RADemics

Predictive Analytics for Dropout Risk and Mental Fatigue Using Integrated Academic and Psychological Data Models

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Abstract

Predicting student dropout risk and mental fatigue has become a critical challenge for educational institutions aiming to improve retention and overall academic success. Traditional models primarily based on academic performance often fail to capture the complex psychological factors that significantly influence student outcomes. This chapter presents an integrated approach to dropout prediction by combining academic data with psychological insights through advanced predictive analytics. The proposed model incorporates academic performance metrics, including grades and attendance, alongside psychological factors such as stress, anxiety, and mental fatigue. By integrating machine learning algorithms with multidimensional data, a more accurate and holistic prediction framework is developed, enabling early identification of at-risk students. This integrated approach not only improves prediction accuracy but also facilitates timely interventions, thereby reducing dropout rates and enhancing student well-being. The chapter explores various machine learning techniques, evaluates their effectiveness, and discusses the challenges and ethical considerations in implementing such models. The findings underscore the importance of addressing both academic engagement and mental health in predictive analytics for higher education. Ultimately, this approach offers a comprehensive framework for fostering student success and retention through data-driven interventions.

Keywords: Dropout Prediction, Mental Fatigue, Academic Data, Psychological Insights, Predictive Analytics, Machine Learning.

Introduction

In recent years, the issue of student dropout and mental fatigue has gained significant attention in educational research and policy-making [1]. Traditional models for predicting student dropout have predominantly relied on academic performance indicators such as grades, attendance, and participation [2]. While these metrics are useful in gauging a student's academic trajectory, they fail to provide a comprehensive understanding of the underlying factors that contribute to a student's disengagement or departure from higher education [3]. Mental health, including factors like stress, anxiety, depression, and overall emotional well-being, plays a crucial role in influencing a student’s ability to succeed academically and maintain persistence in their studies

[4]. Recognizing the complex interplay between academic performance and mental health is essential for improving retention rates and promoting a supportive learning environment [5].

To address the limitations of traditional dropout prediction models, this chapter proposes an integrated approach that combines both academic and psychological data to develop more accurate predictive analytics [6]. By incorporating academic indicators such as exam grades [7], class participation, and assignment completion with psychological data, including self-reported mental health assessments and physiological stress markers [8], a more holistic model of student engagement is formed. Such an integrated model moves beyond simple correlations between academic performance and dropout rates and considers the multidimensional nature of student experiences, including their emotional and psychological well-being [9]. Through the use of machine learning algorithms, this model can identify at-risk students early, offering institutions the ability to intervene proactively before academic disengagement becomes irreversible [10].

While academic data alone provides a limited view, the integration of psychological insights into dropout prediction models enhances their ability to capture the full range of factors affecting student success [11]. Stress, anxiety, and burnout are often linked to declines in cognitive performance, focus, and motivation, making them significant contributors to poor academic performance [12]. Students experiencing mental fatigue may struggle with concentration, memory retention, and problem-solving, which can directly impact their academic outcomes [13]. For instance, a student who may not appear academically "at risk" based on grades alone could still be battling significant mental health issues that are impairing their academic performance [14]. Addressing these underlying psychological factors provides an opportunity to intervene in a way that improves both academic outcomes and mental well-being [15].