

Project Proposal: Explainable AI for Smart Gradebooks: Predicting Student Performance and Recommending Personalized Support

Problem Statement:

Traditional gradebooks lack predictive & diagnostic capabilities. Teachers spend time manually analyzing student data. AI can help, but trust requires explainability.

Research Questions:

1. How accurately can ML models predict student performance?
2. How do explainable AI techniques (e.g., SHAP, LIME) affect trust?
3. Can the system recommend personalized support effectively?

Dataset Options:

- UCI Student Performance (~650 students); link: <https://archive.ics.uci.edu/dataset/320/student+performance>
- OULAD (~32k students, realistic & large scale) <https://data.mendeley.com/datasets/5b82ytz489/1>
- Mendeley Student Metrics; link: <https://data.mendeley.com/datasets/5b82ytz489/1>

Data Preprocessing: Clean, encode, and normalize student data to ensure quality and consistency.

Modeling: Implement and compare Logistic Regression, Decision Trees, Random Forest, XGBoost, and Neural Networks.

Explainability: Apply SHAP and LIME for both global and local model interpretation.

Prototype: Develop an interactive dashboard to visualize predictions, student risk levels, and key influencing factors.

Evaluation:

It will be evaluated by model performance using metrics such as Accuracy, Precision, Recall, F1-score, and AUC. Baseline models will be compared against more advanced techniques to identify the most effective approaches. In addition, a usability study will be conducted with teachers to understand how explanations influence their trust, clarity, and overall perception of the system.

Motivation & Contributions:

The project is motivated by a desire to bridge AI and education, helping teachers make informed, timely decisions to support students. Key contributions include establishing benchmark predictive models, demonstrating how explainable AI can enhance teacher trust, and delivering a prototype smart gradebook that provides actionable insights for personalized student support.