COMPARING THE PERFORMANCE OF DATA MINING ALGORITHMS IN THE PREDICTION OF TEACHER'S PERFORMANCE

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ABSTRACT

Teachers are the most significant part of the educational system in terms of improving student learning and ensuring their future success. Teacher's performance has a direct impact on student learning and student progress. The performance of a teacher in the classroom is based upon various factors such as Lecture preparation, teaching method/communication ability, Utilization of teaching aids, Coursework and day-to-day living are inextricably linked, distribution of Study materials, Subject-matter expertise, Completion of the curriculum preparation Punctuality and regularity, Class control and behavior with students. The aim of this paper is to predict a teacher's performance by using various Machine learning algorithms. For prediction of teacher's performance, we develop models using Decision tree (CART) , k nearest neighbor(KNN), Naïve Baye's Classifier, Support Vector Machine (SVM) and Artificial Neural Network (ANN). We consider above 10 Independent variables to develop models. We collected primary data from students by designing a questionnaire which is called feedback form. Data analysis was done by using R studio. This study observe that Artificial Neural Network (ANN) had higher accuracy than other algorithms.

Keywords: *Decision tree, KNN, Naïve's, SVM, Artificial Neural Network(ANN).*

Introduction

Teachers are responsible for developing knowledge and culture in children. God is the creator of the entire world, and a teacher is the creator of a whole nation, a teacher is a precious gift from God. A teacher is a pivotal factor in a student's life since his knowledge, devotion, and love shape the student's entire life. A teacher utilizes creativity in the classroom to help students focus on their studies.

The teacher shapes the future and present of the students. He also contributes to a good society by being a good student throughout his life. In order to acquire quality objectives related to students, teachers play a crucial role in the education sector. As a result, all educational institutions are concerned about teacher performance.

A proper system for evaluating a teacher's performance has yet to be developed, and there has been little related work done to examine the performance. Using various ways, they are aiming to construct a good evaluation system for the same.

Teachers can educate to assist students in understanding knowledge and concepts that are not included in the textbook. Students will have a better understanding and awareness of the subject if teachers connect with them using relevant, real-life examples, occurrences, and so on. They can apply their learning to a variety of subjects while using real-life examples. Sample of 100 teachers' were used for this study according to 10 questions teacher's performance was evaluated and categorized. For prediction purpose machine learning algorithms like Decision tree, KNN, Naïve Baye's, SVM, Neural network algorithms were used. Neural network algorithm shows greater accuracy rather than other algorithms.

Literature Review:

Patil V V. et.al. (2019) have used Naive Bayes classifier technique for prediction of teacher's performance and also estimates accuracy of the model. Bansal et.al (2018) has developed models using machine learning algorithms to detect Dementia and then compare those algorithms by their accuracy of classification. Huapaya et.al (2020) focuses on the classification of machine learning algorithms and the determination of the most efficient algorithm with the help of accuracy and precision.

Objectives:

1. To predict a teacher's performance by using various Machine learning algorithms.

2. To find the best predictive machine learning model for the prediction of teacher's performance.

Methodology:

For evaluation of Teacher's performancecollege collect feedback of teachers from students. A questionnaire type feedback forms are given to the students which contains questions like Preparation of lecture, teaching method/communication skill , Use of teaching aids, Correlation of curriculum with day to day life, Supply of study ,Depth of subject knowledge , Syllabus completion-Exam preparation , Regularity and punctuality , Behavior with students and Class control. Each question got a 10 rating from the students. They were divided into different categories such as Outstanding, Very Good, Good, Satisfactory, Fair, and Average College evaluates the teacher's overall performance based on these questions. Overall performance is used as a response variable for classification. For further analysis, college uses weighted mean to analyze the performance of the teacher. And this calculated weighted mean is used to categorize the teacher according to the classes such as Outstanding, Very good, Good, Satisfactory, Fair and Average.

1) k-fold cross validation:

K fold cross validation is a technique in which initial data randomly partitioned into k mutually exclusive subsets or folds, D_1, D_2, …, D_k and testing is performed k times. In iteration i^{th} partition D_i is reserved as a test data or test set and remaining partitions are collectively used to train the model. That is, in the first iteration subset of dataset D_2, D_3,…, D_k collectively use as a training set to obtain a first model which is tested on D1. The second iteration is trained on D_1, D_3, D_4,…,D_k and tested on D_2 and so on. In general 5 to 10 folds cross validation is used.

2) Decision Trees:

Decision Trees (DTs) are a one of the non-parametric supervised learning method used for classification and regression. The purpose is to learn simple decision rules from data attributes to create a model that predicts the value of a target variable. A decision tree classifier can be built without any domain information or parameter settings, making it suitable for exploratory knowledge discovery. In the machine learning domain, CART is one of the most often used methods for constructing decision trees.
CART develops a binary decision tree by splitting records at each node based on a single attribute's function. CART uses the GINI Index for best split. The initial split generates two nodes, each of which we try to split in the same way, resulting in a root node. To identify the candidate splitters, we go over all of the input fields once more. We label a node a leaf node if no split is identified that significantly reduces diversity of that node. Eventually, just a leaf node remains, and we have built a whole decision tree. Because of overfitting, the complete tree that is not to be treated does not do the greatest job of classifying a fresh batch of records. Every record from the training set was assigned to a leaf of the full decision tree at the end of the tree-growing procedure. A class can now be assigned to each leaf. High-dimensional data can be handled via decision trees.

3) Naïve Baye's classifier:

Naive Baye's classifier assumes that the presence of a particular feature in a class is unrelated to the presence of any other feature. Bayesian classifiers are statistical classifiers that predict probabilities of class membership, such as the probability that a given tuple belongs to a specific class. Naïve Baye's classifier is based on the concept of Baysean classifier. When used to big data sets, Bayesian classifiers results showed great accuracy and speed.

4) Support Vector Machine (SVM):

The Support Vector Machine is a one of the best supervised machine learning algorithm for classification and regression. It can solve both linear and non-linear problems and widely used. SVM algorithm uses the nonlinear mapping to transform the original training data into higher dimensions within this new dimension. It searches for the linear optimal separating hyper plane (that is a decision boundary separating the tables of one class from another) with an appropriate non linear mapping to sufficiently high dimensional data from two classes can always be separated by hyper plane. The SVM finds this hyper plane by support vectors

(essential training tuples) and margins (defined by support vectors)

5) k-nearest neighbors (KNN) algorithm:

k-nearest neighbors (KNN) algorithm is one of the simple procedures that can be used for classification. When large samples are involved, it classifies them based on the category of their closest neighbors. This classifier used some or all the pattern available in training set to classify test pattern. The basic idea behind this classifier is to detect similarities between the pattern and every other pattern in the training set.

Without making any assumptions about the distribution from which the training examples are selected, the nearest neighbor approach achieves consistently high performance among the various method of supervised learning. The distances to the nearest training case are used to classify the sample. The KNN algorithm amplifies this idea by taking the k-nearest points and assigning the class of majority. It is normal to choose k small and/or break ties (typically 1,3 or 5). Large k values help to reduce the effect of noisy point within the training data set and the choice of k is often performed through cross validation. An object is classified according to majority vote of the class of the neighbors.

- The object is allocated in the class with the most members among the k-nearest neighbors.
- If k = 1 then it becomes a nearest neighbor algorithm (NN).
- This algorithm gives you a more correct classification for boundary patterns than N-N algorithm.
- The value of k has to be specified by the user and the best choice depends on data.
- Larger value of k reduces the effect of noise on the classification. The value of k can be arbitrarily increased when the training data set is large in size.
- The k value can be chosen by using the validation set and choosing the k value giving the best accuracy on the validation set.

6) Artificial Neural Network (ANN):

A neural network is a network of connected input-output units with a weight assigned to each connection. The network learns by modifying the weights during the learning phase so that it can anticipate the right class label of the input tuples. However, Artificial Neural Network algorithms have certain advantages, including a high tolerance for noisy input and the capacity to classify factors for which they have not been trained. They can be used when you may have little knowledge of the relationship between attributes and the classes. There are many different types of neural networks and neural network algorithms. Back propagation is the most famous neural network method.

Data Analysis:

We use 10 –fold cross validation for all the algorithms to predict teacher's performance. Using 10-fold cross-validation the following results are obtained.

Decision tree (CART):A

Decision tree was build by using CART i.e. Classification And Regression Tree

Table 1:Results of Decision tree using 10-fold cross validation

cp	Accuracy	Kappa
0.04166667	**0.59**	0.3685185
0.13333333	0.56	0.3248966
0.35000000	0.49	0.1999374

Here, highest accuracy (0.65) corresponds to cp= 0.04166667

The final value of cp which was used for the model was cp = 0.04166667.

K-nearest Neighbor algorithm (KNN):

Table 2:Results of KNN using 10-fold cross validation

k	Accuracy	Kappa
5	**0.65**	0.4529262
7	0.62	0.4018927
9	0.62	0.4028476

Here, highest accuracy (65%) corresponds to k=5

Therefore, the final value of k which was used for the model was k = 5.

Support Vector Machine(SVM) :

Table 3:Results of SVM using 10-fold cross validation

Accuracy	Kappa
0.59	0.3740053

The SVM Model is obtained with accuracy 59%

Tuning parameter 'C' was held constant at a value of 1

Naive Baye's classifier:

Table 4:Results of Naïve Baye's using 10-fold cross validation

usekernel	Accuracy	Kappa
FALSE	0.2555556	-0.07440561
TRUE	0.2555556	-0.07440561

The Naïve Baye's Model obtained with accuracy 25.5556%

Artificial Neural Network algorithm (ANN):

Table 5: Results of ANN using 10-fold cross validation

size	decay	Accuracy	Kappa
1	0e+00	0.57	0.3399217
1	1e-04	**0.66**	0.3399217
1	1e-01	0.62	0.4113711
3	0e+00	0.54	0.2952031
3	1e-04	0.51	0.2586085
3	1e-01	0.56	0.3263785
5	0e+00	0.60	0.3965171
5	1e-04	0.58	0.3649415
5	1e-01	0.56	0.3229756

The highest accuracy 66% corresponds to the size = 1 and decay = 1e-04.

The final values of size and decay which was used for the model were, size = 1 and decay = 1e-04.

Results & Discussion:

Comparative analysis of machine learning algorithms:

Table 6:Classification Accuracy of all models

Sr.No.	Method	Accuracy
1	Decision tree	59%
2	SVM	65%
3	KNN	59%
4	Naïve Bayes	25%
5	ANN	66%

As shown in the table the Neural network algorithm shows greater accuracy (66%) than other algorithms. SVM shows 65% accuracy which can also be considerable. The accuracy of the Naive Baye's algorithm, on the other hand, is only 25% which is not considerable for prediction purpose.

Conclusion:

Teacher performance evaluation is essential to meet the institute's quality objectives, as we all know, but the most important thing is to make accurate predictions of teacher performance. Correct prediction can be achieved by using a model with high accuracy. In this case, the optimum model for predicting teacher's performance is an Artificial Neural Network (ANN). Therefore, for teacher's performance prediction, a neural network algorithm is helpful.

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