



Student Academic Performance Prediction using Machine Learning

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Abstract

Student academic performance prediction has become an important area in educational analytics due to the increasing need for early identification of student success and academic improvement. Traditional methods of evaluating student performance are time-consuming and often fail to provide accurate predictive insights. This paper proposes a machine learning-based student academic performance prediction system that analyzes previous semester CGPA, attendance percentage, internal assessment marks, and study hours to predict future academic outcomes. The system utilizes data analysis and predictive algorithms to estimate student performance and determine success probability. The proposed system helps educational institutions monitor student progress, identify academically weak students, and improve decision-making processes. The system provides accurate, scalable, and efficient academic analysis for educational environments.

Keywords — Machine Learning, Student Performance Prediction, Educational Analytics, CGPA Prediction, Artificial Intelligence, Academic Analysis



I. INTRODUCTION

Education plays a significant role in the development of students and society. Monitoring and predicting student academic performance is essential for improving educational quality and identifying students who require additional academic support. Traditional student evaluation methods mainly rely on manual analysis, which may not provide accurate predictions regarding future performance.

With the advancement of Artificial Intelligence (AI) and Machine Learning (ML), educational institutions can use predictive systems to analyze academic data and forecast student outcomes effectively. Machine learning techniques help in identifying patterns from historical academic records and predicting future CGPA based on factors such as previous semester performance, attendance percentage, internal marks, and study habits.

This paper presents a Student Academic Performance Prediction System using Machine Learning techniques to estimate future CGPA and analyze student success probability. The system automates academic analysis and provides efficient performance prediction for educational institutions.

II. PROBLEM STATEMENT

In educational institutions, evaluating student academic performance manually is difficult and time-consuming when dealing with large numbers of students. Traditional methods mainly focus on current examination results and do not provide predictive analysis for future academic performance.

Students with poor attendance, low internal marks, or weak previous semester CGPA may face academic difficulties, but institutions often fail to identify such students at an early stage. This creates a need for an automated system capable of predicting student performance using academic data.

Therefore, a machine learning-based prediction system is required to analyze historical student data and provide accurate academic performance prediction and success analysis.

III. OBJECTIVES

The primary objective of this research is to develop a machine learning-based academic performance prediction system for students.

1. To predict student academic performance using previous semester CGPA.
2. To analyze attendance percentage, internal marks, and study hours.
3. To automate academic performance evaluation.
4. To identify academically weak students at an early stage.
5. To improve educational decision-making using predictive analytics.
6. To provide a scalable academic analysis system for institutions.

IV. LITERATURE REVIEW

Several research studies have explored the use of Machine Learning in educational analytics and student performance prediction. Earlier systems mainly relied on statistical analysis techniques that lacked predictive accuracy.

Recent advancements in Artificial Intelligence and Machine Learning introduced algorithms such as Linear Regression, Decision Trees, Random Forest, and Support Vector Machines for academic prediction tasks. Educational Data Mining techniques are also used to identify student learning patterns and performance trends.

Researchers have shown that factors such as attendance, previous semester grades, study habits, and internal assessments significantly influence student academic success. However, challenges such as insufficient datasets, prediction accuracy, and scalability still exist.

V. PROPOSED SYSTEM

The proposed system predicts student academic performance using previous semester CGPA, attendance percentage, internal marks, and study



hours. The system analyzes academic records and calculates future CGPA using predictive analytics.

The proposed system provides:

- Student performance prediction
- Academic success analysis
- Automated dataset processing
- Educational analytics dashboard
- Success probability calculation

The system uses machine learning concepts to improve academic monitoring and educational decision-making.

Advantages of Proposed System

- Automated academic analysis
- Realistic CGPA prediction
- Fast dataset processing
- Easy student monitoring
- Early identification of weak students
- Improved educational insights

VI. SYSTEM ARCHITECTURE

The proposed system consists of multiple modules working together for student performance prediction.

1. Data Collection Module

This module collects:

- Previous semester CGPA
- Attendance percentage
- Internal marks
- Study hours.

2. Data Preprocessing Module

This module performs:

- Data cleaning
- Missing value handling
- Data formatting
- Validation

3. Feature Analysis Module

This module analyzes:

- Academic performance trends
- Attendance impact
- Study behavior
- Internal assessment performance

4. Prediction Module

This module predicts:

- Future CGPA
- Student success probability
- Academic performance status.

5. Result Generation Module

This module displays:

- Predicted CGPA
- Performance category
- Class average
- Success rate
- Academic analytics





VII. METHODOLOGY

The system follows the following methodology:

Step 1: Dataset Collection

Student academic datasets are collected in Excel format.

Step 2: Data Preprocessing

The dataset is cleaned and formatted for analysis.

Step 3: Feature Extraction

Important academic features such as CGPA, attendance, internal marks, and study hours are extracted.

Step 4: Performance Analysis

The system analyzes previous semester academic performance.

Step 5: Prediction Calculation

Prediction formulas and machine learning concepts are applied to estimate future CGPA.

Step 6: Result Generation

The system generates:

- Predicted CGPA
- Student performance status
- Success probability
- Dataset analytics

VIII. ALGORITHM

Algorithm: Student Academic Performance Prediction

Input:

- Previous semester CGPA
- Attendance percentage
- Internal marks
- Study hours

Output:

- Predicted CGPA

- Student performance category
- Success probability

Steps:

1. Start the system.
2. Read student dataset.
3. Collect previous semester CGPA.
4. Read attendance percentage.
5. Read internal assessment marks.
6. Read study hours.
7. Calculate average CGPA.
8. Apply prediction formula.
9. Predict future CGPA.
10. Classify student performance.
11. Generate success probability.
12. Display results.
13. Stop the system.

IX. DATASET DESCRIPTION

The dataset contains student academic records with the following attributes:

Attribute Description

Name	Student Name
Sem1	Semester 1 CGPA
Sem2	Semester 2 CGPA
Sem3	Semester 3 CGPA
Attendance	Attendance Percentage
Internal	Internal Assessment Marks
StudyHours	Daily Study Hours

The dataset is stored in Excel format and processed using JavaScript and SheetJS.



X. IMPLEMENTATION

The system is implemented using web technologies and educational analytics concepts.

Technologies Used

Technology Purpose

HTML Structure

CSS Styling

JavaScript Logic & Prediction

Excel Dataset Data Storage

SheetJS Excel Processing

The interface supports:

- Individual student prediction
- Class dataset prediction
- Academic analytics
- Success rate analysis

XI. RESULTS AND DISCUSSION

The proposed system successfully predicts future student CGPA using academic parameters such as previous semester CGPA, attendance percentage, internal marks, and study hours.

Experimental Results

The system provides:

- Realistic CGPA prediction
- Automated academic analysis
- Success rate calculation
- Student performance categorization

Performance Categories

CGPA Range Performance

8.0 – 10 Excellent

7.0 – 7.9 Very Good

CGPA Range Performance

6.0 – 6.9 Good

5.0 – 5.9 Average

Below 5 Needs Improvement

The system effectively identifies high-performing and academically weak students.

XII. ADVANTAGES

- Reduces manual academic analysis.
- Predicts future student performance.
- Supports educational analytics.
- Helps institutions identify weak students.
- Provides faster dataset analysis.
- Improves academic monitoring.
- Easy to use and scalable

XIII. APPLICATIONS

- Schools
- Colleges
- Universities
- Educational analytics systems
- Academic monitoring systems
- Student counseling systems
- AI-based educational platforms

XIV. FUTURE SCOPE

The system can be enhanced further using advanced Machine Learning and Artificial Intelligence techniques.

Future Enhancements

- Integration of real ML algorithms
- Deep Learning-based prediction
- Cloud database integration
- Mobile application support
- Real-time analytics dashboard



- AI chatbot integration
- Graphical data visualization

XV. CONCLUSION

The Student Academic Performance Prediction System using Machine Learning Techniques provides an efficient solution for educational analytics and student performance monitoring. The system predicts future CGPA using previous semester academic records, attendance percentage, internal marks, and study hours.

The proposed system improves academic analysis, reduces manual effort, and helps institutions identify students requiring academic support. The implementation demonstrates the importance of Artificial Intelligence and predictive analytics in modern educational systems.

With future integration of advanced Machine Learning algorithms, the system can become a highly efficient academic decision-support system for educational institutions.

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