STUDENT GENERAL PERFORMANCE PREDICTION USING MACHINE LEARNING ALGORITHM

Shikha Pachouly[1], Shubham Zope[2], Rupesh Rajput[3], Atharva Raut[4], Krsinakant Patil[5]

[1]*Computer, AISSMS COE, No1, Kennedy Road, Pune, 411001, Maharashtra, India.*

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Abstract — **After the pandemic and major changes in the education system (online education system) and in students' personal lives, such as dealing with personal loss and social anxiety, which increase dropouts, learning losses, and the digital divide In traditional education system, we only consider the marks obtained by students to evaluate academic performance, but we should also consider the mental condition of the student in which he is being evaluated, just like when we increase time or any service to those who are handicapped. So, for a fair evaluation, or to put it another way, a student-centric approach, we predict student academic performance by taking into account traditional factors as well as his emotional state, interest, and what he has done in his free time or in his interested field data by developing ML models using various algorithms. To do so, we will first create some sets of questionnaires to collect data for our research project, and then, using data analysis and classification, we will implement different ML models and test their accuracy, recall, and precision.**

Keywords — **Performance, Digital Divide,Traditional Education System,Emotional State, Interest,Questionnaires, Data Analysis, Classification, ML models, Accuracy, Recall, Precision.**

I.   INTRODUCTION

Following the pandemic and significant changes to the educational system and students' personal life, such as coping with bereavement and social anxiety, dropout rates and academic losses increased, the digital divide, too. Up until now, we have only evaluated a student's academic success based on the mark they received. The existing educational system results in a dreadful experience for more than 50% of students who are not good at what they are doing, according to the current academic performance evaluation method and honest feedback from a student who is average or below average in education. When more than 50% of students lack enthusiasm for studying, the educational system has failed. We considered a strategy where we would evaluate student using the current educational system while also including additional information, such as their emotional state and interest. Moreover, their work in interested sector. This might make their appraisal of the educational system fairer. The primary goals of this are to raise student general performance and prevent dropouts. The performance of the student is dependent on a number of elements, including their mental state in addition to their grades and academic course work. In light of this, we will carry out a survey in which we will inquire about things like your home, your grades in the 10th and 12th grades, your financial situation, etc. We can determine where the learner is falling behind and where he or she needs to improve by carefully examining these answers. We can help students perform better by adding these answers as an additional feature to our machine learning model.

A system that aims for excellence at all levels and aspects of the students' interest is performance analysis of learning outcomes. This study proposes a comprehensive EDM framework that analyses, predicts, and explains student achievement through the use of a rule-based recommender system. The proposed framework looks at a student's demographics, study-related traits, and psychological aspects in order to obtain as much data as possible from peers, instructors, and parents. The most recent information is gathered via school reports and enquiries, such as student grades, demographic statistics, and elements connected to social and academic life.

Attempting to forecast academic success with the highest level of accuracy possible a variety of effective data mining or extracting techniques. The framework is successful at pinpointing the student's areas of weakness.

II.   RELATED WORK

s. bhutto, i. f. siddiqui, q. a. arain, and m. anwar, in "Predicting Students' Academic Performance Through Supervised Machine Learning," experiment with different supervised learning models and, after comparing a bunch of algorithms, conclude that the Compared to logistic regression, the sequential minimum optimization approach excels due to its increased accuracy.[1]

m. crivei, g. czibula, g. ciubotariu, and m. dindelegan, in "Unsupervised learning-based mining of academic data sets for students' performance analysis," have examined the use of unsupervised machine learning techniques for analysing student academic performance data, notably principal component analysis and relational association rule mining. [2].

Fotopoulou, A. Zafeiropoulos,. L. Cassà, I. M. Guiu, and S. Papavassiliou, in "Collective Emotional Intelligence and Group Dynamics Interplay: Can It Be Tangible and Measurable?" have investigated the group dynamics and collective emotional intelligence in human emotion and studied ways to use that knowledge to make more accurate predictions. [3]

El-Sayed Atlam, Ashraf Ewis, M.M. Abd El-Raouf, Osama Ghoneim, and Ibrahim Gad, in "A New Approach in Identifying the

Psychological Impact of COVID-19 on University Students' general Performance," proposed an online questionnaire was used to gather a variety of data, such as demographics, usage of digital technologies, sleeping patterns, social contact, academic performance, and measures of mental condition, stress, and hopelessness. Two sections of the primary analysis were carried out utilising machine learning methods.. [4]

Chen, P. Chen, and Z. Lin, in "Artificial Intelligence in Education: A Review," studied the effect of AI on student education of student.The study suggested that AI has been extensively adopted and used in education, particularly by educational institutions, in different forms. The systems leverage machine learning and adaptability; curriculum and content have been customised and personalised in line with students' needs. [5]

According to Hasan, S. Palaniappan, A. R. A. Raziff, S. Mahmood, and K. U. Sarkerin's proposal, it is crucial to predict students' success in their academic performance because doing so will help the students themselves take proactive steps and find strategies for assisting students in learning, which will ultimately improve their academic performance. [6]

Vinaya Patil, Shiwani Suryawanshi, Mayur Saner, and Viplav Patil studied the various algorithms with their advantages and disadvantages in "Student Performance Prediction Using Classification Data Mining Techniques." Since the aim of the paper is to predict the student's general performance, they concentrate on the most proficient method to do so effectively. [7]

Alraddadi, S. Alseady, and S. Almotiri, in "Prediction of Students' Academic Performance Utilizing Hybrid Teaching-Learning-Based Feature Selection and Machine Learning Models,"suggested a reliable combination of a wrapper-based approach with a number of machine learning (ML) techniques.[8]

a. Olorunmaiye, O. J. Ogunniyi, T. Yahaya, J. O. Olaoye, and A. A. Ajayi-Banji state in "Modes of Entry as Predictors of Academic Performance of Engineering Students in a Nigerian University" that different modes of admission can affect the academic performance of students. [9]

b. In Aman, A. Rauf, R. Ali, F. Iqbal, and A. M. Khattak's "A Predictive Model for Predicting Students' Academic Performance," they identified key features influencing students' performance and then developed an accurate prediction model for prediction of their performance prior to taking admission in an intended programme or deciding to continue for higher classes and semesters in the same programme or to quit the program. [10]

Yupei Zhang, Yue Yun,Rui An, Jiaqi Cui, Huan Dai, and Xuequn Shang studied "Educational Data Mining Techniques for Student Performance Prediction: Method Review and Comparison Analysis." Before a student enrols in a course or sits for an exam, their grade will be predicted as part of a process called student performance prediction (SPP). The domains of AI & data mining have been paying growing attention to this prediction problem, which is a core goal toward individualised education (EDM). The SPP research is thoroughly examined in this paper from the perspectives of machine learning and data mining. [11]

Havan Agrawal and Harshil Mavani in "Student Performance Prediction using Machine Learning" In this essay, a model is put out to forecast student success in a university setting. The method used is a form of machine learning known as neural networks. Moreover, the importance of a number of distinctive qualities, or "features," is considered in order to determine which of these are connected to student achievement. The last section contains the experimental data that shows how well machine learning works in this situation. [12]

Xu Zhang, Ruojuan Xue, Bin Liu3, Wenpeng Lu1, and Yiqun Zhang in "Grade Prediction of Student Academic Performance with Multiple Classification Models" introduce AI and describe various AI applications in education and course

evaluation.It then goes on to list the most Common educational problems that have been solved using AI and machine learning methods are then covered, followed by a discussion of some of the most exciting new directions in study.[13]

Le Hoang Son1, Hamido Fujita in "Neural-fuzzy with representative sets for student performance prediction "The multi-input, multi-output student academic performance prediction problem is addressed in this study with a novel approach. The MIMO SAPP seeks to forecast a student's success going forward once they have enrolled in college. [14]

Byung-Hak Kim, Ethan Vizitei, and Varun Ganapathi investigated "Student Performance Prediction with Deep Learning," a method in which a machine predicts students' future performance as they interact with online coursework. [15]

Thi Dinh,Ha Dinh,Thi To Loan Pham,Loan Loan,Giap Cu Nguyen,Nguyen Thi,Nguyen Thi Lien Huong in "An Empirical Study for Student Academic Performance Prediction Using Machine Learning Techniques" This study looks at a machine learning approach that predicts a student's final grade point average based on personal traits, academic achievement in the first and second years of college, a gap year, and university entrance scores. The information was gathered via a poll of graduate students from three separate years as well as the university's student management information system. [16]

In "Multiclass Prediction Model for Student Grade Prediction Using Machine Learning," give a thorough examination of machine learning methods to forecast students' final course marks while increasing the accuracy of the prediction. In this paper, two modules will be emphasised. Using a dataset of 1282 genuine student course grades, we first assess the accuracy performance of six well-known machine learning approaches, including Decision-Tree , SVM, NB, kNN, Logistic Regression (LR), and Random Forest (RF). [17]

In "Predicting Student's Performance Using Machine Learning Methods: A Systematic Literature Review," explored the causes of the lack of studies on the various prediction techniques and significant factors that influence a student's academic performance. This systematic study's goal is to learn more about the machine learning methods and traits that are currently used to predict student success. [18]

Nabil, M. Seyam and A. Abou-Elfetouh, in "Prediction of Students' Academic Performance Based on Courses' Grades Using Deep Neural Networks," The main goal of this paper is to explore the efficiency of deep learning in the field of educational data mining, especially in predicting students' academic performance and identifying students at risk of failure. This study used a dataset gathered from a public 4-year university to create prediction models to forecast students' academic success in upcoming courses based on their current grades. the previous courses of the first academic year using a deep neural network (DNN), a decision tree, a random forest, gradient boosting, logistic regression, a support vector classifier, and K-nearest neighbours. [19]

In "Improving Learning Experience of Students by Early Prediction of Student Performance using Machine Learning," highlight the use of ML to help academics identify potential weaknesses Such students might be actively involved in enhancing learning experiences by being proactively integrated into the learning processes. They employed gaussian distributions, logistic regression, linear discriminant analysis, classification and regression trees, kNN[20]

For learning environments like schools and colleges, predicting students' achievement one of the most crucial issues since it aids in the creation of efficient processes that, among other things, increase overall outcomes and prevent dropout. As a result, rigorous analysis and processing of this data might provide us with knowledge about the students' knowledge and how it relates to academic assignments. The suggested work's primary goal is to predict & categorise student performance. The existing system concentrates only on the traditional method of grading students, it only considers answers given by a student in its curriculum examination, he doesn't have a freedom to choose subject of his interested nor he able to grasp a essence of an subject that he wants to aim for that subject in his higher studies.

With SMO, you can make sure that the company has a strong online presence and build the brand's reputation online. Consider that it Along with introducing customers to the company, it also aids in branding by raising brand recognition and recall. Reaching a web audience is made possible by social media optimization.. The disadvantage of this system is that it is based solely on information provided by parents and students, with no input from teachers. not Considering the emotional condition of students. [1]

Assisting teachers in the educational process, predicting students' success in classes, identifying the kind of learners they are, and categorizing them based on their commonalities all benefit instructors. understand and plan things and also give very similar results, so it would give more accurate results. By grouping students, the outliner, i.e., non-group able

students, will be left out of evaluation and also affect the accuracy of the model. It only considers two classes for prediction, which are not enough to gain insight on the performance of an individual student. [2]

This opens up many new avenues for developing better and more accurate models for various predictions in which human emotion can play a significant role in analysis. Having too many classes in a model may result in over fitting, which is not good for any model. [3]

It works similarly to a conventional one, but it runs slowly and the model's parameters need to be carefully adjusted. All of the data from individual students was used since the sample size for this study's students who completed an online COVID-19 questionnaire was too small to generate any meaningful machine learning models..[4]

Show how AI can be used effectively and change the education system, as well as how we are already using AI in various forms in our system. They used AI to improve the efficacy and effectiveness of the educators or teachers in carrying out different administrative jobs. Its features are more like traditional ones. This paper doesn't provide any description of the used dataset. [5]

Uses a decision tree, which takes less work to prepare data during pre-processing than other techniques. Instability can result from a tiny change with in data that has a huge impact on the decision tree's structure. [6]

Such a set of test data may readily and rapidly be used to predict the class. Additionally, it excels in multiclass prediction. Probability outputs from predict should not be taken too seriously.[7]

Uses educational data mining. uses a hybrid model that combines the ML model with an optimization algorithm. Questions in this paper are related only to course and instructor-related topics, not their emotional states. uses two datasets, which may cause complexity.[8]

To analyse the data, statistical analysis is used, and the null hypothesis and chi square test are calculated. Data collection is only about the name, modes of entrance, the class of degree, the aggregate level of education (CGPA), but not about other features that affect student performance.[9]

Uses educational data mining. prediction of student career fields Based on its academic performance and social characteristics Only examination data is considered academic data. No collective analysis of all the extracted data The proposed theory is only used to forecast students' futures.[10]

 Governments, businesses, and organizations can collect trustworthy information through data mining. It can be applied to marketing research to identify potential customer interests in products and then make those products available to those customers. Data mining aids organizations in assessing the effectiveness of their own policies and procedures. Data analytics is a challenging process, and using the technologies frequently calls for people with training. The expense of adopting data analytics may deter small enterprises from doing so. Finding sufficient data that isn't already private or proprietary can sometimes be challenging.[11]

All of the features are assumed to be independent of one another, to contribute equally to the result, and to be of equal importance. Data classification into binary groupings appears to be inadequate. The major goal of this study was to locate at-risk students without taking performance levels into account. putting pupils in different tiers based on their performances Adjectives like bad, average, good, fantastic, etc. could be preferable. This allows teachers to provide each student more customised feedback.[12]

How AI can effectively use and able to change education system and how we are already using AI in different forms in our system. They used ai in effectiveness and efficacy and usefulness of the educators or teachers in carrying out different administrative jobs. This paper doesn't provide any description on used dataset.[13]

The premise and consequence parameters make form a parameter set in MANFIS. The premise parameters are used by the fuzzification layer to convert sharp input values to fuzzy ones. The consequent layer, on the other hand, makes use of the consequence parameters to get the outputs in their final form. The number of parameters in the premise and consequence are equivalent to the number of input variables and fuzzy rules, respectively. After training, the outputs are calculated for Using just one parameter set, all entries in the training set. It's evident that parameter set's values skew toward the most recent training record. As a result, training errors will be reduced. a fresh network known as MANFIS-S is created to address MANFIS's issues with the parameter set and learning approach. [14]

Feature engineering is the process of removing features from unprocessed data in order to more clearly describe the underlying issue. It's essential to machine learning since it improves model accuracy. The method may occasionally require domain knowledge. Feature engineering is the process of removing features from unprocessed data in order to more clearly describe the underlying issue. It is essential to machine learning since it improves model accuracy.The approach may at times need domain expertise.[15]

This paper aids in the generation of knowledge about students' performances, which is subsequently used to build an effective learning strategy. data gathered from management students who have graduated. Only two data sources, entry database, which includes location, gender, and university entry score, are used to compile datasets.[16]

Finding hidden patterns and forecasting trends in a large database can be a potential strategy to help the competitive educational field. According to this study, socioeconomic status, demography, and learning activity are the most frequent influences that have a significant impact on students' academic achievement..[17]

They claim The most often utilised factors in predicting success were found to be demographic, academic, family/personal, and internal assessment. To determine the most suitable data-driven models, a thorough examination of the literature has been conducted.and pertinent machine learning techniques and characteristics for forecasting student academic achievement. They are not considering the other things that affect the general performance of the student which is their financial condition, students' relation with their parent and student mental state. [18]

Several model validation techniques were used, including stratified 5-fold cross-validation and random hold-out. Deep artificial neural network , decision tree , logistic regression , support vector classifier , K-nearest neighbour , random forest , and gradient boosting are some of the machine learning techniques that were used.. They use a dataset that is provided by the university, they do not generate the dataset themselves.[19]

For data classes with imbalances, SMOTE (Synthetic Minority Over-sampling Technique) was used. It is an oversampling technique that uses artificial minority class samples. The dataset only includes 250 undergraduate students. They solely perform assessments consisting of projects, labs, midterms, and quizzes.[20]

III.PROPOSED METHODOLOGY

Successfully comprehending the problem statement and implementing the new Model design are key stages in model development. After deciding on a suitable data set format, it is crucial to match it to the needs of our problem statement and designed model because we want to study how human emotions affect students' overall performance. To do this, prepare the right set of questions to collect data from students in our data set format, which can improve the accuracy of our predictions. There are some key features of the data set which will impact most on the model like age, address, family income, travel time extracurricular activity etc. This feature and functionalities will helps to analyze the general performance of students. The proposed system will help to keep track and retrieve the student performance in a particular course and semester, It will able to research the factor that affect the student general performance. The proposed framework looks at a student's demographics, study-related traits, and psychological aspects in order to obtain as much data as possible from peers, instructors, and parents. The most recent information is gathered via school reports and enquiries, such as student grades, demographic statistics, and elements connected to social and academic life. Attempting to forecast academic success with the highest level of accuracy possible using a variety of effective data mining techniques. The framework is successful at pinpointing the student's areas of weakness
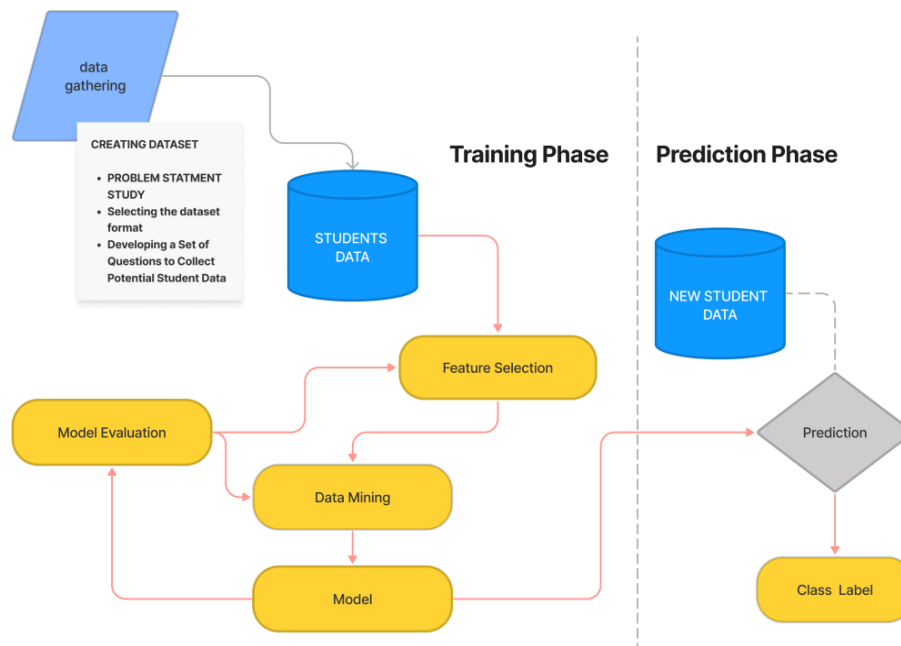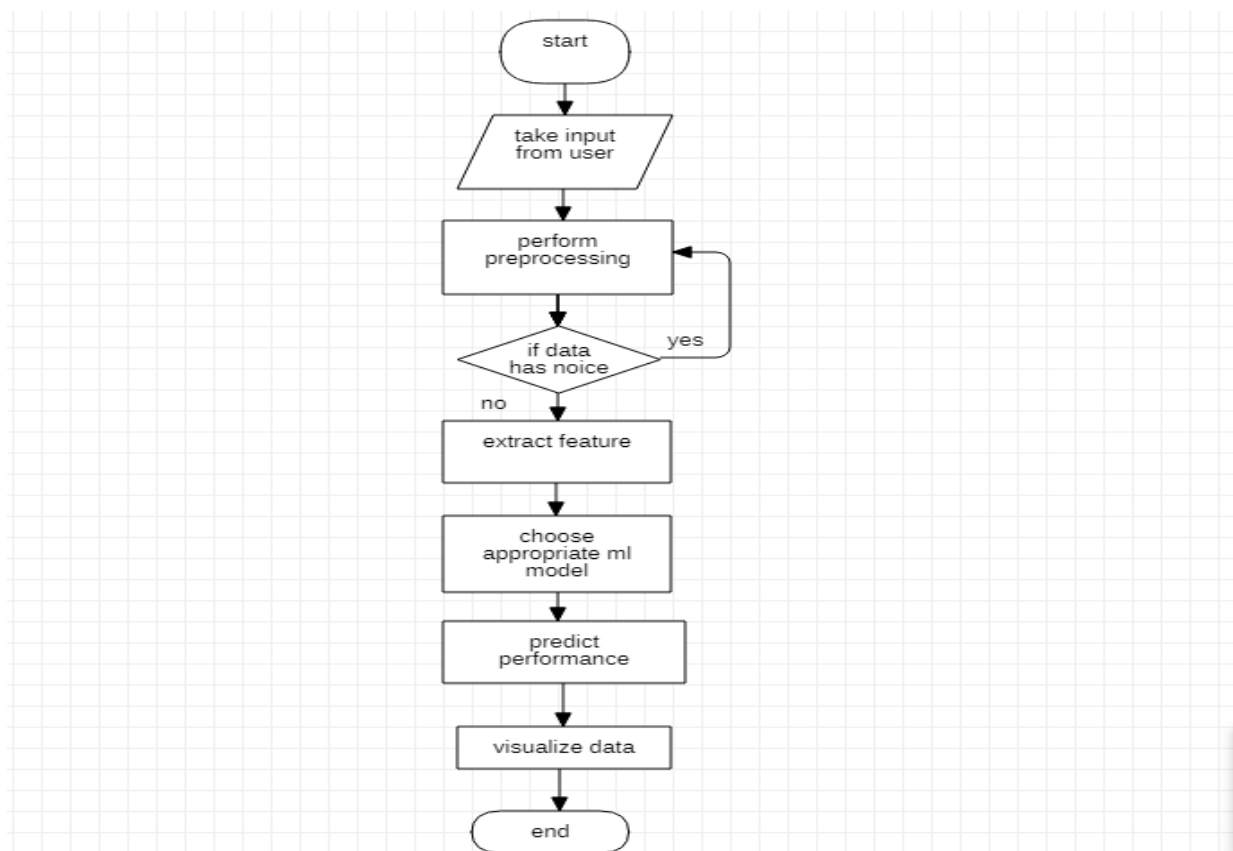
● **System Architectural Diagram**

Figure (a) : system Architectural Diagram

● **Flowchart Diagram:**

Data-set description:

As previously said, we developed our own dataset for this problem statement by selecting variables carefully that would produce a high-quality dataset used for performance analysis. Student grades and social, demographic, and economical characteristics are included in the dataset properties. All information came from surveys on Google Forms. The dataset contains data on a student's interests, mental health, and interpersonal relationships. It has 33 attributes, which are listed in Table 1.

Sr.no	Feature	Questions	Data Types	Input Format
1	Gender	Sex of the student	Binary (M/F)	Female / male , (0/1)
2	Age	The age of the student	Integral	From 10-15 , 15-18 , 18-25,25+
3	Address(loc.)	Type of address of student	Binary	Urban/ rural /Metro
4	Parental Status	Parental relationship of student	Binary	Living together / divorsed
5	Educational status of Mother	Mothers Education	Multiple	School, College UG, PG,PHD
6	Mothers Job	Occupation of Mother	Multiple	Teacher, health, services, at home, others
7	Educational status of Father	Education of student's father	Multiple	School, College UG, PG,PHD
8	Fathers Job	Occupation of student's father	Multiple	Business / Service / Unemployed
9	Guardianof Student	Student's Gurdian	Multiple	Father/Mother/Other
10	Family_Size	Family Size	Binary	Less than 4/More than 4
11	Family_Relationship	Relation of student with Family	Integral	1-5
12	Reason_for_choosing_college	Why Chose this this school/college	Multiple	Close to home/school reputation/course preference/Family pressure
13	Reason_for_choosing_course	Reason of choosing this course	Multiple	Your preference/Family pressure/Peer pressures
14	Home To Scl Time	time required to travel from home to school	Integral	1-15 min , 15-30 min,30-45 min , more than 45 min
15	Study_Time	Daily Study Time of Student	Integral	1-15 min , 15-30 min,30-45 min , more than 45 min
16	income	family	Multiple	0-1 lac/2-5 lac/ Above 8 lac
17	Backlogs	Backlogs of Student	Binary	Yes/no(0/1)
18	School_support	school support in Education	Binary	Yes/no(0/1)
19	Family_Support	Family educational support	Binary	Yes/no(0/1)
20	Extra_Activities	Extracurricular activities	Binary	Yes/no(0/1)
21	Extra_paid_class	Extra Classes of Student	Binary	Yes/no(0/1)
22	Internet	Access to Internet at home	Binary	Yes/no(0/1)

23	Nursery_Scl	Been to nursery school	Binary	Yes/no(0/1)
24	Higher_Edu	Planning for higher education	Binary	Yes/no(0/1)
25	Relationship	With a romantic relationship	Binary	Yes/no(0/1)
26	Free_time	Free time after school	Integral	1-5
27	Go out	Going out with friends	Integral	1-5
28	Alcohol_Consumption	Weekend consumption of Alcohol by Student	Integral	1-5
29	Daily_Alcohol_Consumption	Daily consumption Alcohol	Integral	1-5
30	Health_Status	Health Status	Integral	1-5
31	Absences	Number of school absences	Integral	Range of percentage 0 -99
32	Scholar	SCHOLARSHIP	Multiple	None ,25% , 50% , 75% , Full

IV.   CONCLUSION

Hence, Using the Proposed System we can predict student academic performance Using machine learning model by not only considering academic grades of student but also considering economic, social, geographical background of Student. Using this system, it will be easy to postulate the career decision of Student and it will help to change the current Evaluation System of Student general Performance. Also, with machine learning it can be said that project is a sincere effort to design and implement the student general performance prediction model. We successfully gathered data from students and created our own dataset in suitable format.future feature selection techniques could be different. on the datasets, several classification techniques can also be applied.

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