Chapter 19
Efficient Student Behaviour Analysis in E-Learning Using Data Mining Approaches

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ABSTRACT

Recognising and assessing how pupils act is essential for customising educational opportunities and enhancing educational results in online learning. In particular, Support Vector Machine (SVM), Decision Tree (DT), and Naive Bayes (NB) are employed in this work to analyse the characteristics of pupil conduct in online educational settings. The main goal is to determine the best strategy for thoroughly comprehending how students communicate in online learning environments. Employing metrics like RMSE (Root Mean Square Error), RSE (Relative Absolute Error), and RRSE (Relative Root Square Error) to evaluate the outcome of DM (Data Mining) methods. The results show that SVM regularly beats DT and NB throughout all criteria, showing that it has a greater capacity to identify complex relationships in pupil activity records with RMSE of 0.02714, RAE of 0.00279 and RRSE of 0.02117, respectively. The tool used for execution is Jupyter Notebook, and the language used is Python.

INTRODUCTION

Student behaviour analysis in e-learning using data mining is a burgeoning area of research and application that harnesses the power of data-driven insights to understand, optimise, and enhance the learning experience (Chandrakala et al., 2021). Data mining techniques, which involve the extraction of patterns and knowledge from large datasets, play a crucial role in deciphering the complexities of student behaviour in e-learning environments (Al-Awawdeh, 2023). Here, we explore the significance, methods, and implications of student behaviour analysis using data mining in the context of e-learning (Aravind et al., 2023).

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SIGNIFICANCE OF STUDENT BEHAVIOR ANALYSIS IN E-LEARNING

Personalised Learning Paths: By analysing student behaviour, e-learning platforms can tailor learning paths to individual preferences, strengths, and weaknesses (Al-Awawdeh & Kalsoom, 2022). Data mining enables the identification of patterns in how students engage with content, allowing for the creation of personalised learning experiences that align with their unique needs (Al-Awawdeh, 2022).

Early Intervention and Support: Student behaviour analysis facilitates the early identification of potential challenges or struggles. Educators and institutions can intervene promptly by detecting patterns indicative of disengagement, procrastination, or difficulty understanding certain concepts, providing targeted support to help students overcome obstacles and succeed in their learning journey (Angtud et al., 2023).

Adaptive Learning Environments: Data mining allows for the development of adaptive learning environments. By understanding how students navigate and interact with online materials, platforms can dynamically adjust content delivery, difficulty levels, and learning resources (Eliwa, 2021). This adaptability enhances the overall effectiveness of e-learning by catering to individual students' diverse learning styles and preferences (Bhat et al., 2023).

Predictive Analytics for Student Success: Predictive analytics, a subset of data mining, enables the forecasting of student success or potential challenges (Eliwa & Badri, 2021). By analysing historical data on student behaviour and performance, e-learning systems can predict future outcomes, allowing educators to proactively address issues and implement strategies to enhance overall student success rates (Flores et al., 2023).

METHODS OF STUDENT BEHAVIOR ANALYSIS USING DATA MINING

Clickstream Analysis: Clickstream analysis involves tracking and analysing the sequence of actions performed by students while navigating through e-learning platforms. This method helps identify patterns in how students interact with content, how much time they spend on specific activities, and which resources they find most valuable (Gomathy & Venkatasbramanian, 2023).

Learning Management System (LMS) Data Analysis: LMS data contains a wealth of information related to student behaviour, including login frequency, time spent on various modules, assessment scores, and participation in discussion forums (Groenewald et al., 2023). Data mining techniques can uncover patterns and trends in LMS data, providing valuable insights into students' engagement levels and academic progress (Kem, 2023).

Social Network Analysis: Social network analysis explores the interactions and relationships between students within online learning communities (Kem, 2021a). By analysing communication patterns, collaboration, and participation in group activities, educators can gain insights into the social dynamics that impact student engagement and learning outcomes (Kalsoom et al., 2021).

Sentiment Analysis: Sentiment analysis evaluates the sentiment expressed in students' interactions, discussions, or feedback. (Kem, 2021b). Mining sentiment data can reveal the emotional tone of student responses, helping educators gauge overall satisfaction, identify areas of concern, and address emotional factors influencing the learning experience (Kalsoom et al., 2023).