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PhD Dissertation Thesis Defense

Entitled

IDENTIFICATION OF STUDENTS AT RISK OF LOW PERFORMANCE OR FAILURE BY COMBINING RULE-BASED MODELS, ENHANCED MACHINE LEARNING, AND KNOWLEDGE GRAPH TECHNIQUES

by

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Abstract

Technologies and online learning platforms have changed the contemporary educational paradigm, giving institutions more alternatives in a complex and competitive environment. Online learning platforms, learning-based analytics, and data mining tools are increasingly complementing and replacing traditional education techniques. However, academic underachievement, graduation delays, and student dropouts remain common problems in educational institutions. One potential method of preventing these issues is by predicting student performance through the use of institution data and advanced technologies. However, to date, scholars have yet to develop a module that can accurately predict students' academic achievement and commitment. This dissertation attempts to bridge that gap by presenting a framework that allows instructors to achieve four goals: (1) track and monitor the performance of each student on their course, (2) identify at-risk students during the earliest stages of the course progression (3), enhance the accuracy with which at-risk student performance is predicted, and (4) improve the accuracy of student ranking and development of personalized learning interventions. These goals are achieved via four objectives. Objective One proposes a rule-based strategy and risk factor flag to warn instructors about at-risk students. Objective Two classifies at-risk students using an explainable ML-based model and rule-based approach. It also offers remedial strategies for at-risk students at each checkpoint to address their weaknesses. Objective Three uses ML-based models, GCNs, and knowledge graphs to enhance the prediction results. Objective Four predicts students' ranking using ML-based models and clustering-based KGEs with the aim of developing personalized learning interventions. It is anticipated that the solution presented in this dissertation will help educational institutions identify and analyze at-risk students on a course-by-course basis and, thereby, minimize course failure rates.

Keywords: Rule-based System; Prediction; At-risk Student; Machine Learning; Knowledge Graph; Personalized Learning