Student Flexibility in Online Learning

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Abstract-Since the past few years, the Internet has become from being nearly non-existent into the biggest, most accessible database of information which has been ever created. Online education is the process of achieving knowledge and skills through electronic devices by using the internet. With the help of online education, mentors and tutors finds it possible to reach the students more flexibly and they get to teach the students more efficiently. The students who are not able to attend regular offline classes can also learn anything from anywhere easily with the help of the internet. The aim of this project is to predict how much the students can adapt/be flexible to Online Education based on several factors like financial conditions, network type, age of the students, location, institution type, internet type, device etc. With the help of this project, we aim to build multiple classification models using Orange tool and from that the model with the best accuracy is chosen.

Index terms-Accuracy, Flexibility, Classification model, Visualization.

Introduction

Recent years have seen a rise in the popularity of online education, particularly after the COVID-19 pandemic started. Students had to adjust to new modes of learning and participating in their assignments since the move to virtual learning.

In this modern time of learning, students should possess the ability to adapt. For them to thrive academically, they must be able to adapt to new learning spaces, technologies, and teaching methods. For this, they need to be resilient, open to learning, and change-friendly.

Students have a great deal of flexibility thanks to online education, which enables them to take charge of their learning and customize it to suit their own needs and interests. Online education can give students greater freedom in a number of ways, including:

1. Time: Students who learn online are able to complete their schoolwork at their own speed and on their own time. Students are able to study and finish assignments during any time of the day, which makes it simpler to juggle other duties like employment or family obligations.

2. Location: Students can learn online from any location as long as they have access to the internet. Students who reside in remote or rural locations or who are unable to attend classes on campus because of physical limitations or other restrictions may particularly benefit from this.

3. Course: Students can select from a variety of courses and programmes offered through online learning that best suit their professional aspirations or personal interests. Also, it's common for students to enrol in various institutions' courses at once, resulting in a more individualised and varied educational experience.

Overall, the adaptability of online learning gives students a more flexible and individualised educational experience, allowing them to pursue their academic and professional objectives in accordance with their own schedules.

Literature Review

1. This study studied the impact of flexible learning delivery format on learning made by a group of Human Resource Development UG students among various types of learning techniques meeting the online learner's learning styles.

2. The authors looked at the elements influencing student satisfaction with adaptable online learning in response to recent advancements in technology and the trend towards flexible learning in education.

3. The implementation of the learning style theory in the context of online learning is the topic of this research.

4.The goal of this essay is to determine whether flexible learning in the classroom contributes to the advancement of quality education.

5. The objective of this research is to examine how students employ flexibility in online academic subjects in terms of learning time, place, and access to learning resources, and to determine how all this relates with variations in course performance.

6. The purpose of this study is to determine how behavioural engagement and academic

achievement in an online learning environment are impacted by perceived flexibility.

7. In this article, the effects of COVID-19 are discussed, along with the methods being used to support undergraduate scientific instruction as the epidemic progresses.

8. The study used two surveys—one that was given to 50 faculty members and another that was given to 280 students who were chosen at random—to find out more about the challenges, perks, and perceptions of online learning in Jordan.

9. The purpose of this study is to examine how university students perceive flexibility, self-regulated effort, and satisfaction with the distant learning process, as well as how they feel about distance learning.

10.This method study was carried out to determine whether students were prepared to use the adaptive learning methods that were set up in the local environment in accordance with the Commission on Higher Education Memorandum Order.

11. Due to the COVID-19 Pandemic, flexible learning has taken the place of on-campus instruction at higher education institutions (HEIs) in the Philippines. This essay examines the difficulties students have when the university implements flexible online learning in rural areas based on their prior knowledge and experiences.

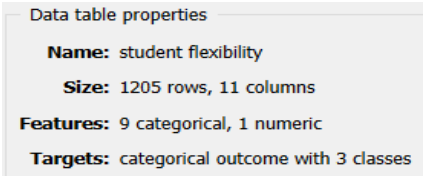
Implementation

Tools used-Orange, Excel

Orange is an open-source toolset for data mining and visualisation . It has a visual programming front-end for interactive data visualisation and exploratory qualitative data analysis.

Data Description

The dataset Student flexibility in online learning is obtained from Kaggle. The dataset explains how much the students can adapt/be flexible to Online Education based on several factors like financial conditions, network type etc. This dataset consist of 1205 instances and 11 features among which one is the target variable. This dataset contains no missing values. Flexibility level is chosen as the target variable which has values high, low and moderate.



The attributes in the datasets are:

- Flexibility level
- Education level
- Institution type
- Gender
- Age
- Device
- IT student
- Location
- Financial Condition
- Internet type
- Network type

Pre-processing

Here, in the dataset as a part of Preprocessing, the data set which was in categorical form has been treated as ordinal by doing Continuize Discrete Variables in order to get a better understanding of the model.

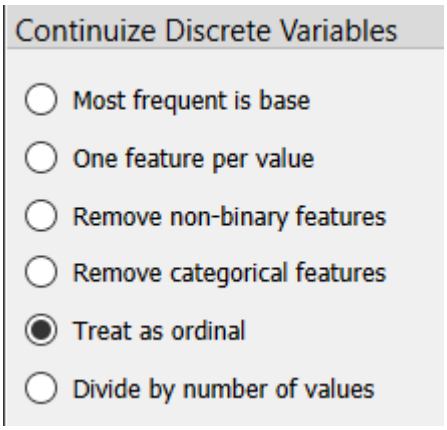


Fig. Treat as ordinal

Outliers in the dataset are found and removed so as to make the dataset more accurate.

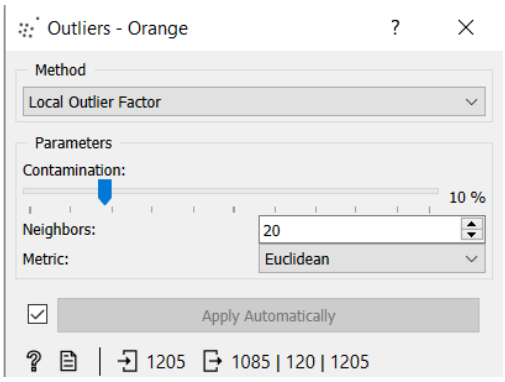


Fig. Outliers

Data Exploration

To analyse the data and find out more about it, the data needs to be explored.

To analyse the data well, visualization techniques are used. The visualization technique mainly used here is distributions.

Flexibility level

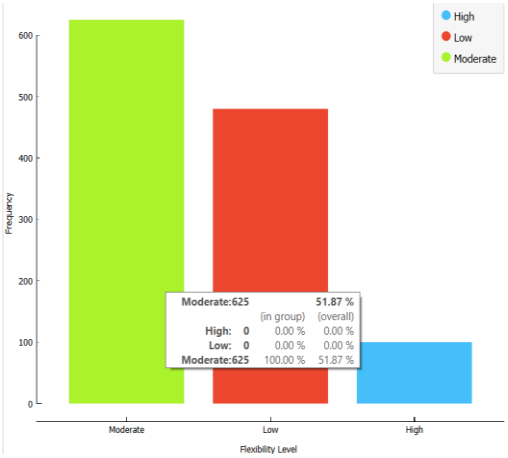


Fig. Flexibility level

From the above distribution it can be understood that most of the students are moderately flexible

Gender vs flexibility level

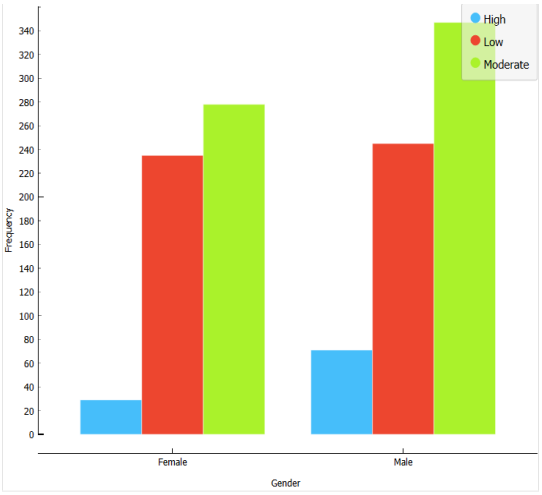


Fig. Gender vs flexibility level

Male:663		**55.02 %**
	(in group)	(overall)
High: 71	10.71 %	5.89 %
Low:245	36.95 %	20.33 %
Moderate:347	52.34 %	28.80 %

Female:542		**44.98 %**
	(in group)	(overall)
High: 29	5.35 %	2.41 %
Low:235	43.36 %	19.50 %
Moderate:278	51.29 %	23.07 %

From the above data we can see that most of both male and female students are moderately flexible to online learning out of which 52.34% are male and 51.24% are females from their respective groups. This shows that gender doesn't greatly affect in deciding the flexibility of students in online learning.

Education level vs flexibility level

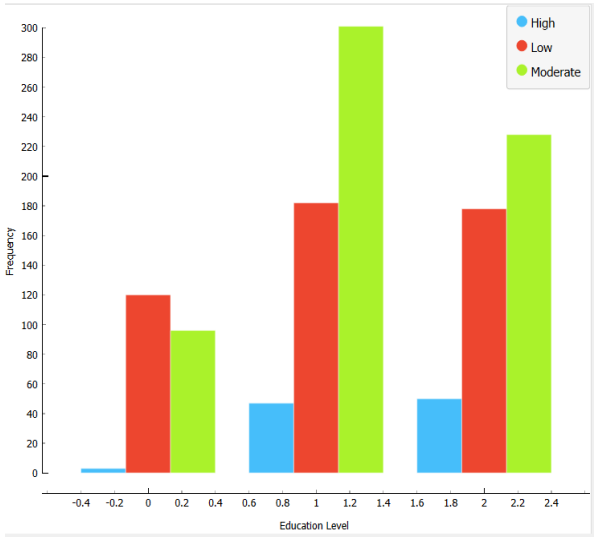


Fig. Education level vs flexibility level

From the above chart we can understand that college students are least flexible, school students are moderately flexible and university students are highly flexible to online learning.

Device vs flexibility level

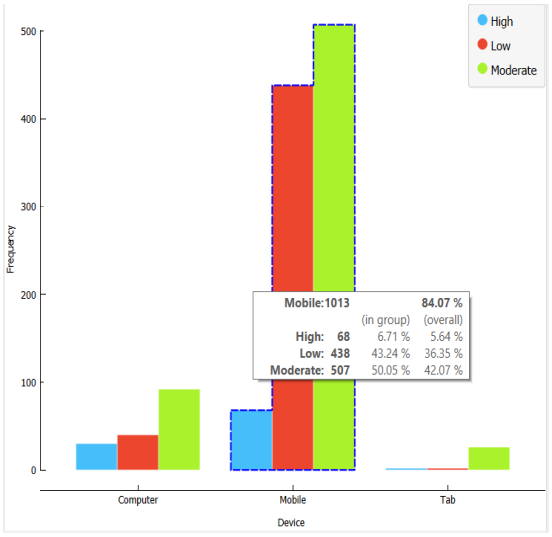


Fig. Device vs flexibility level

From the above chart it is visible that most of the students attending online classes use mobile as their device.

Age vs flexibility level

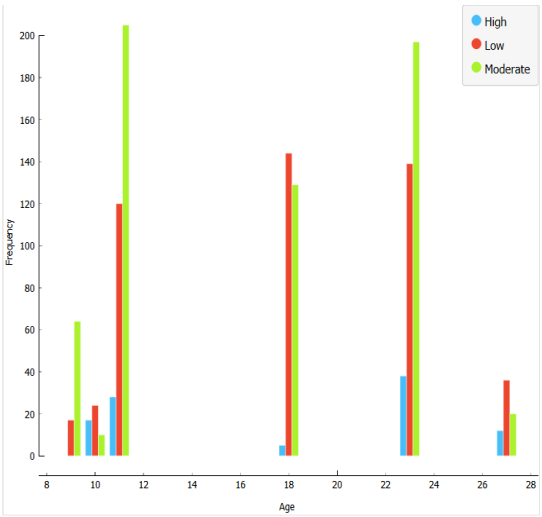


Fig. Age vs flexibility level

Students in the age group 22 to 24 are highly flexible, students around 18 years are moderately flexible and students around 10 years are the least flexible.

Location vs flexibility level

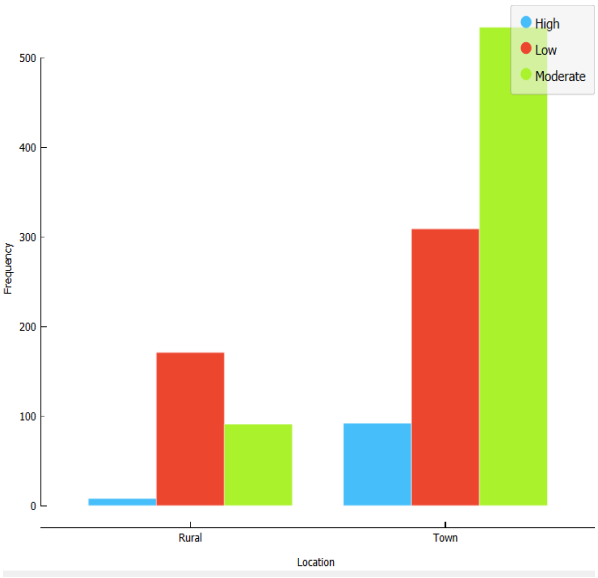


Fig. Location vs flexibility level

Students living in town area are more flexible compared to students living in rural area.

Financial condition vs flexibility level

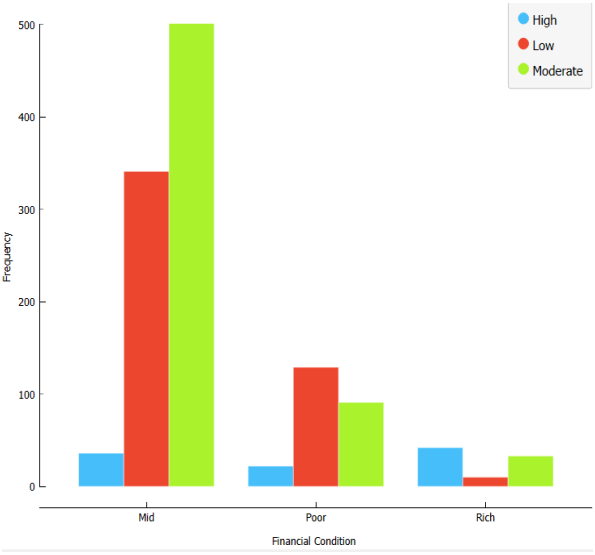


Fig. Financial condition vs flexibility level

The chart shows rich students are more flexible in online learning and the poor students are less flexible. This shows that financial condition is a major deciding factor in student flexibility.

Internet type vs flexibility level

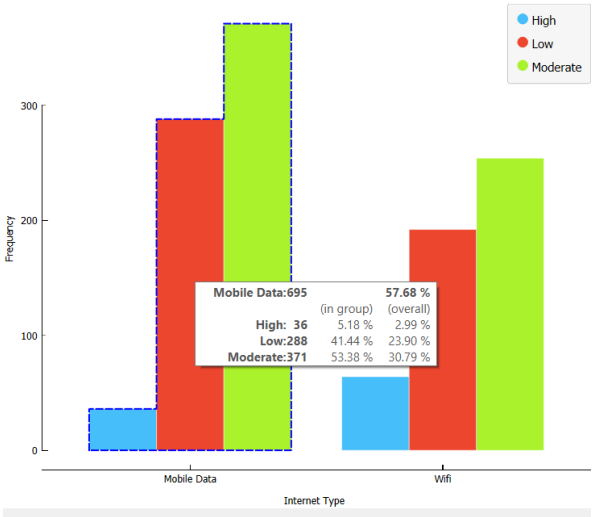


Fig. Internet type vs flexibility level

From the above chart, it can be understood that even though most of the students use mobile data as their internet type, students using wifi have high flexibility in online learning.

Network type vs flexibility level

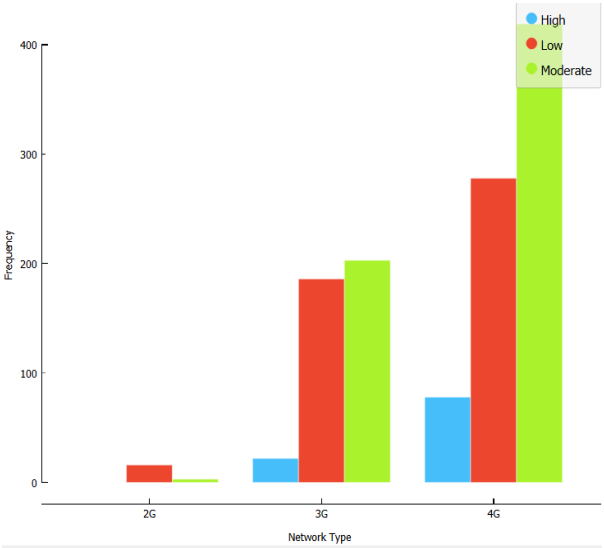


Fig. Network type vs flexibility level

Most of the students use 4G network and are highly flexible and very less students using 2G network are least flexible in online learning.

IT student vs flexibility level

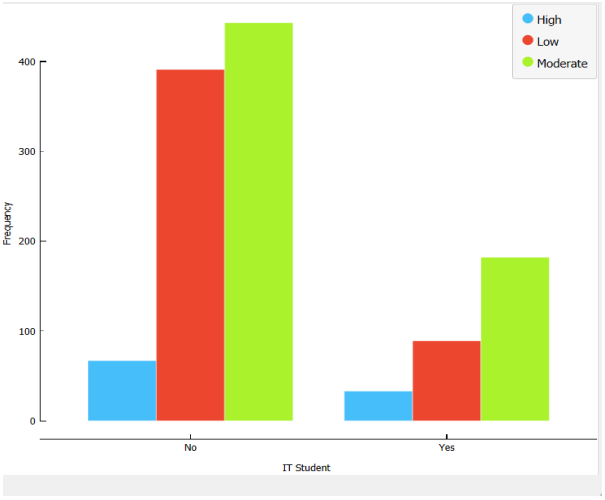


Fig. IT student vs flexibility level

Most of the students are not in IT field, however they are more flexible compared to IT students. This shows that IT students do not decide the flexibility.

Institution type vs flexibility level

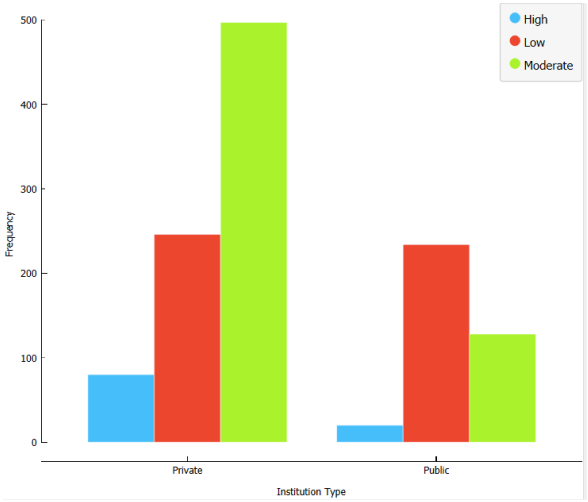


Fig. Institution type vs flexibility level

Most of the students are studying through private institutions and are more flexible compared to students in public institutions.

Classification Techniques

The classification techniques used in this project are K-Nearest Neighbour(k-NN), Gradient boosting, Random forest, Neural Network, AdaBoost and Tree.

1.K- Nearest Neighbours Algorithm (KNN)

The k-nearest neighbours algorithm, sometimes abbreviated as kNN, is a great learning algorithm that makes assumptions or classifications about how to group a single data point based on closeness.

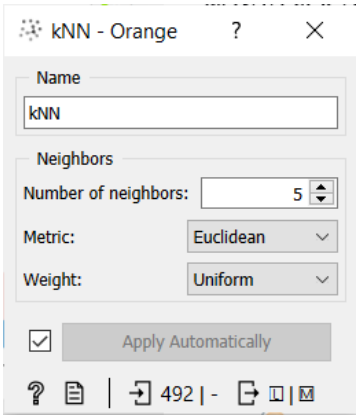


Fig. kNN Model Parameters

The model evaluation value

Model	AUC	CA	F1	Precision	Recall
kNN	0.924	0.828	0.827	0.828	0.828

Fig. kNN Evaluation Parameter

2.Gradient boosting

Gradient boosting is a boosting technique used in classification tasks and regression, including others. It gives a prediction model in the form of an ensemble of decision trees.

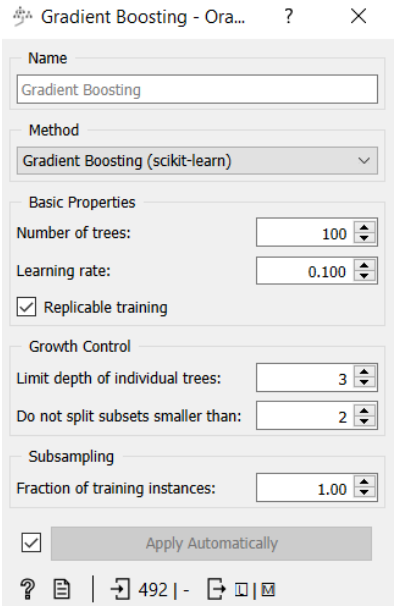


Fig. Gradient Boosting Model Parameters

The model evaluation value

Gradient Boosting	0.911	0.782	0.780	0.788	0.782

Fig. Gradient Boosting Evaluation Parameter

3.Random forest

The widely used machine learning method known as random forest, which combines the output of several decision trees to obtain a single outcome, was developed by Leo Breiman and Adele Cutler. Its adaptability and usefulness, as well as the fact that it can address regression and classification concerns, are what drive its extensive adoption.

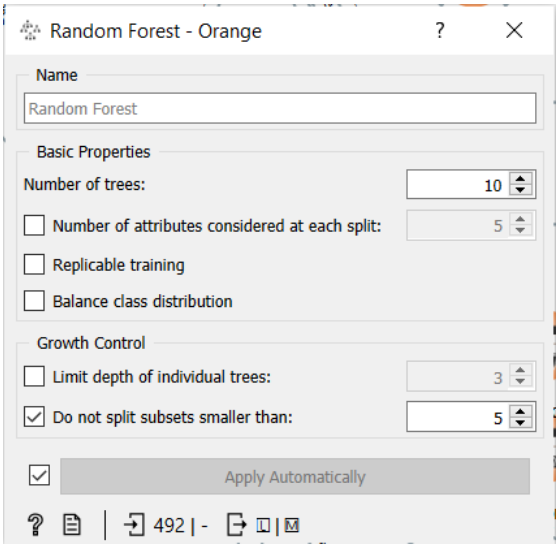


Fig. Random Forest Model Parameters

The model evaluation value

Model	AUC	CA	F1	Precision	Recall
Random Forest	0.953	0.845	0.845	0.847	0.845

Fig. Random Forest Evaluation Parameter

4.Tree

Tree is an algorithm that divides data into nodes based on class purity. It comes before Random Forest. Both numerical and categorical datasets can be handled by Tree in Orange, which was created in-house.

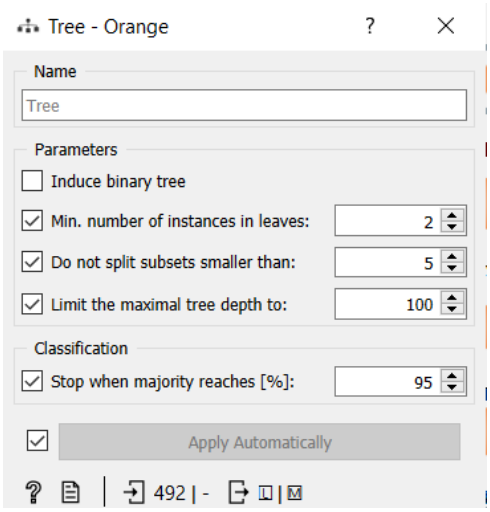


Fig. Tree Model Parameters

The model evaluation value

Tree	0.935	0.829	0.829	0.830	0.829

Fig. Tree Evaluation Parameter

5.Neural Network

The Multi-layer Perceptron technique by Sklearn, which can learn both linear and non-linear models, is used by the neural network widget.

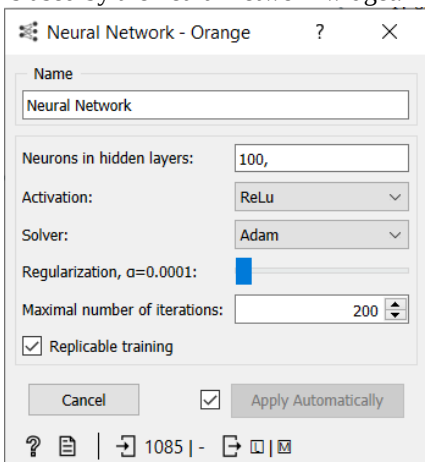


Fig. Neural Network Model Parameters

The model evaluation value

Neural Network	0.934	0.823	0.821	0.826	0.823

Fig. Neural Network Evaluation Parameter

6.AdaBoost

Robert Schapire and Yoav Freund developed the machine-learning method known as AdaBoost. It is the short for Adaptive boosting. It can be used to improve the performance of many other learning algorithms. By modifying the weak learners, it does this.

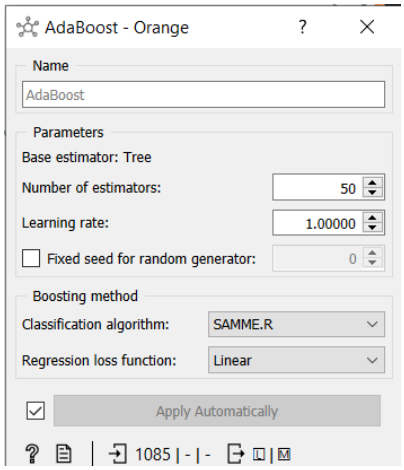


Fig. AdaBoost Model Parameters

The model evaluation value

AdaBoost	0.939	0.840	0.839	0.842	0.840

Fig. AdaBoost Evaluation Parameter

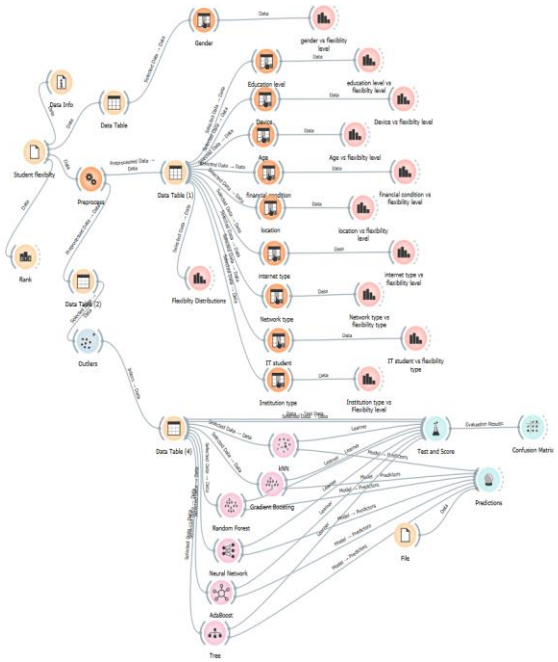


Fig. The orange connection diagram

Result and discussion

The dataset Flexibility in online learning consists of 1205 instances and 11 columns. Flexibility level is chosen as the target variable. Classification model applied in the datasets are KNN, Gradient boosting, Random Forest, Neural Network, AdaBoost and Tree. The performance value obtained for each model is given below

Model	AUC	CA	F1	Precision	Recall
kNN	0.924	0.828	0.827	0.828	0.828
Tree	0.935	0.829	0.829	0.830	0.829
Random Forest	0.953	0.845	0.845	0.847	0.845
Neural Network	0.934	0.823	0.821	0.826	0.823
Gradient Boosting	0.911	0.782	0.780	0.788	0.782
AdaBoost	0.939	0.840	0.839	0.842	0.840

Fig. Evaluation Result

Among the applied classification models, Random Forest has highest accuracy which is 84.5%. The confusion matrix of Random Forest is given below.

Prediction

Actual \ Predicted	High	Low	Moderate	Σ
High	65	9	19	93
Low	0	391	52	443
Moderate	8	80	461	549
Σ	73	480	532	1085

Fig. Confusion matrix of Gradient Boosting

All the 10 features Education level, Institution type, Gender, Age, Device, IT student, Location, Financial Condition,Internet type and Network type are necessary for the classification for the dataset.

An external test data was applied to test the classification using the Random Forest model and the classification is

Predictions - Orange

Show probabilities for (None)

	Random Forest	Education level	Institution type	Gender	Age	Device	IT
1	Moderate	1	0	0	11	1	0
2	Moderate	1	0	0	18	1	0
3	Moderate	1	0	1	11	1	0
4	Moderate	1	0	1	11	1	0

Fig. Classification outcome for the given data

Conclusion

The main goal of lectures are to educate the students. It is important to make sure that the students are flexible to learning. When the lectures are online, even though it gives more opportunities to students compared to offline learning, there can be certain limitations too. This project was done to get an idea of how effective are online learning to students.

Even though some factors like financial conditions greatly affected online education, it can be seen that most of the students are moderately flexible to online education. Among the applied classifications, Random Forest gives the best accuracy for predicting the student flexibility in online education.

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