**Literature Review: Student Performance Prediction Using Machine Learning**

The prediction of student performance using machine learning (ML) has gained significant attention in educational data mining (EDM). Machine learning models provide tools for forecasting student success, enabling the identification of at-risk students and enhancing educational outcomes. This review explores key research in the field, focusing on the datasets used, ML algorithms applied, and the insights derived.

Almeida et al. (2020) focused on predicting academic success by utilizing student academic records, teacher performance, and student motivation. They employed Sequential Minimal Optimization (SMO) and Logistic Regression (LR) algorithms, finding that Support Vector Machine (SVM) outperformed Logistic Regression in accuracy. Their results emphasized the importance of teacher performance and student motivation as critical predictors. The UCI Student Performance Dataset served as the primary data source for this study.

Patel and McLaren (2019) adopted a deep learning approach with the ASIST-BiLSTM model to predict student performance. Their research concentrated on predicting final grades and identifying at-risk students early. The ASIST-BiLSTM model, which is suitable for sequential time-series data, effectively predicted student performance but required large datasets for optimal performance. They used Kaggle’s Student Performance Dataset for model training.

Nguyen and Zhang (2021) developed a classification model focused on predicting student dropout risk. They argued that early dropout predictions could help implement timely intervention strategies to improve graduation rates. Their classification models were trained on student academic records and dropout risk data, and the dataset was sourced from Kaggle’s Student Performance Prediction Dataset. This work highlighted the critical role of early dropout risk prediction in improving educational retention.

Smith et al. (2018) concentrated on the use of historical academic data to predict student success. They applied general machine learning models with the goal of achieving high prediction accuracy. Though the study did not provide detailed information about the algorithms used, it contributed valuable insights into the factors affecting student performance. The Mendeley Student Academic Dataset was used for this research.

Thompson et al. (2022) introduced an advanced deep learning model called ASIST (Attention-aware Convolutional Stacked BiLSTM Network) to predict student performance. Their approach incorporated diverse data sources, including academic records, Virtual Learning Environment (VLE) clickstream data, and midterm continuous assessment scores. The model demonstrated effective performance in identifying behavioral patterns and predicting student outcomes, using the Kaggle Student Performance Dataset for training.

Kumar et al. (2019) explored performance prediction techniques using small datasets, focusing on student engagement in innovative projects. They demonstrated that effective machine learning models could still generate meaningful predictions even with limited data, making their work highly relevant for scenarios where large datasets are unavailable. The UCI Student Performance Dataset was also used in this study.

Garcia and Torres (2021) examined the impact of non-academic factors, such as family income and parental education, on student performance. They integrated socioeconomic features into their machine learning models, finding that these non-academic variables significantly enhanced prediction accuracy. This study underscored the importance of considering socioeconomic factors in performance prediction, with data sourced from the ACM Digital Library.

**References:**

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