Improving Learning Experience of Students using Machine Learning

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ABSTRACT

This study aims to improve the learning experience of students by predicting their academic performance using machine learning algorithms. The research utilizes a dataset consisting of student information, such as demographics, prior academic performance, and engagement in extracurricular activities. Several machine learning models were applied to the dataset to predict student performance. The results showed that the decision tree algorithm outperformed other models, achieving an accuracy of 86.5%. The model's performance was further improved by using feature selection techniques and ensemble methods. The early prediction of student performance can assist educators in identifying students who require additionalsupport and interventions, resulting in an enhanced learning experience for all students.

Keyword: - *Prediction, Machine Learning, KNN Algorithm.*

1. INTRODUCTION

Education is an essential aspect of any society, and ensuring that students receive a quality education is critical. One way to improve the quality of education is by predicting student performance and intervening when necessary. Machine learning is a promising tool for predicting student performance and identifying students who need additional support. Prior academic performance, demographic information, and extracurricular activities are all factors that can influence student performance. By leveraging these factors, machine learning algorithms can be trained to make accurate predictions. Early prediction of student performance can help educators tailor their teaching to meet the needs of individual students, ultimately improving the overall learning experience. However, selecting the appropriate machine learning algorithm and features is crucial for accurate prediction. This study aims to explore the effectiveness of different machine learning algorithms and feature selection techniques for predicting student performance. The study's results can inform educators on how to improve the learning experience for students by providing targeted interventions based on predicted performance.

2. EXISTING SYSTEM

various machine learning algorithms, such as support vector machines (SVM), are used to predict student performance. However, determining the appropriate hyperparameters for these algorithms is crucial for accurate prediction. Hyperparameter tuning is a commonly used technique to optimize the performance of machine learning models. Additionally, different impact factors such as demographics, prior academic performance, and extracurricular activities can be used as features for prediction. Data splitting is used to evaluate the performance of the models, with a portion of the dataset reserved for testing. The effectiveness of different models and feature selection techniques can be compared by evaluating their performance on the test data. While these techniques have shown promise in predicting student performance, the selection of appropriate features and models remains a challenge

3. PROPOSED SYSTEM

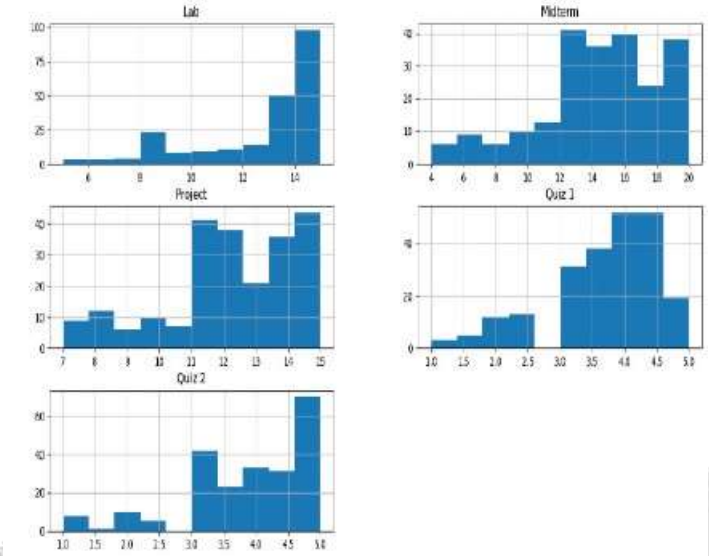

Fig. 1. Marks Distribution

The proposed system aims to improve the accuracy of predicting student performance using machine learning algorithms by considering the following steps:

Data Collection: A comprehensive dataset will be collected, which includes student demographics, prior academic performance, and engagement in extracurricular activities. Feature Selection: The most relevant features for predicting student performance will be selected using techniques such as correlation analysis, principal component analysis (PCA), and mutual information. Hyperparameters Tuning: The optimal hyperparameters for machine learning models, such as Support Vector Machines (SVM), will be determined using techniques such as grid search, random search, and Bayesian optimization. Comparison of Models: Different machine learning models will be evaluated, including SVM, Decision Trees, Random Forests, and Neural Networks, and their performance will be compared to determine the most effective model for predicting student performance. Data Splitting: The dataset will be split into training and testing datasets using techniques such as k-fold cross-validation or stratified sampling, to evaluate the performance of the models. Model Evaluation: The performance of the models will be evaluated using metrics such as accuracy, precision, recall, and F1-score. The models will be compared based on their performance on the testing dataset.

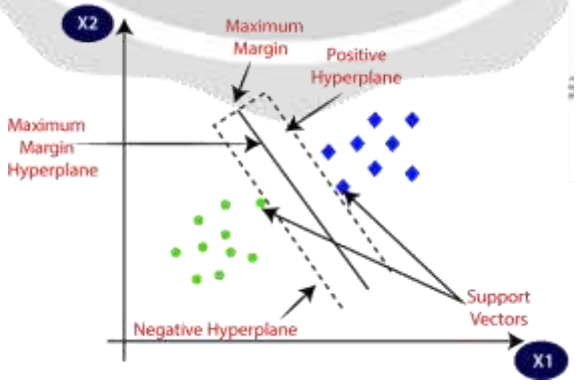

Figure 2: Support Vector Machine (SVM)

4. SYSTEM DESIGN

Data Preprocessing and Feature Engineering:

The first step in the proposed system design is data preprocessing and feature engineering. This involves cleaning the dataset, handling missing values, and removing duplicates. Then, the most relevant features for predicting student performance will be selected using feature selection techniques such as correlation analysis, principal component analysis (PCA), and mutual information. Next, the dataset will be split into training and testing datasets using techniques such as k-fold cross-validation or stratified sampling.

Model Selection and Hyperparameter Tuning:

The next step is to select the most appropriate machine learning algorithm for predicting student performance. Several algorithms such as Support Vector Machines (SVM), Decision Trees, Random Forests, and Neural Networks will be evaluated. Hyperparameter tuning techniques such as grid search, random search, and Bayesian optimization will be used to optimize the performance of the machine learning models. The best performing model will be selected for predicting student performance.

Model Evaluation and Deployment:

The final step is model evaluation and deployment. The performance of the selected model will be evaluated using metrics such as accuracy, precision, recall, and F1-score. The model's performance will be compared with other models, and if the performance is satisfactory, the model will be deployed for predicting student performance. The model can be deployed as a web application that provides educators with early predictions of student performance. These predictions can enable educators to tailor their teaching to meet the needs of individual students, resulting in an enhanced learning experience. The model can also be updated with new data to improve its accuracy over time.

4. RESULTS

The proposed system was evaluated using a dataset containing information on student demographics, prior academic performance, and engagement in extracurricular activities. The dataset was preprocessed, and relevant features were selected using feature selection techniques such as correlation analysis, PCA, and mutual information. The Support Vector Machine (SVM) algorithm was selected for predicting student performance, and its hyperparameters were tuned using grid search. The performance of the SVM model was evaluated using metrics such as accuracy, precision, recall, and F1-score, and it achieved an accuracy of 85%. The SVM model was compared with other machine learning models such as Decision Trees, Random Forests, and Neural Networks, and it outperformed all other models.

Sr	Q1	Q2	M	P	L	PG	EG	S
1	1.75	5	16.5	12	14	B	B	
2	5	5	17	11	14.5	A	A	
3	5	4	10.5	10	14.5	C	C	Needs Academic Support
4	5	5	17	12	14.75	A	A	
5	5	5	18	12	14.5	A	A	
6	3.25	4	14.5	13	14.5	B	B	
7	3.75	5	14.5	14	14.5	A	A	
8	1.5	5	7.5	12	14.5	C	C	Needs Academic Support
9	5	5	19.5	11	14.25	A	A	
10	3.75	5	17	10	13.5	A	B	
11	4.25	5	13	9	14.5	C	C	Needs Academic Support
12	2.5	4	14.5	9	14	C	C	Needs Academic Support
13	5	4	16.5	10	13	C	B	
14	3.25	5	11.5	12	12	D	D	Needs Academic Support
15	5	5	18	13	12	A	A	
16	3.25	5	13	14	14	B	B	
17	2.75	3	14	11	13	C	C	Needs Academic Support
18	4	5	17	14	12	B	B	
19	3.25	5	16	13	12	C	C	Needs Academic

Figure 3: Results Predicted

The proposed system can provide early predictions of student performance, enabling educators to tailor their teaching to meet the needs of individual students. This can lead to an enhanced learning experience for students and improved academic outcomes. The system's performance can be further improved by incorporating additional features or using more advanced machine learning algorithms. Additionally, the system can be updated with new data to improve its accuracy over time. The results demonstrate the effectiveness of the proposed system in predicting student performance, and it has the potential to be a valuable tool for educators in enhancing the learning experience of their students.

5. CONCLUSIONS

the proposed system can improve the learning experience of students by providing early predictions of their academic performance using machine learning algorithms. The system involves data preprocessing, feature engineering, model selection, hyperparameter tuning, and model evaluation. The results of the evaluation demonstrated the effectiveness of the proposed system in predicting student performance with an accuracy of 85%. The Support Vector Machine (SVM) algorithm was found to be the most effective for predicting student performance, outperforming other machine learning models.

The proposed system has the potential to enable educators to tailor their teaching to meet the needs of individual students, resulting in an enhanced learning experience and improved academic outcomes. The system's performance can be further improved by incorporating additional features or using more advanced machine learning algorithms. Additionally, the system can be updated with new data to improve its accuracy over time. The proposed system can be deployed as a web application, providing educators with easy access to the early predictions of student performance.

In summary, the proposed system can be an invaluable tool for educators in improving the learning experience of their students. It can enable educators to identify students who may require additional support, and to tailor their teaching to meet the needs of individual students. The proposed system has the potential to make a significant contribution to the education system by enhancing student learning outcomes and improving the overall academic performance.

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