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Survey on Student Performance Analysis System based on Machine Learning

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ABSTRACT: This paper is about Learning-based performance analysis of results, which is a system that strives for excellence at different levels and dimensions in the student's area of interest. This system is only meant to analyse and predict how students will do. The proposed framework looks at the demographic, academic, and psychological traits of students to get as much information as possible from them, their teachers, and their parents. In the proposed paper, different machine learning algorithms have been compared on how well they solve the problem statement.

I. INTRODUCTION

Education is a key part of a country's long-term economic progress and a big part of how it grows and changes. The literacy statistics show the percentage of students who fail because they quit school or don't do well in certain classes. The number of people who can read and write is going up all over the world. In particular, failing a core class like math is a big deal because it gives you the knowledge you need to do well in the rest of your classes. A school has to keep track of all of its students' information, which makes for a big database.

Educational data mining uses many methods, such as decision trees, Naive Bayesian, neural networks, k-nearest neighbour (KNN), and many others. With these methods, you can find out a lot of things, like association rules, classifications, and clustering. It showed what kinds of data could be collected, how to pre-process the data, how to use data mining methods on the data, and how to get the most out of the new knowledge. From the extracted data, you can learn a lot of different things. In this age of "big data," a lot of structured and unstructured data about students is made every day. Big Data is hard to work with and needs software that runs on a lot of computers at the same time. Previous research looked at the most common ones, like attribute selection and classification methods like the decision tree method.

The proposed work analysis various factors affecting the performance of students, data which is collected from domain experts such as psychiatrist with respect to factors affecting students' performance are considered, before feeding the data to ML algorithms the exploratory data analysis is done. In this stage distribution nature of data, scaling of data to standard values, analyzing the missing data and compensating null values is done. Having done EDA data is fed to ML model to train the model. Later it is saved in the form of pickle file and performance analysis is done.

II. LITERATURE SURVEY

IhsanA. Abu Amra, AshraY.A[2] says that techniques for finding hidden information and patterns about student performance are growing quickly. This paper suggests a model for predicting how well students will do in school by using two classification algorithms, KNN and Naive Bayes, on a set of data from the Ministry of Education in Gaza Strip for 2015 about secondary schools. The main goal of this kind of classification is to help the Ministry of Education improve performance by letting them know early on how well students will do. Teachers can also use the right tests to help students learn more. The results of experiments show that Naive Bayes is better than KNN because it gets the highest accuracy score (93.6%).

Nikita Gorad, Ishani Zalte[3], choosing the right career is one of the most important decisions, and as the number of career paths and opportunities increases, it becomes very difficult for students to make this decision. According to a survey by the Scientific and Industrial Research Council (CSIR), about 40% of students are uncertain about their career options. This can lead to incorrect choices of profession and subsequent work in areas they did not intend, reducing talent productivity. Therefore, it is very important to make the right career choice at the right age to prevent the consequences of the wrong career choice.

Ganeshan et al. [4] proposed a web-based analysis system for student counseling and performance analysis. This system uses the techniques used in recommended systems. It divides students into similar groups. When a new student comes, this system assigns him a group by analyzing his features and also offers him similar courses.

Lopez et al. [5] proposed a data mining approach-based model for academic attrition (loss of academic status) at the University of Colombia. Two data mining models were defined to analyze the academic and nonacademic data, the models use two classification techniques, naive Bayes and a decision tree classifier, in order to acquire a better understanding of the attrition during the first enrolments and to assess the quality of the data for the classification task, which can be understood as the prediction of the loss of academic status due to low academic performance.

B.K Baradwaj, S.Pal [9] The model aims to predict the sales of the first four registrations of a student. First consider one of these periods, then at a particular registration. To train the model and measure their performance with various algorithms publically hosted dataset available in the kaggle repository have been considered.

III. METHODOLOGY

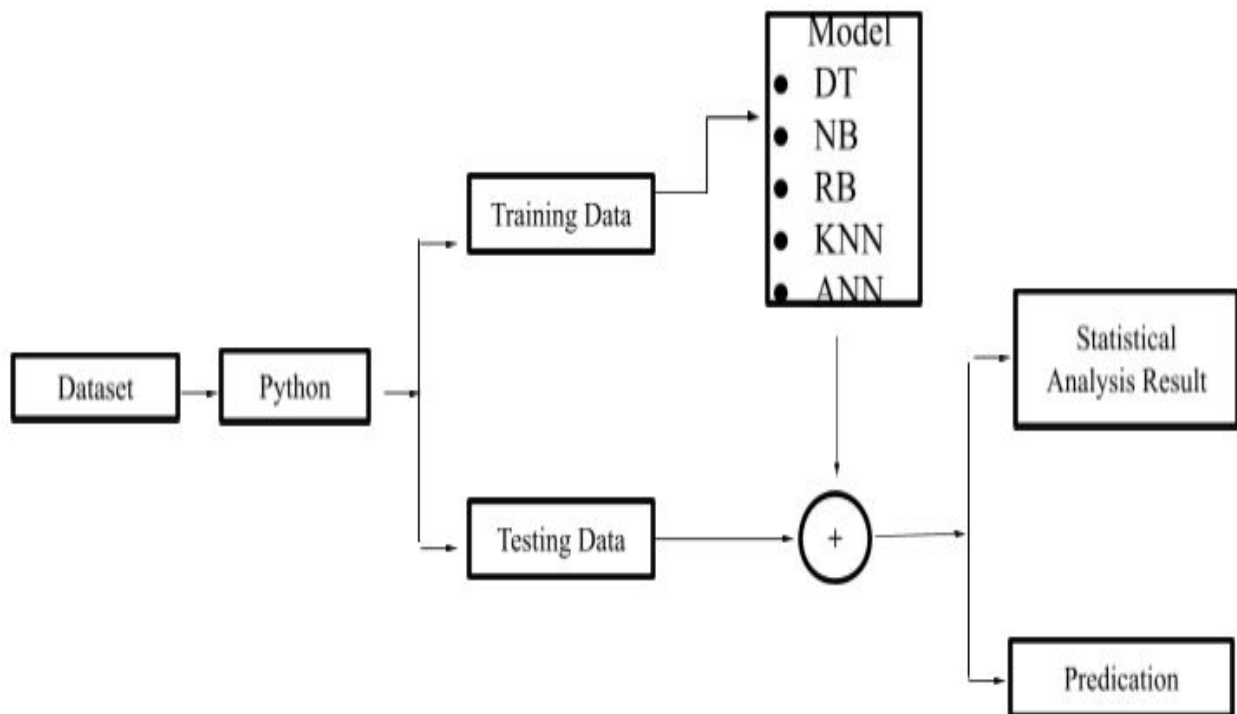


Fig.1.: Schematic Diagram of Data Analysis and Prediction Model

The above diagram shows the adopted methodology in the proposed system, dataset which plays key role on the end result is collected form the kaggle repository, it is analyzed using python libraries such as pandas, preprocessing is done using pandas, then it is split into training and test data to measure accuracy, this data is fed to Machine Learning algorithm to build the model, performance of each model backed by algorithms is measured using statistical analysis and end result is displayed.

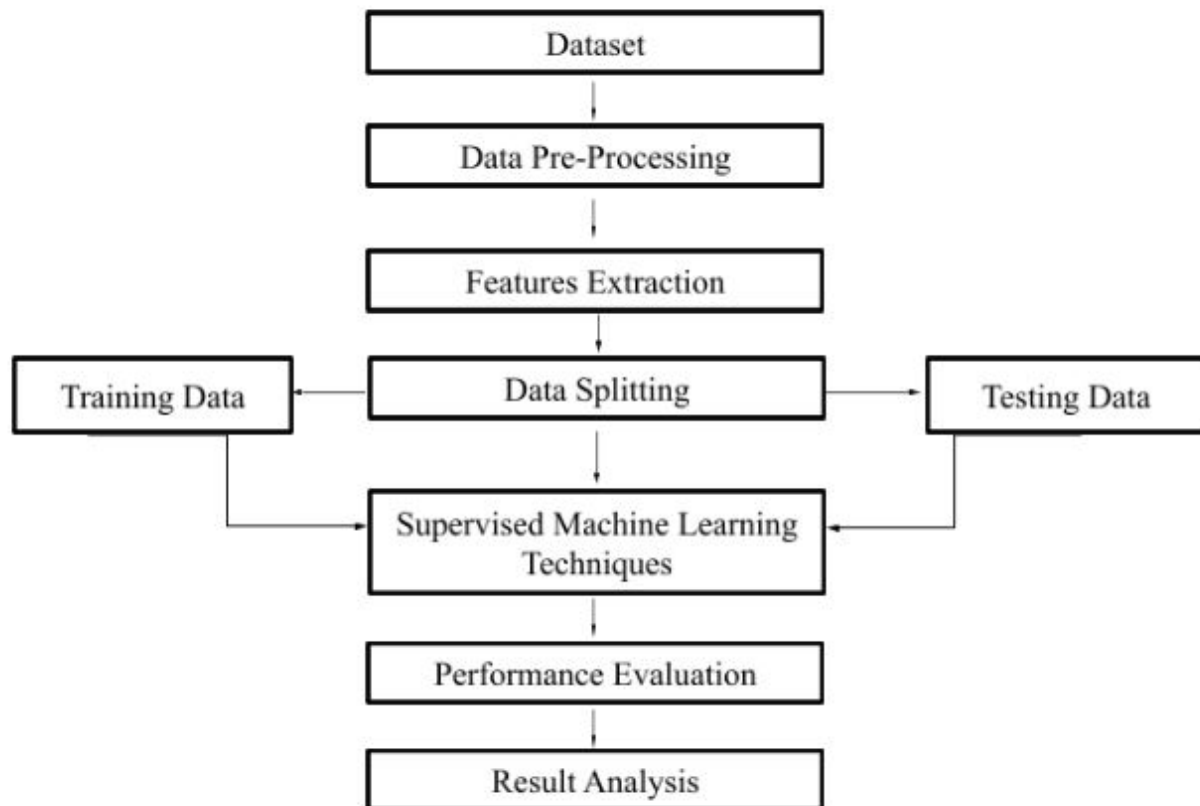


Fig.2.: Methodology in Student Performance Analysis

- **Dataset:** A collection of data pieces that can be treated by a computer as a single unit for analytic and prediction purpose.
- **Data Pre-processing:** It is the process of transforming raw data into an understandable format. It is also an important step in data mining as we can't work with raw data.
- **Feature Extraction:** It refers to the process of transforming raw data into numerical features that can be processed while preserving the information in the original dataset.
- **Data Splitting:** It is used to split data into a train, test, or validation set.
- **Training Data:** It is an extremely large dataset that is used to teach machine learning model.
- **Testing Data:** It is separate set of data used to test the model after completing the training.
- **Supervised Machine Learning Technique:** Regression and classification, classification separates the data, regression fits the data.
- **Performance Evaluation:** It is an important aspect of the machine learning process. However, it is complex task.
- **Result Analysis:** It provides valuable things from mining so that it can provide information which helps in analysis of student performance and making career decisions and processes.

IV. DIFFERENT DATA MINING TECHNIQUES USED FOR PREDICTING STUDENT’S PERFORMANCE

Serial No.:	Author’s	Attributes which affect prediction accuracy	Result (accuracy)				
			DT	NB	RB	KNN	ANN
1.	F Sarker et. al.	Internal attributes + students’ first semester mark (Model1)	--	--	--	--	74.5
2.	F Sarker et. al.	Int + Ext attributes + students’ first semester mark (Model2)	--	--	--	--	76.5
3.	F Ahmad et. al	Gender, race, hometown, GPA, family income, uni. mode entry, SPM grades	--	67.0	71.3	--	68.8
4.	Mashaal A.et. al.	first midterm exam (Predict Students Failure)	--	91	55.0	--	89.8
5.	M Suljic et. al.	GPA, URK , MAT, VRI	--	76.6		--	73.9
6.	R Asif et. al.	HSC, MPC and HSC marks, pre-uni marks, marks in different courses	73	83.6	56.9	74	67.6
7.	El-Halees et. al.	SS_Type, HSC marks, City, Gender, Speciality	--	67.5	71.2	--	--
8.	A Aziz et. al.	Gender, race, Hometown Location, Uni Entry Mode, Family Income	68.8	63.3	68.8	--	--
9.	K D Kolo et.al.	status, gender	66.8	--	--	--	--
10.	Jyoti Bansode	SSC marks, SSC medium, Admission type, mother’s occupation	85	--	--	--	--
11.	R. Sumitha et. al.	TWM, MOE, TOB, ATD ECUT, CGPA, arrears,	97.2	85.9	96.1	--	--
12.	S V. Shinde et. Al	Student’s Internal Assessment	97.5				
13.	M Pandey et. al.	Academic information’s, Demographic information	98.8	91.5	84.1	--	--
14.	N Goga et. al.	family, PEP, EES, end of the first session result	99.9	--	96.7	--	--
15.	G. S Josan et. al.	Sex, INS-High, TOB, MOI, TOS, PTUI, SArea, Mob, Com-HM, Netacs, Int-GR, Atdn.	69.7	65.1	--	--	--
16.	M Koutina et. al.	Another master, Comp literacy, Bachelor in	68.5	100	90.9	100	--
17.	D. Kanojia	Comparison of naïve basian and KNN classifier	--	93.70	--	63.65	--
18.	B. Harish Kumar Reddy	Gender, Age, Marital Status, No of children, Occu., Job associated with PC, Bachelor,	--	--	71.3	--	--

Table 1: Different data mining techniques used for predicting student’s performance1to15[17]

With respect to the table 1–15 above [17]. In the field of educational data mining, it is common to make predictions about how well a student will do in school. For predictive modelling, you need to use techniques like classification, clustering, association rule mining, and regression analysis. Almost all research papers look at the only classification algorithm for figuring out how well a student will do. There are many classification methods for making predictions, but we are looking at decision trees, naive bays, support vector machines (SVMs), artificial neural networks (ANNs), K-nearest neighbours, linear regression, etc. Random forest, random tree, REPTree, LADTree, J48, and so on. Table shows the different research papers, who wrote them, and the most important things about them that help predict how accurate the different data mining algorithms are.

Using the Naive Bayes and K-Nearest Neighbor algorithms, Maria Koutina and Katia Lida Kermanidis got an accuracy of 100° in their work. "Overall accuracy of resample data and feature selection (percent)" is where the results are shown. Gender, age, marital status, number of children, occupation, occupation, computer-connected, bachelor's degree, another master's degree, computer skills, and a bachelor's degree in computer science can be used to predict how well a student will do in school.

V. DISCUSSION ON THIS PREDICTING STUDENT’S SURVEY

In this particular section, They will discuss the main findings of our analysis. In this analysis, we found that the most used data mining algorithms for Decision Tree, Naive Bayes , Artificial Neural Networks, Rulebased and K-Nearest Neighbor. In Decision tree algorithm, the maximum and minimum accuracy for predicting student's academic performance are 99.9% and 66.8% respectively. To find the maximum prediction accuracy, Maria Goga, Shade Kuyoro and Nicolae Goga used the combination of students' attributes like family, PEP, EES, end of first session result. . In Naive Bayes algorithm, the maximum and minimum accuracy for predicting a student's academic performance 100% and 63.3% respectively. Maria Kotina and others. Maximum with different combinations of student attributes such as gender, age, marital status, number of children, profession, computer-related profession, bachelor's degree, another master's degree, computer skills, bachelor's degree in computer science, etc. Obtained the accuracy of with rule-based algorithms, the maximum and minimum accuracy for predicting student performance is 96.7% and 55.0%, respectively. Maria Gogaetal to find the maximum prediction accuracy. At the end of the first session, we used a combination of student attributes such as family, PEP, EES, and results. With the KNearest Neighbor algorithm, the maximum and minimum accuracy for predicting student performance is 100% and 74%, respectively. With Artificial Neural Networks (ANN), the maximum and minimum accuracy for predicting student performance is 89.8% and 67.6%, respectively. Mashael A. Al Barrak and Mona S to find the maximum prediction accuracy. AlRazgan used a combination of student attributes, such as the first midterm exam of the first-year course.

Data Mining Technique	Decision Tree	Naïve Bayes	Rule Based	K-Nearest Neighbor	Neural Network
Highest Accuracy	99.9%	100%	96.7%	100%	89.9%
Lowest Accuracy	66.8%	63.3%	55%	74%	67.6%
Average Accuracy	83.35%	81.65%	75.85%	87%	78.7%

Table 2.: Show the prediction accuracy that uses classification method grouped by algorithms for predicting student performance.

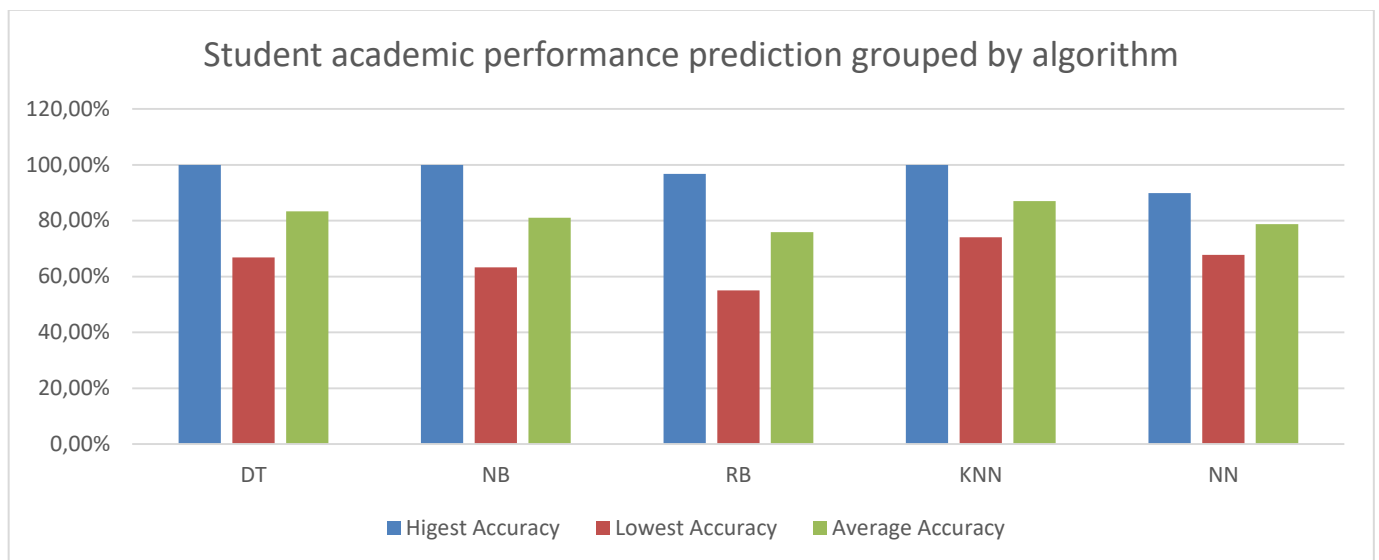


Fig.3.: Student Academic Performance Prediction Grouped by Algorithm used

VI. CONCLUSION

Education is very important in today's generation, and how to analyze the school's education system and predict the progress of educational institutions is very important. The focus of the proposed automation system is to predict the progress of the institution. The proposed automation system focuses on making predictions about students' academic performance and social behavior. The accuracy of the model is also calculated. Another area is to use a support vector machine (SVM) to create a classifier and analyze suitable classifiers to perform the classification.

VII. FUTURE WORK

In the future, one could list out the areas on which should supposed to pay attention to improve the efficiency of student performance. You can derive a user interaction model to dynamically provide student records and alert staff about poor grade students. You can make predictions with neural networks and expect improvisational results. You can add non-academic attributes along with academic attributes. In the proposed system, a naive Bayes algorithm is used for classification and prediction. Similarly, many such algorithms can be used to classify and predict student behavior and academic performance. Due to the small volume of the dataset under consideration, future work will use larger datasets and compare the results with other classification algorithms.

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