Abstract

The management of educational institutes are perpetually in the process of innovating policies to enhance the quality of educational services. The intellectual growth of the students and the popularity of institute are some of the critical areas that management strives to improve upon continuously. However, increasing level of stress among students and growing dropout rate are the primary concerns to them nowadays. Frequent failures and performance below expectation can be the two critical reasons behind these. Importantly, early prediction of student performance and timely guidance can help in reducing the number of failures and performance degradation. Proper guidance can even motivate a student to perform better than expectation. It can, in turn, bring down the stress among students and help in controlling the dropouts. An early prediction before course commencement may be advantageous as it can even assist the course selection decision.

The growing popularity of the application of artificial intelligence techniques in education catalyses the researchers to analyse various exciting aspects of learning. Analysing and modelling student performance are the two most challenging and popular research topics among them. Multiple factors influence the performance in non-linear ways; thus making these fields more attractive to the researchers. The widespread availability of educational datasets further catalyses this interestingness nowadays, especially in online learning. However, the insufficiency of quality data to interested researchers makes early performance prediction more challenging in classroom-based education. It is also important to mention here that the performance influencing factors should be identified first before building up an early prediction model. The existing studies primarily focus on cumulative grade point average, assessments, their background, behaviour etc. The assessment scores turn out to be the most influential among them during prediction. However, it can not help in case of early prediction as the assessment scores are available only during the tenure of the course. The researchers have achieved significant accuracy in predicting student performance when internal assessment scores are available, but efficient prediction before course commencement still remains an open challenge.

Superior teaching acts as a catalyst which improves the knowledge dissemination process from teacher to the student. It also motivates the student to put more effort into the study. Significantly, the research question, how the performance or grade correlates with teaching, is still relevant in present days. This work has initially proposed a quantifiable measure to indicate performance improvement concerning the expectation of the student. It has then analysed the association between teaching and performance improvement. Besides, previous knowledge on the course topics could also affect student performance. However, quantifying the knowledge is a research challenge. This work has proposed a semantic approach for quantifying domain knowledge and further analyses its' impact on student performance. The result indeed establishes the fact that superior teaching or strong domain knowledge motivate more students to not only perform as per their expectation but also better than that. Further analysis of course selection pattern support these facts. It shows that the superior students are aware of this, and they choose elective courses accordingly.

This work has used the expected teaching quality and domain knowledge as two critical predictors to classify the student performance before course commencement. A real dataset containing nearly 0.6 million pre-processed records helps in this predictive analysis. Importantly, the existing state-of-the-art classifiers turn out to be less efficient for this task. This work, therefore, proposes a novel classification approach, named random wheel, which not only works efficiently on this dataset, it also works well with other benchmarked datasets. This novel approach predicts 80% of the failures before course commencement. It also predicts 2 out of 3 improvements correctly. Besides, the random wheel provides an additional confidence measure to indicate the predictive strength. It, in turn, increases the acceptability of the prediction.