MEASURING STUDENT PERFORMANCE USING LEARNING APPROACH AND SELF-REGULATION STRATEGIES

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Abstract

Students' differ in their learning styles and their self-regulation strategies impact their academic scores. Support vector machine (SVM) is a supervised machine learning algorithm which is used for classification and prediction. Predicting student academic scores is important as it can help in improving their learning at an early stage and results in improved performance. This paper focuses on predicting student academic scores basis their style of learning and self-regulation strategies. It aims at implementing SVM algorithm using radial basis function kernel to predict students' academic scores. This can further help in identifying the students that may score low in examinations and accordingly remedial actions can be taken to improve their learning.
Keywords: *Support Vector Machine; Academic Performance; Learning Approach; Self-regulation strategies; Student*

1. INTRODUCTION

Education is an essential component and plays vital role in an individuals' life. It is important for the overall development of any person. Apart from traditional teacher-student relation there exists various ways of learning which includes conference meet, guidance, narrating, and analysis; and is carried out at all stages of life. For an individual, learning serves as an input in shaping his/her life. A learner undergoes different exams at different phases of life. The career success of a learner is measured by the success they achieve in their examinations and their success in university entrance exam [1]. In the field of education, data mining has contributed tremendously to benefit the society in large. Students are future of any country and their education is essential for the growth of country. Educational data mining is a field of data mining that focuses on analysing educational data generated through various educational organizations, intelligent tutoring systems, e-learning and etc. It can be used to improve teaching-learning process and thereby increasing the interest of students. It helps in student retention i.e. decreasing the drop rate, enhancing academia and increase the job rate hence increasing employability. There exists a relationship between non-academic parameters of students and their academic scores [2]. This raises the need to study the impact of non-academic parameters of students on their academic scores. A case study done on Indian students showed that non-academic parameters put effect on their CGPI [3]. Learning approach and self-regulation strategies are two parameters that are related to psychological behaviour of students that deals with their behaviour and mind. In a learning process it can be used to improve the performance of students.

The present study focuses on implementing SVM on students' data related to learning approach and self-regulation strategies. SVM is a supervised machine learning algorithm that is used to build classification and prediction models. In this study SVM has been implemented to classify the students and predict their academic scores. Section 2 describes the related work and the parameters. The proposed work and methodology are discussed in section 3. Section 4 gives the results and section 5 concludes the work.

2. RELATED WORK AND FACTORS IMPACTING ACADEMIC SCORE

Prediction is a data mining technique that is used to predict or foresee the values of dependent variable with the use of independent variables. The dependent variable is known as predicted variable and independent variables are known as predictors. The present study comprises of two predictors namely learning approach and self-regulation strategies and academic score of students as predicted variable. Prediction has various advantages in the field of education. It can be used to identify the students who are slow learners and, on its basis, remedial actions can be taken to improve their learning. Different techniques have been used to analyse the students' data to predict their academic score such as neural networks [4], backward propagation [5], radial basis functions [6] and multilayer perceptron [7]. The work carried in [8] aimed at identifying students' conduct in online examinations, disclosing anomalous values in the answer sheets and to predict their academic scores in end term assessments. A study in [9] has showed that self-regulation learning strategies have relevance with academic scores of students and it can be used to predict the risk of failure which is beneficial for students and educational institutes.

Learning Approach is defined as the way students understands and perceive the subject matter and prepare for the exams. Three types of learning approaches have been defined namely – deep, strategic and surface [10]. Deep learning approach is the one in which student studies deeply to understand the concepts of the topic and to know the background details. Surface learning approach is the one where in student studies to pass the exam without having in-depth knowledge of the subject matter. Strategic learning is the one where for difficult topics student studies deeply and for others surface approach is followed. Self-regulation learning strategies are defined as the way students regulate and put their efforts for studies in best possible way. It includes sub factors namely – rehearsal, effort regulation, critical thinking, elaboration, concentration and help seeking [11] [12] [13].

3. PROPOSED WORK AND METHODOLOGY

The proposed work is depicted in figure 1. The study focuses on classifying the students into three classes namely High, Average and Low basis their parameters related to learning approach and self-regulation learning strategies. The algorithm makes use of the radial basis function kernel to implement SVM. The study makes use of secondary dataset consisting of 450 records of students related to learning approach and self-regulatory learning strategies. The dataset has been divided into two sets – training and testing in the ratio of 7:3.

SVM is a supervised algorithm that has been used to classify the students and predict their academic scores. It divides the datapoints into classes by finding a hyperplane. The line that divides the points as far as possible i.e. that defines the maximum distance is known as margin.

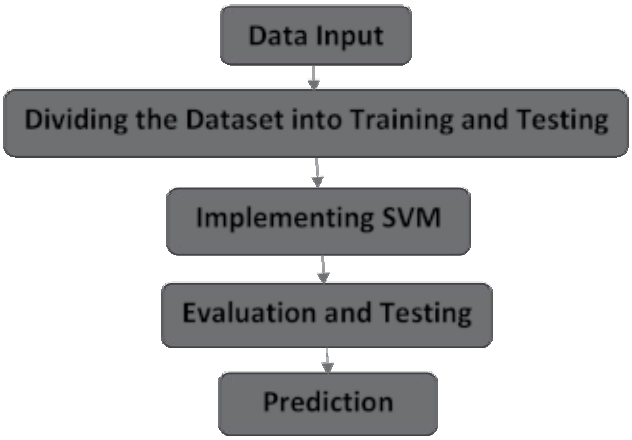


Fig. 1. Flowchart to classify the students and predict their academic scores

4. RESULTS AND DISCUSSIONS

The proposed work has been assessed using sensitivity, specificity and accuracy. Sensitivity is a statistical metric that measures the positive values whereas specificity measures the negative values. Accuracy is another statistical metric that measures the trueness. The equations have been provided below and the statistical values for evaluation and testing is given in table 1 and table 2.

Sensitivity= (True Positive)/(True Positive+False Negative)*100
pecificity= (True Negative)/(True Negative+False Positive)*100
Accuracy= (True Positive+True Negative)/(True Positive+True Negative+False Posiive+False Negative)*100

Table 1. Overall Statistics

Statistics	**Radial Basis Kernel**
Accuracy	0.8468
95% CI	0.7913, 0.8796
p-value	2.2e-15

Table 2. Confusion Matrix

Prediction	**H**	**L**	**A**
H	59	0	12
L	0	7	0
A	6	0	50

5. CONCLUSION

The study focuses on predicting academic scores of students' basis their non-academic parameters – learning approach and self-regulation learning strategies. The use of data mining techniques in the field of education to analyse students' data and data generated through various educational institutes and organizations can prove to be beneficial for the society. Predicting the academic scores of students before examinations can help in identifying slow learners. With identification of students that are at risk of failure

or may score low, remedial actions can be taken beforehand to improve their learning by arranging extra classes and other measures. This will further help in improving academic scores of students.

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