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Machine Learning for Predicting Student Performance and Enhancing Engagement in Higher Education

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Abstract

As higher education increasingly integrates digital technologies, machine learning (ML) offers promising opportunities to support data-informed teaching and learning strategies. This study investigates the application of ML models to predict student academic performance and identify disengagement early in the semester. Drawing on a dataset containing attendance records, assignment scores, learning management system interactions, and demographic features from undergraduate courses, the research compares the performance of several supervised learning algorithms, including decision trees, random forests, and support vector machines. Results demonstrate that ML models can accurately predict final course outcomes with over 85% accuracy, allowing instructors to proactively support at-risk students. Additionally, the study discusses the development of a real-time dashboard for faculty to interpret predictive outputs and adjust instruction accordingly. Beyond prediction, the use of ML tools fosters more personalized learning environments by enabling adaptive feedback and tailored intervention strategies. The paper also examines the ethical implications of using student data, addressing privacy, consent, and algorithmic transparency. Ultimately, this research contributes to the ongoing discourse on artificial intelligence in education and offers practical insights into how predictive analytics can empower educators to improve student success and engagement.

Keywords: Analytics, Education, Ethics, Intervention, Prediction