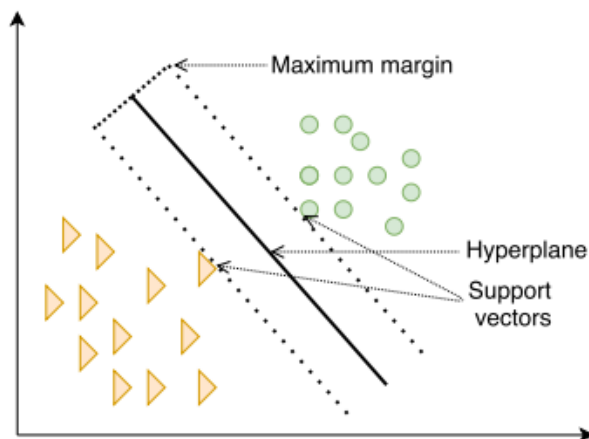
*Random Forest Classifier* is an ensemble supervised learning method which combines together predictions from multiple machine learning algorithms to generate more accurate predictions compared to a standalone model. (K. Mahmud. et, al, 2021) As a forest contains a lot of trees, a random forest classifier contains a lot of decision trees. The following steps are required to perform random forest classifier:

Firstly, there are  $k$  number of data points chosen from the training dataset. A decision tree is built that is associate to these  $k$  data points.

Steps 1 and 2 are repeated until generating  $N$  number of decision trees during the training period.

For a new data point, each of the trees generates the prediction values of  $y$  and assigns that data point to the average across all the predicted  $y$  values.

*Support Vector Machine* is one of the widely adopted classification techniques (Chen Junli et. al. 2000). The support vector machine (SVM) tries to find an optimal hyperplane that can classify data points in an  $N$ -dimensional space. SVM can be used with the data points of binary classes. Hence, SVM applies a kernel to transform the data points into a  $N$ -dimensional space where the classes can be separated linearly. To find the optimal hyperplane, SVM determines support vector that are basically two marginal data points of different classes. Support vectors are selected considering that the hyperplane should be positioned at the least possible distance from both of them. The idea of the support vector classifier is described in figure 1.



**Fig 1.** Support Vector Machine Classifier (Awad, M. et. al. 2015).

*XGBoost Classifier* (eXtreme Gradient Boosting) is a new classification method dated in 2016 (Chen Junli et. al, 2000). Tree boosting classifier is a highly efficient and widely used machine learning technique. XGBoost classifier is a popular implementation of the gradient boosting tree algorithm. Gradient boosting is a supervised learning algorithm, which predict a target variable by combining the estimates of a set of simpler models. Figure 2 illustrates schematically how gradient tree boosting works:

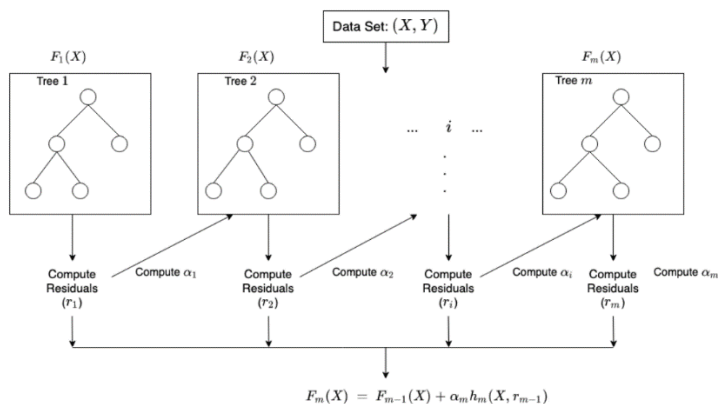


Fig 2. Diagram illustrating XGBoost classifier

### B. Case Study

In this paper we have worked with a public dataset to apply our models and to make prediction on android malware detection (Yerima, Suleiman 2018). The dataset has 216 variables and 15032 cases.

Firstly, we have done the preprocessing of the data. All the data are binary data, that's why all the methods mentioned in the previous section are classification methods. There were 10 outliers in all the dataset and they were removed from the dataset. Since all the data are binary, there were no need of standardization or normalization. The intention is to predict if a call made at an android application is malicious (S) or Benign (B). There are 5556 S calls and 9476 B calls. Secondly, we have coded the column *class*, which is the depended variable in binary numbers since it takes two values: S and B.

Machine learning techniques which we have used in this paper to predict android malwares are Naïve-Bayes classifier, K-Means classifier, Logistic Regression, Decision Tree classifier, Random Forest classifier, Support Vector Machine and XGBoost classifier. The aim is to conclude which is the best classifier method for predicting android malwares.

Python is used for programming all the machine learning techniques. We have used Anaconda Spyder (Python 3.9). Module *scikit-learn* is the most used module in python. This module contains the functions for all the algorithms presented in this paper.

### IV. RESULTS

Machine learning algorithms used for android malware detection are evaluated based on some criteria: confusion matrix, accuracy, precision, and recall. Figures 3-9 show the matrix confusion for each of the classifiers. Based on these matrices we can evaluate the classifiers model and analyze them.

Confusion Matrix for Naive Bayes Classifier

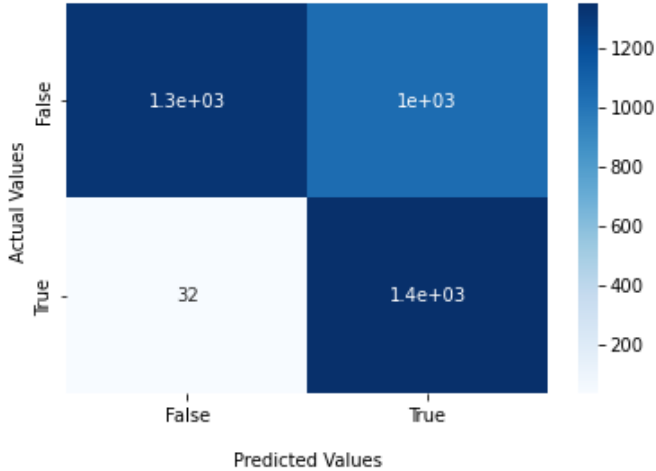


Fig 3. Confusion Matrix for Naïve-Bayes Classifier

Confusion Matrix for K-Means Classifier

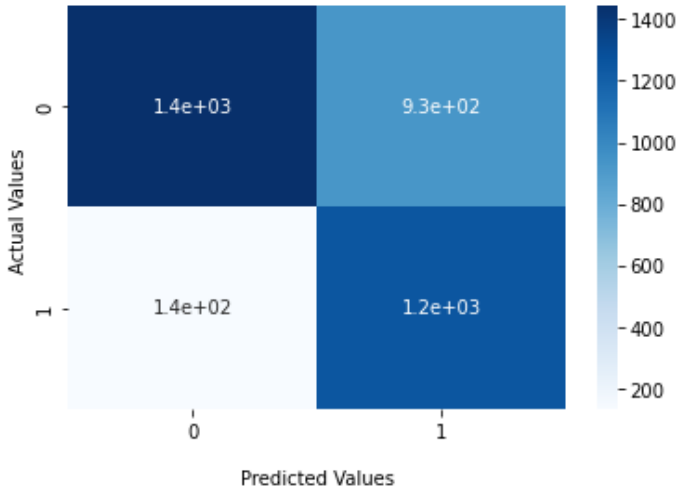


Fig 4. Confusion Matrix for K-Means Classifier

Confusion Matrix for Logistic Regression Classifier

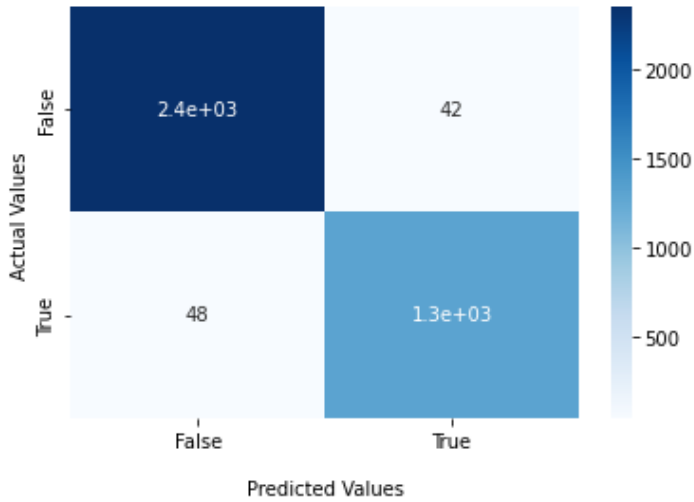


Fig 5. Confusion Matrix for Logistic Regression Classifier

Confusion Matrix for Decision Trees Classifier

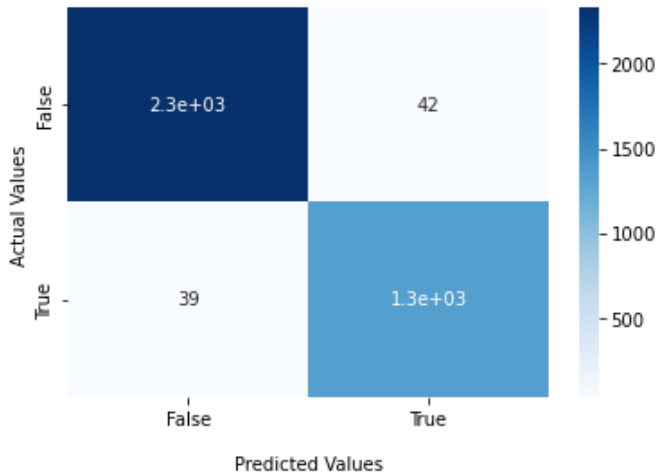


Fig 6. Confusion Matrix for Decision Tree Classifier

Confusion Matrix for Random Forest Classifier

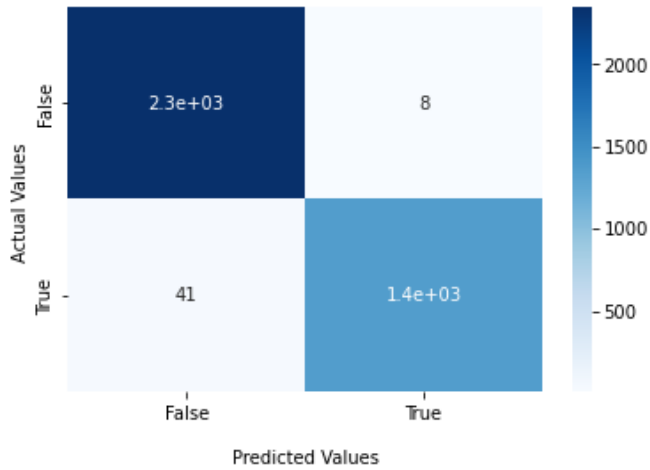


Fig 7. Confusion Matrix for Random Forest Classifier

Confusion Matrix for Support Vector Machine

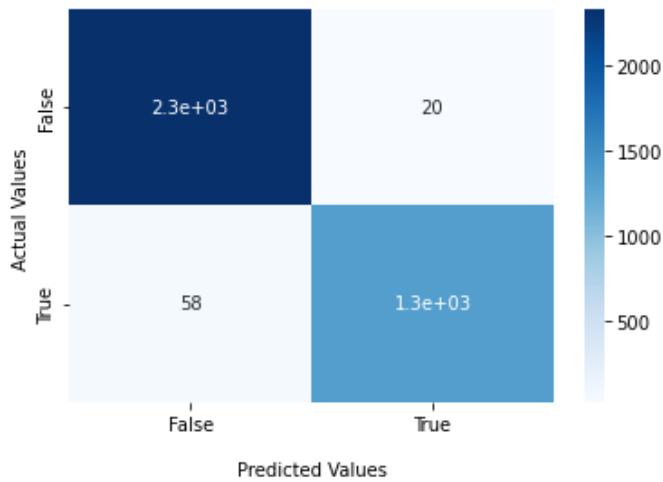


Fig 8. Confusion Matrix for Support Vector Machine

Confusion Matrix for XGBoost Classifier

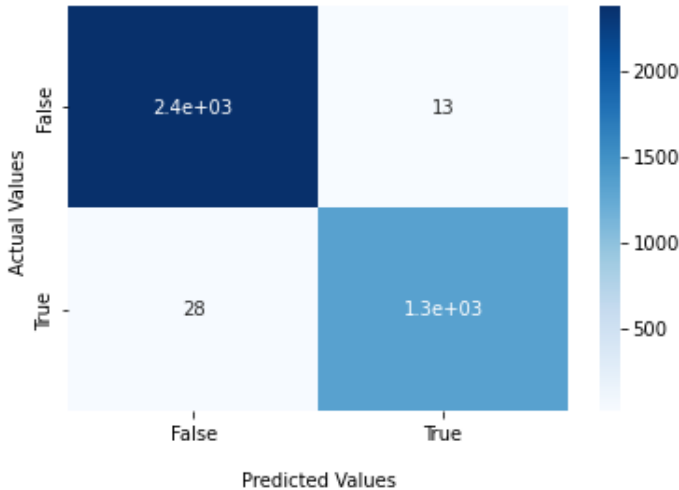


Fig 9. Confusion Matrix for XGBoost Classifier

It is clearly that all these techniques converge approximately at the same levels. Random Forest Classifier has less False-s predicted as Trues-s and Decision Trees Classifier has more False-s predicted as True-s. To have a better background of the valuation of machine learning techniques table 1 gives a summary of accuracy, precision and recall values for each method.

As seen in table 1, values of accuracy, precision and recall differs between different methods. K-Means gives the lowest value of accuracy followed by Naïve-Bayes Classifier. Logistic Regression, Decision Trees Classifier, Random Forest Classifier, Support Vector Machine and XGBoost give a very high value for accuracy. In this cases is difficult to distinguish one model as the best because in different executions these values has some small changes since the train/test dataset are chosen randomly.

Table 1. Evaluation of machine learning techniques

Machine Learning Techniques	Accuracy	Precision	Recall
Naïve-Bayes Classifier	0.7111	0.5624	0.9726
K- Means Classifier	0.7102	0.5678	0.9191
Logistic Regression	0.9755	0.9753	0.9586
Decision Tree Classifier	0.9718	0.9582	0.9665

Random Classifier	Forest	0.9869	0.9942	0.9707
Support Machine	Vector	0.9792	0.9853	0.9586
XGBoost		0.9891	0.9904	0.9785

For this reason, to have a better background of the evaluation of these metrics we have programmed some code and store the data for all these metrics for all the techniques in ten and twenty different executions. In the end, we calculated the mean of the values resulted in these different executions. When it was calculated the mean of ten randomly executions the third values were the same for all the methods with the value 0.9. When taking into consideration twenty executions accuracy, precision and recall values were 1.0 for all the machine learning techniques. Since, it was difficult to decide which of the methods is the best using the three metrics, we analyzed ROC Curve.

The ROC Curve (Receiver Operating Characteristic Curve) is a very important tool for evaluating classification methods. (Odusami, M. 2018) It is a chart that shows the performance of a classification model for all classification thresholds. The ROC curve plots both true positive rate and false positive rate. The perfect classifier shows a combination of two straight lines, from the origin point (0,0) to the top left corner (0,1) and then to top right corner (1,1). Figure 1 shows that we have classifiers for our data which have the perfect performance.

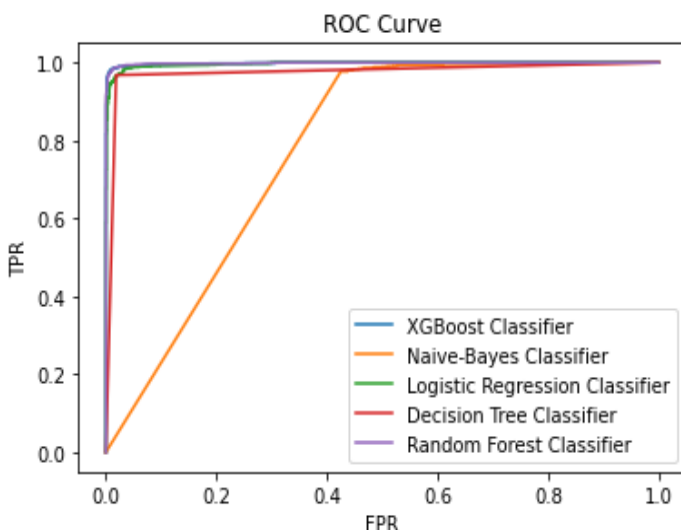


Fig 10. ROC Curve



Naïve-Bayes classifier seems to be the 'worst' of all the machine learning techniques for our data. XGBoost and Decision Tree classifiers are the perfect ones based on ROC Curve. From table 1 we see that even their evaluation metrics are so near each other with some small differences.

## V. DISCUSSION AND CONCLUSIONS

In this paper we have presented some android malwares and introduce some of their properties. In the second section, we have introduced some machine learning algorithms that we have used to detect android malware. The dataset that we analyzed had 216 variables and 15032 different cases. All the data were binary data and all the algorithms that were studied were classification algorithms. There were 10 outliers and no missing values. Based on the algorithms, Random Forest Classifier had less False-s predicted as Trues-s and Decision Trees Classifier had more False-s predicted as True-s. Based on the accuracy value, Random Forest Classifier and XGBoost classifier were the best with the higher accuracy value. But, we noticed that these values were not to much different from the accuracy value of Logistic Regression, Decision Tree Classifier and Support Vector Machine. For, this reason it was also presented the ROC curve. Naïve-Bayes classifier resulted the 'worst' of all the machine learning techniques for our data. XGBoost and Decision Tree classifiers are the perfect ones based on ROC Curve.

To conclude, XGBoost, Decision Tree Classifier and Random Forest Classifier were the best to detect and predict android malwares based on our data.

For further work, it is also important to test some deep learning techniques on these data, such are Artificial Neural Network, LSTM. Not just to have a comparison between machine learning techniques for predicting android malwares, but to extend this comparison between machine learning and deep learning techniques.

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# Orbital Forest and Territorial Systems in Tirana

## ABSTRACT

*Historically human development, including social and economic development is tightly connected to land-use and with “spatial planning” which from time to time has been either been planned or sprawl. Planning process is composed of a set of factors which do not act independently, and which are beyond the decision maker’s control and when they come together form a network of interactions of social, economic, political, natural, institutional factor which result on spatial scale. In this regard the aim of this study is to analyze the role of territorial system as a regional developmental strategy in territorial spatial planning. To do so it considers a real Albanian case, Orbital Forest and approaches to it by measuring the planning and implementation phase of Albanian territorial reform. The method used in this work is a mix of case study and content analysis and by processing the materials come up to some results among which the most noticeable one are that the main hindering factor which creates a handicap between planning and implantation of the reform is the large informal areas and the lack of ownership, and that the General Local Plan in Municipality of Tirana, Orbital Forest Case study. At a time when some countries are talking about walls, In Tirana we are building a wall of trees to oxygenate the city. The last strategic objective in Boeri 's General Local Plan 2030 proposes an “Orbital Forest” of 2 million trees, encircling Tirana, acting as a green belt to prevent urban sprawl.*

*Keywords: spatial planning, territorial planning, orbital forest, developmental system*

## I. INTRODUCTION

The fundamental theme regarding the reclamation of the natural dimension within Tirana's urban environment is divided into several different operational sections. These include a continuous orbital forest system around the city with two million trees, including protected nature parks and oases to preserve and nourish the local biodiversity, new ecological corridors along the Lana, Tirana and Erzeni rivers and a green circle known as the "4th Ring" intended as a linear public space for mobility and in a central position compared to the larger Tirana metropolitan area. The project also involves the relaunching of smaller centers as a widespread network for tourism, agriculture and production in communication with each other and with the urban area. In this way the project intends to polarize the chaotic density of the consolidated city through the enhancement of sparsely populated peri-urban areas and satellite centers, each with their own specific potential.

Tirana is affected by the three rivers that of Tirana, Lana and Tërkuçë. These three rivers create an important ecosystem for Tirana. Part of the plan is to create blue and green territories for these rivers. Water will be presented in blue and functional parks green surface.

One of the objectives of the GLP is to orient the development of the housing system by considering use and preservation of the land. For planning and management purposes the territory is divided into territorial units.

The territorial systems in which planning has been developed for the Municipality of Tirana and its 24 Administrative units are:

1. Urban System, is formed by the union of urban territories and is bordered by the green line;
2. Natural system, consists of landscapes, untouched natural spaces, ecological corridors;
3. Agricultural system, consists of agricultural land occupied by field plants, orchards, vineyards, olive groves, wherever it is located and has its essential features fertility and canals, reservoirs, etc. this system is the result of timely interaction between human activities for cultivation and agricultural construction in the territory place within this system;
4. Water system, is the totality of groundwater and surface water resources, including shores;

5. The infrastructure system, consists of the main infrastructure networks at national, county and local level.

Another innovation brought by Stefano Boeri Architeti is that of Vertical Forest. (Boeri 2018).

With the Tirana Master Plan and the first Vertical Forest, the Milanese architect brings to Albania, as well, his idea of a progressive Urban Forestation of the city and metropolitan areas of the world that, multiplying the presence of trees and forests, effectively fights climate change. A strategy that we promoted together with FAO with the first World Forum on Urban Forestation held in Mantua last November.

The plant biomass will mitigate atmospheric pollution by absorbing CO<sub>2</sub> and fine particles, producing oxygen and contributing to the creation of a healthier microclimate

## II. GENERAL CONTEXT OF SPATIAL PLANNING IN ALBANIA

Spatial planning is a solid public tool used by governments to establish a sustainable development of a specific territory with economic, social and environmental focus. The development of General Local Plans for each municipality of Albania orients and try to create stable and predictable conditions for investment and development by giving a special attention to the land use and natural resources of a specific territory. And what is benefited at the end of the planning process? We will have better developed communities which have their own territorial development goals. Spatial planning mediates between the respective claims on space of the state, market, and community. In so doing, three different mechanisms of involving stakeholders, integrating sectorial policies and promoting development projects mark the three schools of transformative strategy formulation, innovation action and performance in spatial planning. In territorial approaches, local actors – including the most marginalized actors – should have a direct hand in identifying challenges, priorities and interventions, and then jointly managing solutions.

Territorial approaches build on existing institutions or create new platforms for dialogue, negotiation and action that are both participatory and multi-actor. They may be initiated at various territorial levels and reach “up” to sub national or national levels or they may be initiated at national levels and reach “down” to the territorial level (participatory planning). The preparation

of the General National Plan (GNP) for Albania it has been a radical undertaking at the central government level in the framework of the new territorial division reform with the vision of presenting "Albania 2030". In is the highest territorial planning instrument in Albania, which addresses planning issues in an integrated way, seeing the Albanian territory as a whole. The General National Plan comes not only as a fulfillment of a legal obligation, but also as a necessity to achieve the objectives of the government program to increase the welfare of citizens and economic growth of the country, through mitigating inequalities, strengthening strategic partnership with neighboring countries and implementing policies that strengthen the competitiveness of economic sectors, thus guaranteeing integration into the European Union. It serves as a baseline for the regions and municipalities to develop the General Local Plans as sustainable models of territory development.

Territorial Planning and Development is based on Law No. 107/2014 "For Planning and territory development" (including any changes and by laws). This Law aims, among other things, to ensure the sustainable development of the territory; to assess the current and perspective potential for the development of the territory at national and local level; promote appropriate actions for the protection, restoration and enhancement of the quality of natural and cultural heritage; enable the right to use and develop the property; to create appropriate conditions and equal rights and opportunities for housing, economic and social activity for all social categories, economic and social cohesion and enjoyment of property rights; ensure that national and local planning authorities draft and update planning documents regularly; ensure that planning authorities coordinate their planning activities to promote harmonized and integrated territorial planning. Legal basis is as below:

1. Law No. 119/2020 "Për disa ndryshime dhe shtesa në Ligjin nr. 107/2014 "Për Planifikimin dhe Zhvillimin e Territorit", të ndryshuar
2. Law No. 42 datë 04.07.2019\_Për disa shtesa në Ligjin 107\_2014
3. Law No. 28 datë 23.03.2017 "Për disa ndryshime dhe shtesa në Ligjin Nr. 107/2014 "Për Planifikimin dhe Zhvillimin e Territorit", të ndryshuar"
4. Law No. 73, 2015 Për disa shtesa dhe ndryshime në Ligjin Nr.107, 2014
5. Law No. 107/2014 "Për Planifikimin dhe Zhvillimin e Territorit" me të gjitha ndryshimet

## 6. Law No. 107/2014 Për Planifikimin dhe Zhvillimin e Territorit

Republic of Albania, as well as defines their functions, competencies, rights and duties and those of the relevant bodies. Relating to the field of territorial planning and development, stipulates that municipalities in the field of infrastructure and public services are responsible in the territory of their jurisdiction for the planning, administration, development and control of the territory, in line with the law. In addition are mandated to on drafting strategic development plans and programs for local economic development.

1. Central level planning, which is performed through the following planning documents:

- ❖ General national plan, for the entire territory of the Republic of Albania;
- ❖ National sectorial plans, for all or part of the territory;
- ❖ Detailed plans for areas of national importance.

2. Local level planning, which is performed through the following planning documents:

- ❖ Sector plans at the regional level;
- ❖ General local plan;
- ❖ Detailed local plans.

### III. METHODOLOGY

Within this paper work was applied the qualitative research method mostly based on a real case study analysis. The procedural research was separated into two main phases: The first phase developed the research framework from acknowledged research in regard to spatial territorial planning, its general context in Albania, the related literature about the economic zones and clustering activities; the second phase a content analysis is done for data collected from the documents reviewed and the interview of the responsible representative of the economic zone.

The aim of the paper is to analysis and investigates the planning, implementation and development process of Orbital Forest in Municipality of Tirana. The procedural steps for the concrete result of the case study are as follow: firstly, I reviewed and analyzed all the documents which are relevant, like national spatial plans, local spatial plans, further documents for strategies of implementation of the approved territorial plans, etc. on this

review are analyzed the procedures, scopes and geographic local of the zone. Data were collected from the official government and municipalities websites.

The study is planned to be fulfilled with some other semi-structured interviews which will be categorized in three main groups: towards the administrators, toward the investors and towards the research groups.

#### **IV. CASE STUDY: ORBITAL FOREST AND TERRITORIAL SYSTEMS IN TIRANA**

Based on Law no. 107/2014 “Për Planifimin e Territorit” (changed) and bylaws in its implementation, is designed General Local Plan for the new administrative territory of the Municipality of Tirana.

During the drafting of this plan are legally and technically identified and defined through the ways of intervention in the territory as well as the development conditions, maximum limits of the extension of the urban system in the natural and agricultural environment, identified by the legal framework in force as the green city line.

During the drafting of the territorial strategy, this legal definition has been transformed into a multi-dimensional strategic project that affects the capital, influencing the legal, environmental and architectural aspects.

For the above, for the Municipality of Tirana, this strategic project defines the Orbital Forest (Metrobosco) of the capital. Orbital forest is defined as an instrument for curbing the consumption of agricultural and natural land, urban sprawl identified as the physical boundary of development and expansion of the urban system in the natural environment.

This border is defined in legal and technical terms as a belt with a function of naturalism, which will connect the existing suburban parks, agricultural areas, forest areas and areas around the lakes, thus being in itself one of the new green spaces of Tirana.

With an area of 2563.8 ha, this forest is conceived as a protective belt which will be able to block land consumption by creating a ring of fruit trees, parks, forests with naturalism generated by a defining strip of the capital of about 2 million from oak trees. This strategic plan involved in four systems, urban system, natural system, agricultural and infrastructural system (redevelopment and restructuring).



These facts have made this strategic plan achieved and affordable for the city and its citizens, and for this, this strategic plan deserves to be praised. All this strategy is applied through rules in the field of action and delimitation. This regulation determines the manner of intervention, spatial typologies according to the types of vegetation, instruments and rules for the implementation of the orbital forest through public instruments and public-private partnership when possible

Orbital Forest, also called Metrobosco, we find implemented in five environments and systems, where we list:

1. **Dajti National Park**, is considered a protected area and consists mainly of forests and some areas where there are water reservoirs, which serve mainly for family agricultural activities. this park includes the perfect habitat for activities related to sustainable tourism, such as hiking and mountain climbing.
2. **Natural Oases-Farkes Recreation Park**, the area surrounding Farka Lake is the point where the green belt penetrates the city, connecting the park with the fourth ring road and the urban environment of the south-eastern part of the capital. as a natural feature, the proximity to the Dajt national park and due to the absence of major pollution problems or concentration points, this area can be considered as a nature reserve, a protected area for wild species and recreational activities.
3. **Productive fruit forests**, the area between Vaqarr and Farka is the natural connection between the Erzen River Park and the Lake Park. It is characterized by hilly plains which in the past have been used for the exploitation of agricultural activities, negatively affected by the presence of the Sharra landfill that requires important environmental works.
4. **Agricultural areas**, this area bounded by the Tirana-Durres axis, is part of a large agricultural territory consisting mainly of fruit-bearing forests, which, although affecting the generation of the green silhouette of Tirana, enable the generation of agricultural economy in these territories. This area lies in the Allgate Lake Park, Kashar Lake Park to the north-eastern part of the Vaqarr Administrative Unit.
5. **Tirana River Park**, which consists of the youngest green space in the northern part of Tirana, part of the natural system of the river banks. Along this space are included recreational and natural surfaces, which will not only mark as landscape silhouettes the water

line of the Tirana River, but will also enable the generation of recreational activities for the northern part of the city. Along this space are included recreational and natural surfaces, which will not only mark as landscape silhouettes the water line of the Tirana River, but will also enable the generation of recreational activities for the northern part of the city.

At a time when some countries are talking about walls, In Tirana we are building a wall of trees to oxygenate the city. This for the sole reason, more over the past 28 years Tirana has faced a rapid population increase, hence urbanization developed faster than infrastructure needed to support its growth. The population of Tirana increased from 280.000 in 1989 to 1 million. The urban sprawl did not respect the standards of sustainable living, but it rather created a wrong philosophy where housing and business construction were the only things that mattered, everything else such as green or public spaces were undermined, hence there was a notable uneven distribution of green spaces vs buildings. Studies for Tirana indicate the ratio of open green space for 100,000 inhabitants is only 4.6ha, which is a low value. Also, since 2013, 2 monitoring stations installed within the urban area of Tirana indicate a very high level of air pollution.

To make things worse, in 2015 the territorial reform grew the Municipality of Tirana from 42 to 110 square kilometers, overnight. Immediate lasting actions were needed. Seeing and relying on the actions and experiences of different citizens... The initiative became the city's sensation. wanted to plant trees to celebrate occasions such as valentine's day, birthdays, gifts and to create lasting memories of their beloved ones.

## V. CONCLUSIONS AND RECOMMENDATIONS

This study is a comprehensive analysis of the spatial territorial planning process undertaken by Albanian government after the 2014 territorial reform which came into place as an emergent need and as a directive which is a must for EU integration. It takes into analysis a real case from Albania which is among the main component of the territorial reform, such as Orbital Forest, that helps to build a green belt across the capital.

Seeing and relying on the actions and experiences of different citizens. The initiative became the city's sensation. Suddenly, everyone in the city wanted to plant trees to celebrate occasions such as valentine's day, birthdays, gifts

and to create lasting memories of their beloved ones. The study has come up with some very interesting findings: after the long lasting transition in Albania which is also currently taking place the 2014 territorial reform is among the very crucial developments of the country; when we analyze the case Orbital Forest, as a balance between the city and nature rediscovered. New yellow line of Tirana will be the Orbital Forest and this idea comes from the Italian architect Stefano Boeri.

The project enables this park to be like a lung and a transportation line. Through it, the urban line and the interurban line are clearly separated. The forest is the point that makes the division between urban and peri-urban area. Some recommendations for further follow up, for territorial approaches to achieve and realize their potential, I would personally suggest that it is important to develop strategies to encourage people daily life, private sectors, state sector and a good mix of all the actors.

Public Relationship (PR) is another strategy that should be followed to the good work was accomplished and that makes proud those who have conducted and the motivation of other individuals.

This project will last about 15 Years and therefore it would be important to support this plan by all actors involved or not. The government may change and there may be blockages, due to dissenting opinions. For this reason, there must be a unification of ideas at the moment a plan is implemented. Because due to the fierce political war things always remain in the middle.

But like everything there are opinions against and in favor and in this strategic plan we split into two groups, whether plain or simple individual specialist. I would like to share with you an opinion different from public opinion.

This type of greenery, have once called green crown of Tirana, because generations of trees around the capital stick "head" as a crown. For a forest to be "orbital", it must revolve around something else - because, as we noted at the top, the orbit as a circular trajectory of a body cannot be separated from the sense of motion. And in conclusion, without thinking against there is no development and being discussed at the round table with all actors and interest groups.

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## R-MODULE Containing a Finite Number of Non Isomorphic Bases to Each-Other

**ABSTRACT.**

*The Bases, as a mathematical concept, is determinant for the content of algebraic structures of vector spaces and  $R$ -modules. The base as a subset of a set that forms the algebraic structure has various particular closely related to the algebraic operations defined in the structure. Thus in a vector space one of the main particular of bases is their isomorphization. Not every  $R$ -module base has this peculiarity. In a  $R$ -module the bases are not always isomorphic between them. Furthermore are found  $R$ -modules that have bases with different number of elements.*

*In this article, in the role of a counterexample, is treated a special  $R$ -module containing different bases that are not isomorphic to each other. The  $R$ -module treated in this article contains different  $n$  bases with number of elements  $i = 1, 2, 3, \dots, n$  where  $n$  is any integer positive number.*

**Keywords:** *non-isomorphic bases,  $R$ -modules, integer*

## I. INTRODUCTION.

### *Definition of module*

Let  $R$  be a ring with identity.

The nonempty  $M$  set together with two operations: the first one that is called addition and is marked by  $+$  bounds each  $(u, v) \in M \times M$  pair with a  $u + v \in M$  element; and the second operation, the left scalars multiplication, denoted by juxtaposition, bounds each  $(r, u) \in R \times M$  pair with an  $ru \in M$  element, is defined **the left R-modul** if the following properties are held:

1.  $M$  is an abelian group under addition.
2. For each  $r, s \in R$  and  $u, v \in M$  we have

$$r(u + v) = ru + rv$$

$$(r + s)u = ru + su$$

$$(rs)u = r(su)$$

$$1u = u$$

The  $R$  ring is called the basic ring of  $M$ , whose elements are called scalars.

### *Linear independence*

A  $S$  subset of  $M$  module is linearly independent if only if for each  $v_1, v_2, \dots, v_n \in S$  and  $r_1, r_2, \dots, r_n \in R$ , we have:

$$r_1v_1 + r_2v_2 + \dots + r_nv_n = 0 \Rightarrow r_i = 0 \text{ for each } i = 1, 2, \dots, n.$$

### *Spanning (Generated) set.*

A  $S$  subset of  $M$  module spans (or generates)  $M$  if only if for each  $u \in M$ , we have:

$$u = r_1v_1 + r_2v_2 + \dots + r_nv_n$$

for some  $r_i \in R$  and  $v_i \in S, i = 1, 2, \dots, n.$

### *Basis of module.*

A  $B$  subset of  $M$  is the basis if  $B$  is linearly independent and spans (generates)  $M.$

## II. CONSTRUCTING OF NON COMMUTATIVE RING ( $R, +, -$ )

Let  $A$  be a random ring with identity. By means of its elements we construct  $[a_{ij}]$  matrices with an infinite number of rows and columns. Thus, the indices  $i, j \in \square$  where  $\square$  is the set of natural numbers.

Let  $m \in \square$  a random natural number.

Now let's take into consideration finite-rows matrices such that: for  $1 \leq i \leq m$  the rows of  $[a_{ij}]$  matrix have any element of  $A$  ring as their components and for  $i > m$  the rows of  $[a_{ij}]$ , matrix have the zero element of  $A$  ring as their components.

These matrices make up the  $R$  set.

In the  $R$  set we define the operation of adding and multiplication of finite-rows matrices the same way as we define the adding and multiplication operation of finite matrices .

Thus:

$$[a_{ij}] + [b_{ij}] = [t_{ij}] \text{ ku } t_{ij} = r_{ij} + s_{ij} \text{ for each } i, j \in \square;$$

$$[a_{ij}] \cdot [b_{ij}] = [u_{ij}] \text{ ku } u_{ij} = \sum_{k \in N} a_{ik} b_{kj} \text{ for each } i, j \in \square.$$

These two operations are well-defined. Indeed:

For the adding operation:

If the  $a_{ij}$  and  $b_{ij}$  elements stand in the rows with indices  $i \leq m$  of the matrix, then they are random elements of the  $A$  ring, and as a result even their sum  $t_{ij}$  is a random element of the  $A$  ring.

If the  $a_{ij}$  and  $b_{ij}$  elements stand in the rows of  $i > m$  indices then they are equal to the 0 element of the  $A$  ring, as a result even their sum  $t_{ij}$  equals zero.

Thus the matrix  $[t_{ij}]$  is a finite-row matrix and contains random element of the  $A$  ring, in the rows with indices  $i$ , for  $1 \leq i \leq m$ , and the zero element of the  $A$  ring in the rows with indices  $i$ , for  $i > m$ . So, the matrix  $[t_{ij}] \in R$ .

For the multiplication operation:

For  $i \leq m$  and  $k \leq m$  the elements  $a_{ik}$  and  $b_{kj}$  are random elements of the  $A$  ring. As a result even  $s_{ij} = \sum_{k \in N} a_{ik} b_{kj}$  are random elements of the  $A$  ring.

For  $i > m$  and any  $k$  the elements  $a_{ik}$  are all equal to the 0 element of the  $A$  ring. As a result even  $s_{ij} = \sum_{k \in N} a_{ik} b_{kj}$  are all equal to the 0 element of the  $A$  ring.

Thus the matrix  $[s_{ij}]$  is finite-row matrix and contains random elements of the  $A$  ring in the rows with indices  $i$ , for  $1 \leq i \leq m$ , and zero element of the  $A$  ring in rows with indices  $i$ , for  $i > m$ .

So, the matrix  $[s_{ij}] \in R$ .

Now let's show that the  $R$  set together with the two operations previously defined make up a ring.

The sum of two finite-rows matrices is reduced to the adding operation of the elements of the  $A$  ring That's why  $(R, +)$  is abelian group. The multiplication operation of the finite-rows matrices is the same as the common multiplication operation of matrices, so that we can conclude that  $(R, +, \cdot)$  is a ring.

### III. CONSTRUCTING OF BASES WITH DIFFERENT CARDINALS FOR R-MODULE R.

Let examine the ring  $(R, +, \cdot)$  as  $R$ -module  $R$  and let's show that this module has basis of different cardinals.

Let  $c^{(1)}$  be the matrix  $[a_{ij}]$  for which  $a_{ij} = 1$  when  $j = 2(i - 1) + 1$  and  $a_{ij} = 0$  otherwise.

So,  $a_{11} = a_{23} = a_{35} = \dots = a_{i,2i-1} = 1$  whereas the other components are equal to 0.

Let  $c^{(2)}$  be the matrix  $[a_{ij}]$  for which  $a_{ij} = 1$  when  $j = 2(i - 1) + 2$  and  $a_{ij} = 0$  or else. Thus  $a_{12} = a_{24} = a_{36} = \dots = a_{i,2i} = 1$  whereas the other components are equal to 0.

Thus:

$$c^{(1)} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & \dots \\ 0 & 0 & 1 & 0 & 0 & 0 & \dots \\ 0 & 0 & 0 & 0 & 1 & 0 & \dots \\ \dots & \dots & \dots & \dots & \dots & \dots & \dots \end{bmatrix} \text{ and } c^{(2)} = \begin{bmatrix} 0 & 1 & 0 & 0 & 0 & 0 & \dots \\ 0 & 0 & 0 & 1 & 0 & 0 & \dots \\ 0 & 0 & 0 & 0 & 0 & 1 & \dots \\ \dots & \dots & \dots & \dots & \dots & \dots & \dots \end{bmatrix}$$

The set  $\{c^{(1)}, c^{(2)}\}$  is basis for the  $R$ -module  $R$ .

To show that this set serves as a basis we at first must show that this set generates  $R$  and that it is linearly independent.

Let this random matrix  $[a_{ij}] = \begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{14} & a_{15} & \dots \\ a_{12} & a_{22} & a_{23} & a_{24} & a_{25} & \dots \\ a_{13} & a_{32} & a_{33} & a_{34} & a_{35} & \dots \\ a_{14} & a_{42} & a_{43} & a_{44} & a_{45} & \dots \\ \dots & \dots & \dots & \dots & \dots & \ddots \end{bmatrix}$  be part of set

$R$ .

Referring to the  $[a_{ij}]$  matrix, let's mark by  $a^{(1)}$  the matrix formed by columns with indices  $2(i - 1) + 1$  and let's mark by  $a^{(2)}$  the matrix formed by columns with indices  $2(i - 1) + 2$ . Thus,

$$a^{(1)} = \begin{bmatrix} a_{11} & a_{13} & a_{15} & \dots \\ a_{21} & a_{23} & a_{25} & \dots \\ a_{31} & a_{33} & a_{35} & \dots \\ \dots & \dots & \dots & \ddots \end{bmatrix} \text{ and } a^{(2)} = \begin{bmatrix} a_{12} & a_{14} & a_{16} & \dots \\ a_{22} & a_{24} & a_{26} & \dots \\ a_{32} & a_{34} & a_{36} & \dots \\ \dots & \dots & \dots & \ddots \end{bmatrix}$$

It is true the equation:

$$a^{(1)}c^{(1)} + a^{(2)}c^{(2)} = [a_{ij}]$$



This equation shows that the set  $\{c^{(1)}, c^{(2)}\}$  spans (generates)  $R$ .

Now let's show that the set  $\{c^{(1)}, c^{(2)}\}$  is linearly independent.

Let's have the linear combination  $r^{(1)}c^{(1)} + r^{(2)}c^{(2)} = [0]$ , with the scalars  $r^{(1)}, r^{(2)} \in R$ .

Let's suppose that  $r^{(1)} \neq [0]$ . This means that in this matrix there is at least one component different to zero. Suppose that this component is  $x_{kt} \neq 0$ .

Examine the linear combination of the row with index  $k$  of the matrix  $r^{(1)}$  and the linear combination of the column with index  $2(t-1) + 1$  of the matrix  $c^{(1)}$ . In the matrix  $c^{(1)}$ , in its  $2(t-1) + 1$  indexed column all the components are equal to 0 except of  $c_{t,2(t-1)+1}$  component which is equal to the element 1 of  $A$  ring.

Thus, in the matrix  $r^{(1)}c^{(1)}$  for the  $u_{k,2(t-1)+1}$  component it is true the equation:

$$u_{k,2(t-1)+1} = x_{kt} \cdot c_{t,2(t-1)+1} = x_{kt} \cdot 1 = x_{kt} \neq 0$$

In the  $r^{(2)}c^{(2)}$  matrix, the component with index  $v_{k,2(t-1)+1}$  is equal to 0. Indeed:

In the  $c^{(2)}$  matrix, the columns that have components different to 0 are the only one with indices  $2(t-1) + 2$ , whereas all components of the columns with  $2(t-1) + 1$  indices are equal to 0.

Therefore :

$$v_{k,2(t-1)+1} = \sum_{k \in N} r_{kt} \cdot c_{t,2(t-1)+1} = \sum_{k \in N} r_{kt} \cdot 0 = 0$$

Finally in the matrix  $r^{(1)}c^{(1)} + r^{(2)}c^{(2)}$ , for the  $a_{k,2(t-1)+1}$  component we have:

$$a_{k,2(t-1)+1} = u_{k,2(t-1)+1} + v_{k,2(t-1)+1} = x_{kt} \neq 0$$

This conclusion contradicts the fact that  $r^{(1)}c^{(1)} + r^{(2)}c^{(2)} = [0]$ .

That's why it is alluded that  $r^{(1)} \neq [0]$  and what remains is that  $r^{(1)} = [0]$ .

The same way of reasoning is followed to show that  $r^{(2)} = [0]$ .

So, the set  $\{c^{(1)}, c^{(2)}\}$  is linearly independent.

Finally the set  $\{c^{(1)}, c^{(2)}\}$  is the basis of  $R$  and the cardinal of this basis is 2.

Let's take  $n = 3$ . Let's mark by:

$c^{(1)} = [a_{ij}]$  for which  $a_{ij} = 1$  when  $j = 3(i-1) + 1$  and  $a_{ij} = 0$  in other cases;

$c^{(2)} = [a_{ij}]$  for which  $a_{ij} = 1$  when  $j = 3(i-1) + 2$  and  $a_{ij} = 0$  in other cases;

$c^{(3)} = [a_{ij}]$  for which  $a_{ij} = 1$  when  $j = 3(i-1) + 3$  and  $a_{ij} = 0$  in other cases.

Reasoning the same way, it is concluded that the set  $\{c^{(1)}, c^{(2)}, c^{(3)}\}$  is the basis of the  $R$ -module  $R$  and the cardinal of this basis is 3.

In general, if  $n$  is a random natural number then as a basis for the  $R$ -module  $R$  serves the set  $\{c^{(1)}, c^{(2)}, \dots, c^{(n)}\}$  where  $c^{(k)} = [a_{ij}]$  for which  $a_{ij} = 1$  when  $j = n(i-1) + k$  and  $a_{ij} = 0$  in other cases for  $k$  that accomplishes the condition  $1 \leq k \leq n$ .

#### IV. CONCLUSIONS.

There is at least one  $R$ -module finite with scalar received from an non commutative ring that for each natural number  $n$  has  $n$  bases with different cardinals from one another. This example, in the role of counterexample, confirms that assertion is not true, "the basics of an  $R$ -module are isomorphism between them".

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