

Design a System to Identify Type of Learner Based on Expression of Learner in Collaborative Learning Environment using Ensemble Learning Method of Machine Learning

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Abstract

Learning plays an important role in an individual's development. Learning is possible through various ways which improves knowledge of individuals. Collaborative learning environment is one of the effective types of learning which improves the skills of learners. It may be possible that few learners are very active and few learners are slow, for such slow learners motivation is required to improve the learning skills. The objective of this work is to identify the type of learner based on the expression of learner in a collaborative learning environment using ensemble learning method of machine learning, based on the type of learner expert or ecosystem will decide further path for slow learners, average learners as well as for fast learners.

Keywords: Collaborative Learning, Machine Learning, Ensemble learning Method

1.Introduction

To acquire new skills by expanding our knowledge is only possible with the help of learning. Learning plays an important role in an individual's development. Learning can be possible in various ways or types and collaborative learning is one of the effective types for learning. Collaborative learning helps to improve problem solving skills, also in collaborative learning, learner try to relate with other learners in group as learners learns in a group, it is possibility to get more individual feedback during the learning process, ultimately it results enhancement in the performance of the learners. It may be possible that in collaborative learning there may be active learners and passive learners. In collaborative learning, important parameters are effective communication and collaboration to become effective learners, as every learner is unique in terms of learning, we can classify the group of learners by predicting the type of learner based on expressions of learner. Ecosystems can help a group of slow learners to improve their performance by providing expert opinion.

2.Literature Review

Collaborative learning has several advantages like, in the traditional teaching learning process, if students do not understand the concept very few dare ask questions to the

professor but if students are working in small groups and performing joint activities they can be more expressive, they can ask each other all the questions.[5]

Graesser et al [6] presented Framework 'Autotutor' based on ITS. student-agent interactions in natural language is proved in this new framework, AutoTutor also inspected the learners reasoning and emotional state.

Rosen [9] presented extensive and innovative research on the assessment of collaborative skills using a computer system and also proved that CPS with a computer agent helps for the identification of a higher level of understanding which is also helpful for observing the learner progress and also gives feedback of the learner.

3.Architecture

In this paper we proposed layered architecture which helps to predict type of learners into fast learners and slow learners depending on the expressions of learners. The proposed architecture consist of Profile Layer,Smart collaborative learning environment Layer,Application Layer. Fig. 1 shows the proposed model architecture

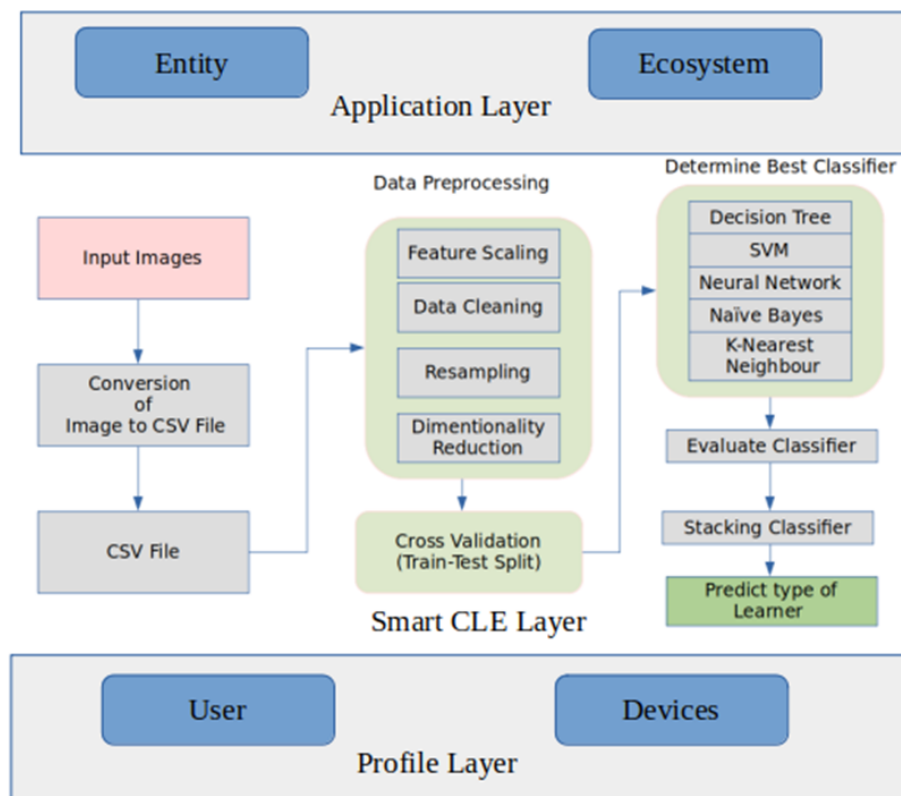


Fig. 1 Architecture

First layer is the profile layer, in profile layer input in the form of facial expression can be taken either by User or Web Services or Devices from input images, second layer is smart collaborative learning environment layer and the third layer is application layer.

Small collaborative learning environment layer takes input as a csv file which is generated from the images using python library and data preprocessing needs to perform on csv file, as data preprocessing is an essential step in almost all the machine learning problems.

4. Data pre-processing

Data pre-processing is one the important task in small collaborative layer of our architecture, Data pre-processing includes various processes including feature scaling, data cleaning, resampling and dimensionality reduction to provide proper data for machine algorithm in order to generate more accurate results, below mentioned are the different techniques of data preprocessing.

4.1 Feature Scaling

It may be possible that csv files generated from images contain great differences in the scale of the numbers and problems may occur, during modeling if we combine the values as features for such a situation feature scaling techniques required. Feature scaling can be achieved by using various techniques like Normalization, Standardization, Robust Scaler.

Values can be rescaled and also shifted by using Normalization, this process is also known as Min-Max scaling. Another feature scaling technique is standardization, in this process the values are centered around the mean with a unit standard deviation. Robust Scaler algorithms is also one of feature scaling technique, in this process algorithm scale features that are robust to outliers.

4.2 Data cleaning

This is another important process in data pre-processing for fixing or removing incorrectly formatted, incomplete as well as corrupt records which is data that does not belong in our dataset.

4.3 Resampling Techniques

This technique performs balancing classes for imbalanced datasets before providing the data as input to the machine learning algorithm, the agenda behind using this technique majority class frequency can be decreased as well as minority class frequency can be increased so that for both the classes approximately the same number of instances can be obtained.

For experiment we have generated data in csv file format using python library from various images of facial expressions of learners, the generated csv file contains imbalanced datasets consist of different class of data such as smart class, poor class, average class.

Fig. 4.3.a shows the imbalanced datasets before resampling consist of different class of data such as smart class, poor class, average class and Fig. 4.3.b shows the balanced datasets after resampling consist of different class of data such as smart class, poor class, average class.

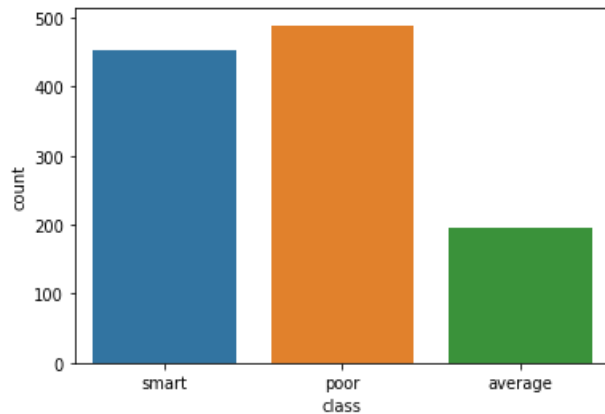


Fig. 4.3.a Imbalanced Datasets

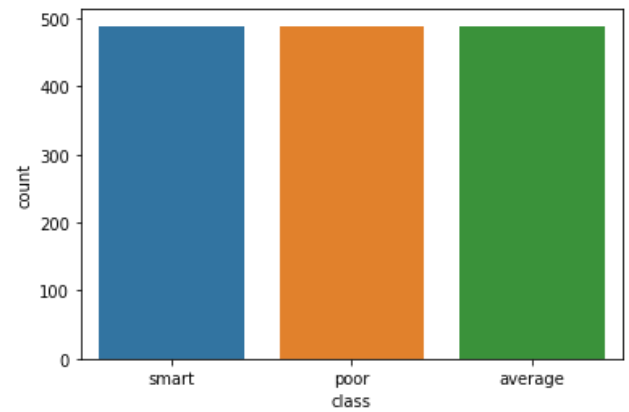


Fig. 4.3.b Balanced Datasets

4.4 Dimensionality reduction

It is also called dimension reduction, in this technique the number of random variables can be reduced under consideration by obtaining a set of principal variables.

After data preprocessing the next step in small collaborative environment is train/test split which is used to estimate the performance of machine learning algorithms, in this step data is splits into Training and Testing sets where model gets train for various classification algorithms like decision tree, SVM classifier, Naïve Bayes Classifier, Neural networks, K-Nearest Neighbour.

5 Determine best classifier

Determine best classifier is also one of the important tasks in machine learning models from various classification algorithms. By calculating accuracy score and confusion matrix we can evaluate best classifier, following fig shows different graphs plotted for confusion matrix for decision tree, SVM classifier, Naïve Bayes Classifier, Neural networks, K-Nearest Neighbour.

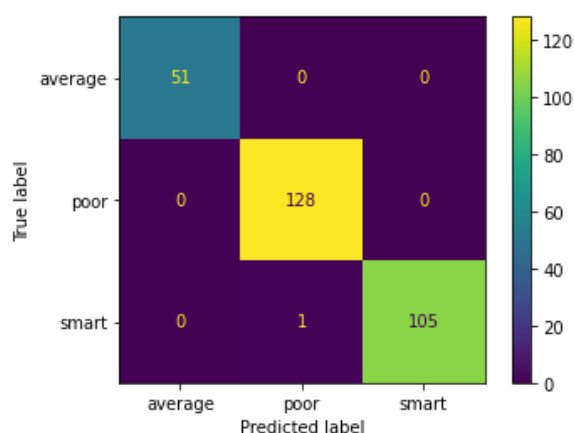


Fig. 5.5.a Decision tree

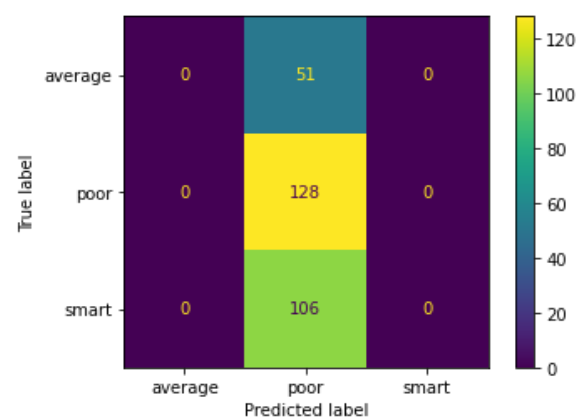


Fig. 5.5.b SVM classifier

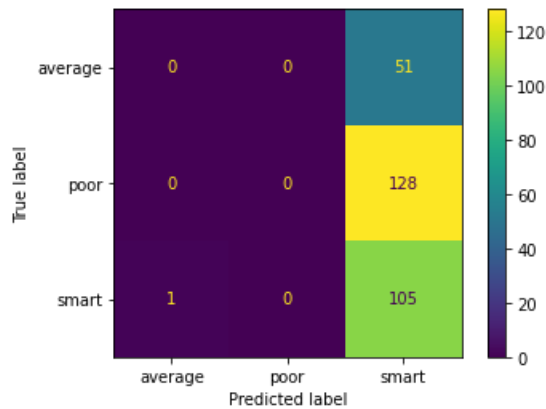


Fig. 5.5.c Naïve Bayes Classifier

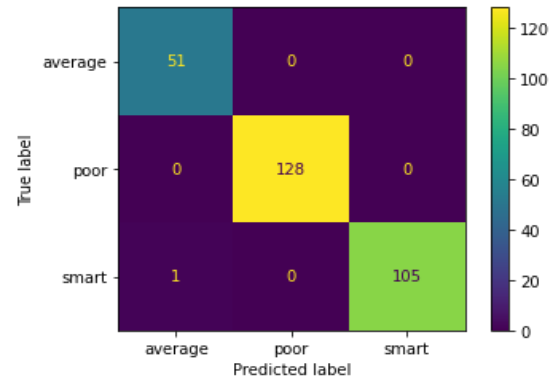


Fig. 5.5.d Neural networks

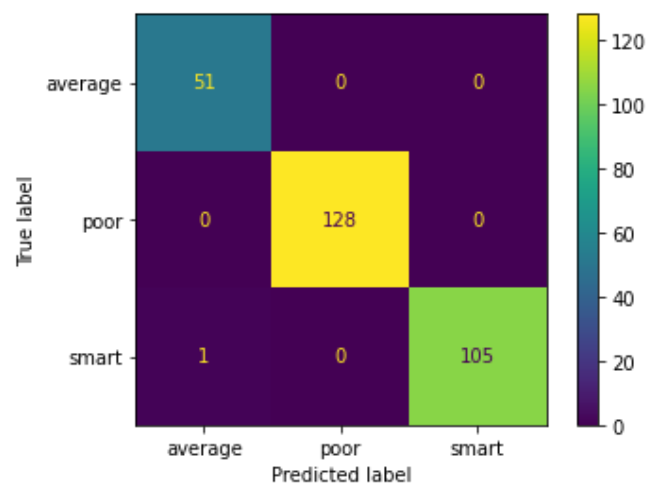


Fig. 5.5.e K-Nearest Neighbour

Fig 5.5.f shows the graphs plotted based on accuracy of the algorithm

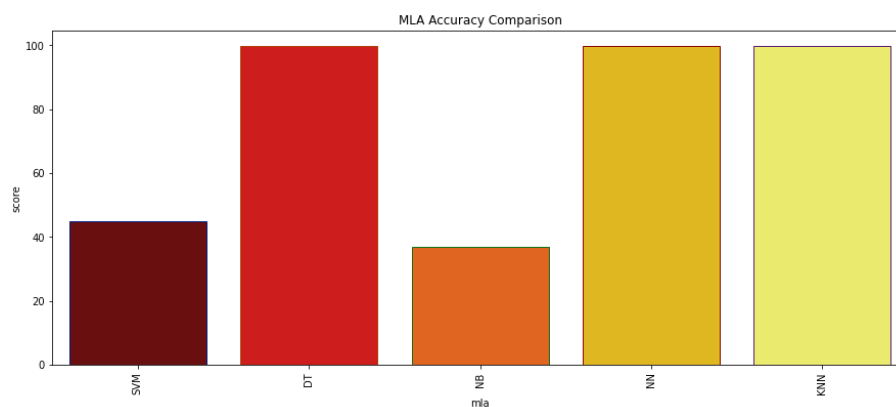


Fig 5.5.f Accuracy of the algorithm

By observing the graphs and result of decision tree, SVM classifier, Naïve Bayes Classifier, Neural networks and K-Nearest Neighbour, evaluate the best classifier algorithms for the Ensemble Learning Methods

6. Ensemble Learning Methods :

These methods help to generate better results and ensemble models that can improve performance of a system. Ensemble Learning Methods are Bagging, Boosting and Stacking.

Stacking Method : In the stacking model there are two level models, level 0 and level 1. The level 0 model consist two or more base models and the level 1 model is also known as meta-model. predictions of base models combines in meta-model. Fig 6.1.a shows the flow of stacking method

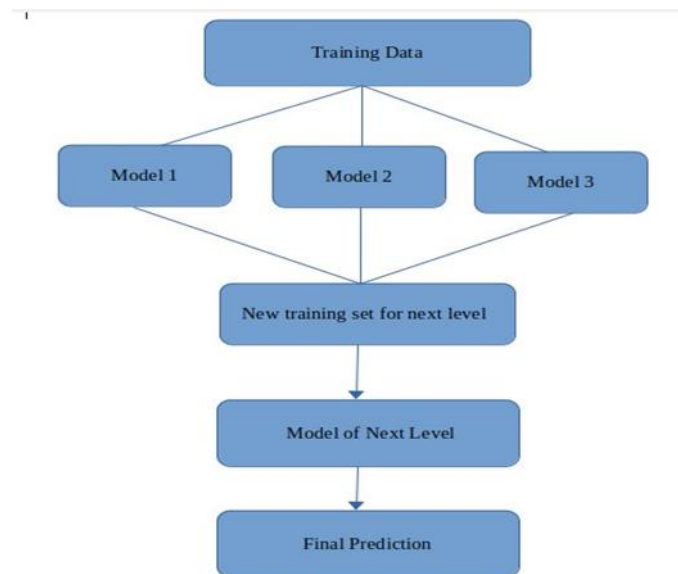


Fig 6.1a Stacking Method

By observing the graphs and result of all the classifier algorithms K-Nearest Neighbour, Neural Networks and Decision Tree are the machine learning considered for Stacking model as shown in fig 6.1.b

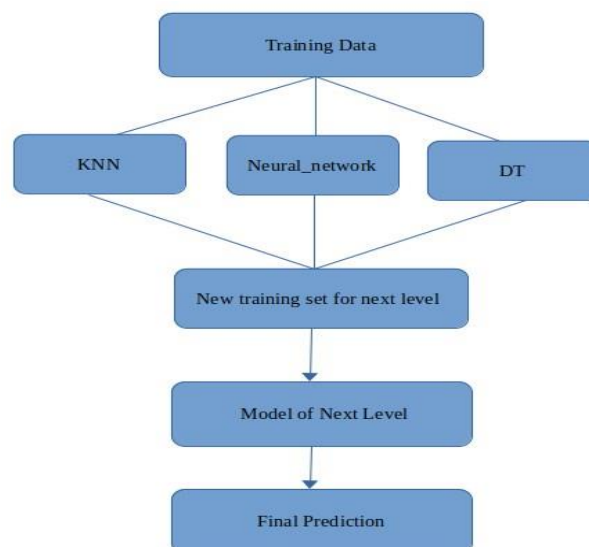


Fig 6.1.b Stacking Method

After applying the Stacking Classifier to K-Nearest Neighbour, Neural networks and Decision Tree more accurate result is generated, below mentioned graph in fig. 6.1.c for confusion matrix is generated after applying Stacking Classifier which shows more accuracy as compared to accuracy of single classification algorithm.

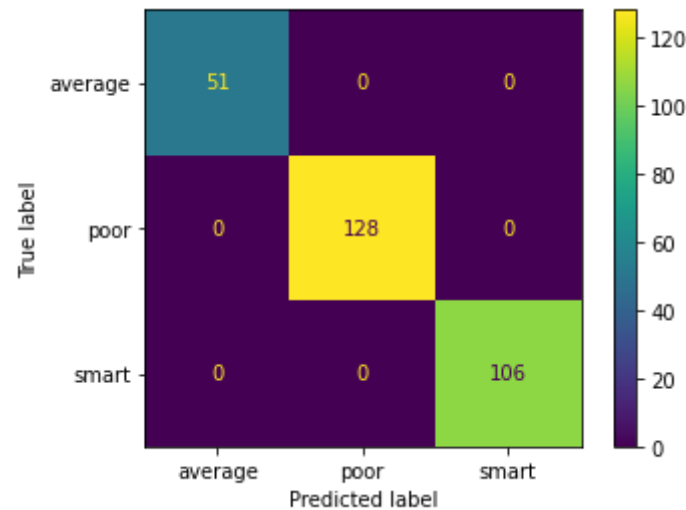


fig. 6.1.c Stacking Model

7. Conclusion and Future Work

In this work we have design a system to identify type of learner based on expression of learner in collaborative learning environment using ensemble learning method of machine learning, which will be helpful to teachers or ecosystems to categorize the learners and can decide amount of efforts required for the specific class of learners. In this work we have designed a system which takes image as an input, this work can be further extended by working on analysing videos as well as audio files

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