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Micro-Behavior Driven Explainable Learning Analytics: A Lightweight Approach to Course Personalization

Communication Info

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Abstract

Personalized learning in online education increasingly relies on predictive models of student engagement. However, many existing approaches are either overly complex or lack interpretability, limiting their practical adoption[1]. This paper introduces a lightweight and explainable framework for course recommendation based on behavioral micro-patterns simple signals such as activity frequency, temporal regularity, and submission delays extracted from the OULAD Dataset [2]. Our approach combines classical machine learning models, including Logistic Regression and Random Forest, with SHAP-based explainability to provide transparent insights into the factors driving predictions[3]. Experimental results demonstrate that micro-pattern features achieve competitive predictive performance compared to more complex models while offering superior interpretability[4]. The findings highlight that effective personalization can be achieved with minimal computational complexity, making the approach suitable for deployment in real-world online learning environments. This study contributes a novel, reproducible, and human-centric methodology that bridges predictive accuracy and transparency, enabling actionable recommendations for both learners and educators in smart learning contexts [5].

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