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Analyzing PG Student Performance Using Deep Learning

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Abstract: This study uses deep learning techniques to predict the academic performance of postgraduate (PG) students. By analyzing data such as grades, attendance, and online activity, we trained models like Deep Neural Networks (DNN) and Recurrent Neural Networks (RNN). Results show DNN achieving approximately 89% accuracy, making it an effective tool for early intervention.

Keywords: Deep Learning, DNN, RNN, Data Mining.

I. INTRODUCTION

Postgraduate students often face academic and personal challenges that impact their performance. Traditional statistical models sometimes fail to uncover hidden patterns. Deep learning, with its ability to model complex relationships, offers a promising approach. The goal of this research is to classify students into High, Medium, and Low performers.

II. LITERATURE REVIEW

Understanding student performance has been a popular research topic for many years. Early studies used simple statistical methods like regression analysis to predict how students would perform. However, these methods often missed deeper patterns in student data.

Al-Barrak and Al-Razgan (2016) used decision tree algorithms to predict student GPA. They showed that data mining techniques can help identify weak students early. Kaur and Singh (2018) explored Support Vector Machines (SVMs) to classify students into different performance categories. Their results were better than traditional statistical approaches. Mishra et al. (2020) focused on using deep learning models and proved that neural networks could find complex relationships in student datasets that traditional methods could not. Another study by Al- Shabandaretal. (2017) applied machine learning to online learning platforms and found that student interaction data (like login frequency and time spent online) is a strong predictor of academic success.

However, most of these studies focused on undergraduate students. Very few studies deal specifically with postgraduate (PG) students, who have different challenges, learning styles, and motivations compared to undergraduate students. This shows a clear need to study postgraduate student performance separately.
Thus, our work aims to bridge this gap by applying Deep Neural Networks (DNN) and Recurrent Neural Networks (RNN) to postgraduate data, achieving better predictive accuracy and deeper understanding.

III. METHODOLOGY

Data was collected from academic records, attendance logs, stress surveys, and online learning activity. After cleaning and preprocessing the data (normalization, encoding), we trained models:
- Deep Neural Network (DNN)
- Recurrent Neural Network (RNN)
Example: A student with 78% marks and 90% attendance was predicted to be a High performer

A. Deep Learning Model Architecture

The DNN model consisted of an input layer, three hidden layers with ReLU activation, and an output layer with softmax activation for multi-class classification.

B. Experiments

We compared deep learning models against traditional baselines:
- Logistic Regression: 74.5% accuracy
- Random Forest: 78.1% accuracy

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- XGBoost: 80.4% accuracy
Deep Learning models:
- DNN: 89.3% accuracy
- RNN: 86.7% accuracy

C. Results

Most students were correctly classified into performance categories. Important features influencing performance included:
- Previous GPA
- Attendance percentage
- Online course engagement
- Stress levels reported

IV. CONCLUSION

Deep learning models outperform traditional methods in predicting PG student performance. The study highlights the importance of early identification of at-risk students. Future research should explore real-time data and expand the dataset.

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