

Student Performance Analysis Using AI

Srushti Sidram Panjlor¹, Dhanashri Vitthal Kate², Aditi Uday Jadhav³, Ankita Pravin Maske⁴, Prof. Vaishali Prashant More⁵

¹ Artificial Intelligence & Data Science at VVP Institute of Engineering & Technology, Solapur,
srushtipanjlor1@gmail.com

² Artificial Intelligence & Data Science at VVP Institute of Engineering & Technology,
Dhanashrikate86@gmail.com

³ Artificial Intelligence & Data Science at VVP Institute of Engineering & Technology,
aditijadhav2219@gmail.com

⁴ Artificial Intelligence & Data Science at VVP Institute of Engineering & Technology,
ankitapmaske.21@gmail.com

⁵ Artificial Intelligence & Data Science at VVP Institute of Engineering & Technology,
vaishalimore@gmail.com

Abstract — This Student Performance Analysis using Artificial Intelligence (AI) is an advanced approach for evaluating and predicting student academic performance through data-driven methods. Educational institutions generate large amounts of student-related data such as attendance, assignment scores, examination marks, and participation records. AI techniques help analyze this data efficiently and provide useful insights for teachers and institutions. This project focuses on identifying patterns affecting student performance and predicting outcomes using machine learning algorithms. The system can help educators identify weak students at an early stage and provide proper guidance for improvement. The proposed system improves decision-making, enhances learning outcomes, and supports personalized education strategies. AI-based analysis reduces manual work and increases the accuracy of student performance evaluation.

Key Words: Artificial Intelligence, Machine Learning, Student Analysis, Prediction System, Academic Performance, Data Analytics.

1. INTRODUCTION

Artificial Intelligence (AI) is transforming the education sector by improving learning methods and academic analysis. Educational institutions collect large amounts of student data every year, but analyzing this data manually is difficult and time-consuming. AI-based student performance analysis helps in understanding student learning behavior and predicting academic results effectively.

The main purpose of this project is to analyze student performance using machine learning techniques. Factors such as attendance, internal marks, assignment completion, and study hours are considered for performance prediction. By using AI algorithms, institutions can identify students who need additional support and improve overall academic performance.

This project also helps teachers make better decisions regarding teaching strategies and student mentoring. AI can

provide accurate predictions and reduce human errors in analysis.

2. Student Analysis Importance and Case Studies

A case study at Ajman University examined how Artificial Intelligence tools improve student academic performance in e-learning environments. Researchers used AI-powered learning systems to analyze student attendance, assignments, quizzes, participation, and exam scores.

Problem Statement

Educational institutions often face challenges in:

- Identifying weak students early
- Monitoring student progress manually
- Providing personalized learning support
- Reducing student dropout rates

Traditional methods were time-consuming and less accurate.

Objective

The main objective was to develop an AI-based system capable of:

- Predicting student academic performance
- Identifying at-risk students
- Improving learning outcomes
- Supporting teachers with data-driven insights

Data Collection

The following student data was collected:

- Attendance percentage
- Internal assessment marks
- Assignment scores
- Quiz performance
- Study hours
- Previous semester results

Technologies Used

- Python

- Machine Learning
- Artificial Neural Networks (ANN)
- Random Forest Algorithm
- Moodle Learning Platform
- Scikit-learn Library

Methodology

1. Student data was collected from academic records.
2. Data preprocessing removed missing and incorrect values.
3. Machine learning models were trained using historical student data.
4. AI algorithms predicted student performance categories:
 - Excellent
 - Average
 - Poor

Some studies also used interpretable AI methods to identify students at risk of failure or dropout.

Results

The AI-based system showed significant improvement in:

- Student engagement
- Knowledge retention
- Academic performance
- Learning motivation

A study involving AI-powered personalized learning tools found improved critical thinking and student participation compared to traditional teaching methods.

policies to determine when school classes happen, what is taught, and who can or must attend. International organizations, like UNESCO, have been influential in promoting primary education for all children. Many factors influence whether education is successful. Psychological factors include motivation, intelligence, and personality. Social factor Student analysis involves in-depth, systematic evaluation of individual learners, groups, or educational phenomena to improve pedagogical approaches, engagement, and outcomes. Case studies in this context, often documented in wikis, provide real-life scenarios for analyzing student behavior, academic progress, and developmental needs.

Importance of Student Analysis

- **Informed Instruction:** Enables teachers to understand student needs, tailor teaching strategies, and resolve classroom issues.
- **Developmental Insights:** Helps identify unique developmental paths across different student groups, including racial, gender, and social class identities.
- **Skill Development:** Uses real-life scenarios to foster critical thinking, reading, and problem-solving skills, allowing students to draw independent conclusions.

3. Literature Review

Many researchers have worked on student performance prediction using machine learning and AI technologies. Previous studies used algorithms such as Decision Tree, Random Forest, Logistic Regression, and Neural Networks for academic prediction.

Researchers found that attendance, study hours, previous marks, and assignment completion significantly affect student performance. AI models provide better accuracy compared to traditional analysis methods.

Educational institutions are increasingly adopting AI systems for smart learning environments and performance monitoring

4. METHODOLOGY

The proposed system follows the following methodology:

4.1 Data Collection

Student data is collected from academic records including:

- Attendance
- Internal marks
- Assignment scores
- Study hours
- Previous semester results

4.2 Data Preprocessing

Collected data is cleaned and transformed by:

- Removing missing values
- Converting categorical data
- Normalizing numerical values

4.3 Model Training

Machine learning algorithms are applied for prediction:

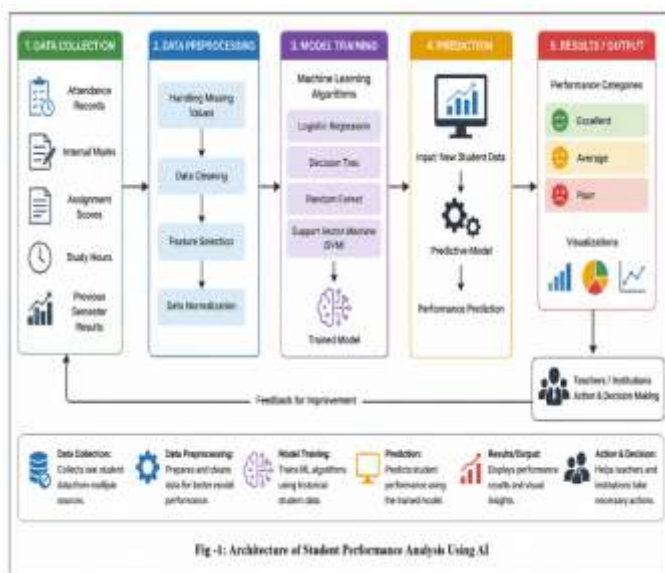


Fig-1: Architecture of Student Performance Analysis Using AI

The precise definition of education is disputed, and there are disagreements about what the aims of education are and to what extent education is different from indoctrination by fostering critical thinking. These disagreements affect how to identify, measure, and improve forms of education. Fundamentally, education socializes children into society by teaching cultural values and norms. It equips them with the skills needed to become productive members of society. This way, it stimulates economic growth and raises awareness of local and global problems. Organized institutions affect many aspects of education. For example, governments set education

- Decision Tree
- Random Forest
- Linear Regression

4.4 Prediction and Analysis

The trained model predicts whether the student performance will be:

- Excellent
- Average
- Poor

The results are displayed through charts and reports for easy understanding.

3. [Frontiers Research – AI for Student Performance Prediction](#)
4. [Meta-analysis on AI Impact in Education](#)
5. [Generative AI and Student Academic Performance](#)
6. [SPAT – Intelligent Student Performance Analysis Tool](#)
7. [Arxiv – Adaptive Intelligence and Performance Analytics](#)

5. RESULTS AND DISCUSSION

The AI model successfully analyzed student data and predicted academic performance with good accuracy. Random Forest algorithm provided better prediction results compared to other models.

The system helps teachers identify students who require extra attention. Visualization charts improve understanding of student progress and overall class performance.

The proposed system reduces manual analysis time and improves educational planning.

6. CONCLUSION

Student Performance Analysis using AI is an effective solution for modern educational institutions. AI techniques help analyze academic data accurately and provide useful insights for improving student performance. The proposed system supports teachers in identifying weak students and taking corrective actions at the right time. In the future, advanced AI models and real-time analytics can further improve educational systems and personalized learning experiences.

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