

Prediction of the Effects of Online Education on Students Health by Machine Learning

BY

Ujjoiny Sarkar

ID: 172-15-9854

Sumaiya Islam Rimu

ID: 172-15-9839

Sumaeya Akther

ID: 172-15-10233

This Report Presented in Partial Fulfillment of the Requirements for
The Degree of Bachelor of Science in Computer Science and Engineering

Supervised By

Mr. Narayan Ranjan Chakraborty

Assistant Professor

Associate Professor and Associate Head

Department of Computer Science and Engineering

Daffodil International University



DAFFODIL INTERNATIONAL UNIVERSITY

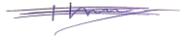
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APPROVAL

This Project titled “**Prediction of Beneficial or Harmful of Online Class Based on Student's Different Problems by Machine Learning**”, submitted by **Ujjoiny Sarkar, Sumaiya Islam Rimu** and **Sumaeya Akther** to the Department of Computer Science and Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering (BSc) and approved as to its style and contents. The presentation has been held on 3 June 2021.

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Daffodil International University

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Daffodil International University

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University

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We hereby declare that, this thesis has been done by us under the supervision of **Mr. Narayan Ranjan Chakraborty, Assistant Professor, Department of CSE** Daffodil International University. We also declare that neither this thesis nor any part of this thesis has been submitted elsewhere for award of any degree or diploma.

Supervised by:



Mr. Narayan Ranjan Chakraborty
Associate Professor
Department of CSE
Daffodil International University

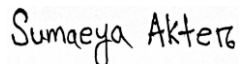
Submitted by:



Ujjoiny Sarkar
ID: 172-15-9854
Department of CSE
Daffodil International University



Sumaiya Islam Rimu
ID: 172-15-9839
Department of CSE
Daffodil International University



Sumaeya Akther
ID: 172-15-10233
Department of CSE
Daffodil International University

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ABSTRACT

The Covid-19 pandemic has disrupted educational activities across Bangladesh, resulting in the closure of educational institutes, affecting nearly four crore students' daily learning activities. Besides, the economic downturn brought on by the pandemic is impacting students and their families. Access to educational opportunities is increasingly difficult for students from low-income families, and the rising poverty rate adds to their woes. According to various projections, Bangladesh's poverty rate is estimated to be around 35-40%, compared to a pre-pandemic rate of around 20%. Poverty has a disproportionate impact on lower-income families, where survival takes precedence over schooling. Otherwise, most of the students are having trouble with understanding the new online platform. Not only that, the poor students cannot afford a laptop to attend classes. Internet issues are also a massive problem, as most of the students have moved from cities to villages to their hometowns, they cannot attend the classes because of low internet connectivity. Those who are attending classes online and came familiar with the online platform, most of them have become addicted to the internet. As a result, they are hampering their eyesight and other physical problems. We have applied seven traditional ML algorithms. They are- KNN, Naïve Bayes, Decision Tree, Support Vector Machine (SVM), Neural Network algorithm, Random Forest, and AdaBoost. The best accuracy was predicted by the neural network, which was 85.45%.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

The COVID-19 pandemic has wreaked havoc on educational systems around the world, with schools, universities, and colleges all but shut down. To combat the spread of COVID-19, most governments agreed to temporarily close educational institutions. As of January 12, 2021, nearly 825 million students are affected by school closures as a result of the pandemic. According to UNICEF monitoring, 23 countries have implemented nationwide closures and 40 have implemented local closures, affecting nearly half of the world's student population. Schools in 112 countries are officially available. [1] As the research is about the students of Bangladesh, it is really hard to manage everything at a time. The people are afraid as well as the government is also terrified of spreading corona vastly. On the other hand, because of lockdown and being quarantined, the government has taken steps to do classes online for students of every school, college and university. During the Covid-19 crisis, the government and educational institutions have taken a few steps to assist students in continuing their studies. Over 45 percent of secondary school students can drop out, according to Covid-19. [2] According to a 2019 study by the Bangladesh Bureau of Educational Information and Statistics (BANBEIS), the country has 10.34 million secondary school students, with 53.83 percent of them being female. At the secondary stage, the current dropout rate is 36 percent. As a result of the pandemic, there may be a substantial increase in the number of dropouts from educational institutions. If schools stay closed, students may focus on earning money rather than receiving an education. The topic has been investigated by the South Asian Network on Economic Modeling (Sanem). The youth, especially students, would be affected by the poverty rate, as there could be an increase in dropout rates.

Universities all over the world were forced to close their campuses indefinitely due to the COVID19 pandemic, and to shift their educational activities to online platforms. Universities were unprepared for such a change, so their online teaching and learning processes evolved. But still, most of the students think that physical class is still better than online classes, as they can interact with teachers face to face. In online classes, many students cannot understand properly, as there are no such practical tools. Otherwise, in a poor and developed country like Bangladesh, many of

the students cannot afford a laptop or a good smartphone. So it is really hard for everyone to attend the classes on time or many of them dropping out. On the other side, the internet issue is also a massive problem in Bangladesh. There are still many places where there is no connectivity to the internet. As people cannot go outside so it is also hard to give a recharge to their mobile operator. The poor students are dropping out as well as they are surviving for a living. The sufferings are not bearable. The students who are using and liking the online platform are also suffering from different types of physical problems. Like- for doing online classes at straight their eye sights are damaging. Otherwise, it is an online platform, so many of them can just lie down on their bed to do online classes, for which they cannot concentrate on their studies properly. Overall, there are both good and bad situations. People are getting familiar with online platforms but poor students are falling behind from education. Students may learn many things online but still, it's creating health issues by damaging eye sights.

1.2 Motivation

- The effect of the recent corona pandemic on students.
- How effective the online class instead of physical class in corona pandemic
- How much problems student fetches for online class?

1.3 Problem Definition

The term "machine learning" is extremely important in today's ICT environment. Machine learning will contribute to the advancement of our medical profession, as well as all fields. In order to provide an effective solution, it is necessary to define the problems and related requirements in this field. For implementing machine learning in the medical sector, it's also necessary to be aware of legislation and regulations, as well as software technical standards and instructional approaches.

1.4 Research Questions

The key questions that this study focuses on are given below:

- Where did the data come from?
- What is the aim of the research?
- What topic is the research being conducted on?

1.5 Research Methodology

In the methodology section of our research paper, we collected data, preprocessed it, categorized it, chose algorithms, implemented them, and then evaluated it. The proposed model's output will be defined at the end of this chapter.

1.6 Research Objectives

Finding out if the online class helpful or harmful based on student behavior.

Some technical issues are pointed below:

- Using an online class, develop an effective model for identifying the key causes of student problems.
- To teach software developers how to work with machine learning using the model.
- Encourage the government to take the necessary steps to address the student crisis.
- Models can be built into smartphone and web applications.

CHAPTER 2

BACKGROUND

2.1 Introduction

In our world, there is no work or science that can reliably predict disease and provide a solution. As a consequence, the background is the current state of student conduct in Bangladesh, as well as the use of Machine Learning in the medical and educational fields. Machine learning is a subset of artificial intelligence (AI) that enables computers to learn and evolve without being explicitly programmed. The creation of computer programs that can access data and learn on their own is referred to as machine learning. Machine learning algorithms learn, but defining the term learning is difficult since there are several different methods for extracting information from data based on how the machine learning algorithm is built. The learning process, in general, necessitates a large amount of data that provides a predictable response to specific inputs. Each input/response pair is an example, and when there are more examples, the algorithm learns faster. Since each input/response pair is located within a problem domain identified by a line, cluster, or other statistical representation, this is the case. These algorithms were used to achieve the best results.

2.2 Related Works

Machine learning is often used to solve forecasting problems. A lot of work has been done using ML to take action on the student issue. This technique has been made a lot easier thanks to machine learning.

Anuradha Khattar et. al. [3] on March 11, 2020, the World Health Organization declared coronavirus disease 2019 (COVID-19) a pandemic. Following that, on 14 March 2020, India's Ministry of Home Affairs declared COVID-19 a "notified disaster" due to an increase in coronavirus cases in the region, resulting in a complete shutdown on March 24, 2020. This has had an effect on all aspects of the world, including education. Academic operations have been interrupted at different levels due to the near-total closing of schools, colleges, and universities. The aim of this online survey is to learn about the daily lives, activities, learning styles, and mental

wellbeing of young Indian students during this unprecedented crisis, as well as to determine how they are adjusting to new e-learning styles and handling their social lives.

Jianlong Zhou et. al. [4] via user-generated content on Twitter, this article investigates group depression dynamics as a result of the COVID-19 pandemic. The recent Coronavirus Infectious Disease 2019 (COVID-19) pandemic has had a global effect that has been unprecedented. Millions of people have also been affected by mental health problems such as depression, tension, worry, fear, disgust, sadness, and anxiety, which have emerged as one of the most serious public health challenges during this extreme health crisis. To develop depression classification models, a new approach focused on multimodal features from tweets and term frequency-inverse document frequency (TF-IDF) is proposed. Emotional, topical, and domain-specific depression cues are all captured by multimodal features. They investigate the issue using recently scraped tweets from Twitter users in the Australian state of New South Wales. Their new classification model may distinguish depression impedances that may be influenced by COVID-19 and related events that occur during the COVID-19 cycle. People became more discouraged after the emergence of COVID-19, according to the findings. The government's actions, such as the state lockout, contributed to the rise in homelessness.

Mushtaq Hussain et. al. [5] the aim of this research is to predict the difficulties that students will face in a future digital design class session. They used machine learning algorithms to evaluate data logged by a technology-enhanced learning (TEL) system named digital electronics education and design suite (DEEDS). Artificial neural networks (ANNs), support vector machines (SVMs), logistic regression, Naive bayes classifiers, and decision trees were among the machine learning algorithms used. Average time, total number of tasks, average idle time, average number of keystrokes, and total related activity for each exercise during individual sessions in the digital design course were the input variables for this study; the output variables were the student(s) grades for each session. Then they used the data from the previous session to train machine learning algorithms, which they then evaluated using data from the next session. To assess the models' accuracy, they used k-fold cross-validation and computed the receiver operating characteristic and root mean square error metrics. The results show that ANNs and SVMs outperform other algorithms in terms of accuracy.

Viet Duong et. al. [6] by mining people's views on social media, this paper seeks to discover the social ramifications of this unparalleled revolution of our digital culture for both the general public

and higher education populations. We see several themes in a large number of COVID-19 tweets that represent the pandemic's most important issues, which are of great concern to both college students and the general public. Furthermore, we find major variations in the sentiments shared by these two groups of Twitter users about the COVID-19 problems. To our knowledge, this is the first social media-based research that focuses on the demographics and reactions to prevalent social problems of college students during a major crisis.

Iman Akour et. al. [7] through use of mobile learning technologies for teaching in educational institutions in the United Arab Emirates was explored in this report. A total of 1880 questionnaires were obtained from various universities in the United Arab Emirates. The research model, which was based on data from a student survey, was evaluated using partial least squares-structural equation simulation and machine learning techniques. Each theorized relationship within the research model was confirmed by their data analysed, according to their findings. It should always be noticed that when it came to predicting the dependent variable, the J48 classifier (89.37 percent accuracy) usually outperformed the other classifiers.

M. Sivasakthi [8] this paper uses a predictive analytic model with classification-based algorithms to estimate introductory programming success of first-year bachelor students in a Computer Application course. The demographics of the students, their grade in introductory programming in college, and their grade in controlling production on a 60-question test are all included in the data collected. WEKA was used to apply collected data to various classification algorithms such as Multilayer Perceptron, Naive Bayes, SMO, J48, and REPTree. As a consequence, statistics based on all classification algorithms are created, and all five classifiers are compared in ability to forecast precision and selecting the optimal functioning classification algorithm.

K. P. Shaleena et. al. [9] Predicting student success in order to avoid or mitigate student failures or dropouts has become increasingly important in recent years. In today's world, student failure and dropout is a big issue. Student dropouts may be influenced by a variety of factors. Data mining can be a useful tool for detecting and predicting these dropouts. A classification system for prediction is described in this article. Here, decision tree classifiers are used, and strategies for resolving the issue of class imbalance are addressed.

Muhammad Nur Yasir Utomo et. al. [10] Uang Kuliah Tunggal (UKT) expenditures are driven by each student's financial capacity, the value of education must also be divided into many classes. Again till currently, there was no standard for making such a classification, despite the fact that it

is an essential task for any higher education system in Indonesia to complete. The goal of this research is to contrast five data mining classification algorithms (Gaussian Naive Bayes, Multinomial Naive Bayes, Bernoulli Naive Bayes, Decision Tree, and SVM) in order to select the optimal algorithm for deciding UKT groups. The experiment is carried out with 230 training data and a 10-fold cross-validation assessment.

B. Minaei-Bidgoli et. al. [11] this paper describes a method for classifying students and predicting their final grades using features derived from logged data in a Web-based education system. They develop, test, and compare the output of a number of pattern classifiers on an online course dataset. A hybrid of several classifiers improves classification efficiency significantly. Furthermore, we boost prediction accuracy by using a genetic algorithm (GA) to learn an acceptable relative weight of the features used. When compared to non-GA classifiers, the GA has been shown to increase the accuracy of cumulative classifier results by around 10% to 12%.

We can see certain similarities and differences between our work and the work discussed above. We attempted to solve the student problem without needing to by predicting satisfaction or disappointment in our research.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

The methodology entails all of the steps that lead to the conclusion of our study, as shown in the Fig. 3.1. The steps are the following:

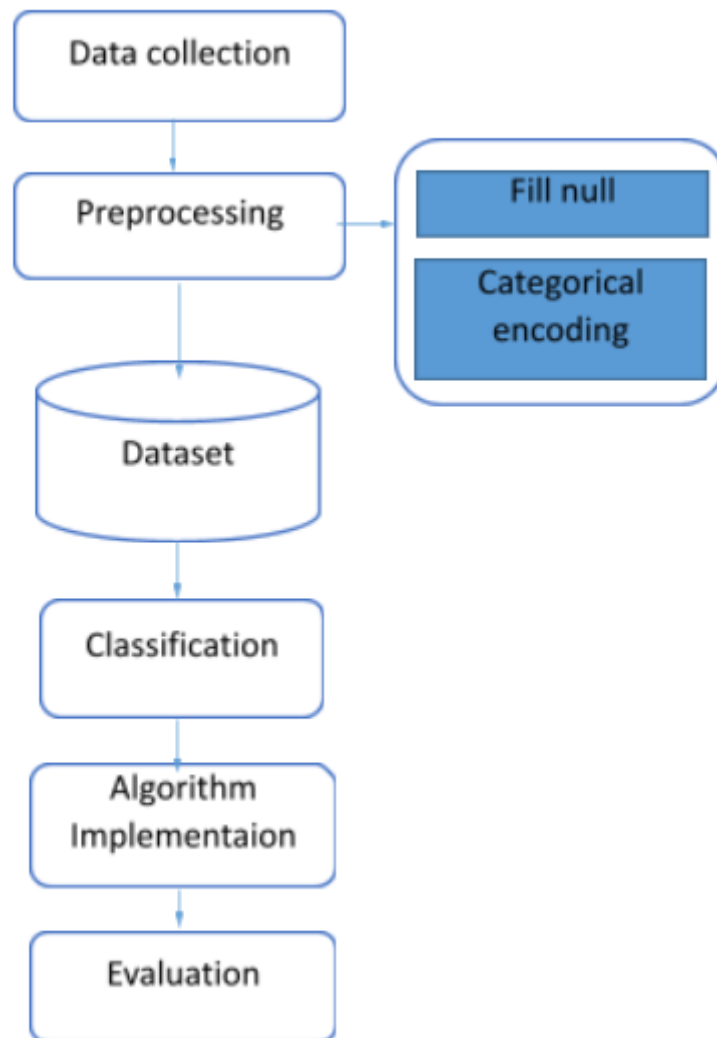


Figure 3.1.1 Methodology diagram

3.2 Data Collection

We collected our data by surveying about 1000 students. This survey was performed for both male and female students. The survey included everything related with the online platform classes and how they are treating the new challenge. Many of the students have given bad reviews with the new education system, where a very few are good with it. There are also several diseases and other things they've told in the survey.

So we carefully collected these parameters by questionnaire that is given bellow:

1. How old are you?
2. What is your gender?
3. Are you studying online right now?
4. How many months have you been studying online?
5. What kind of health problem are you facing by studying online?
6. How many months are you facing the problem?
7. Do you think online classes are harmful for your health?

3.3 Preprocessing

1. Data cleaning: Our initially collected data contains Name and Location these are unnecessary for training our model. So we element all names and locations from main dataset.
2. Transformation: To acquire quality knowledge data transformation is a very important part of any dataset. [1] Machine learning algorithms do not understand strings so we need to convert all strings to numbers. For this purpose, for yes we used 1 and 0 for No.
3. Feature Selection:
For the independent variable we selected Age, diseases they are suffering, how they are treating online platforms, all these things are dependent variables that are predicted by our model.

3.4 Dataset

From our survey, we have collected almost 1000 data of students for both male and female. Here, the percentage of the students who are suffering is given-

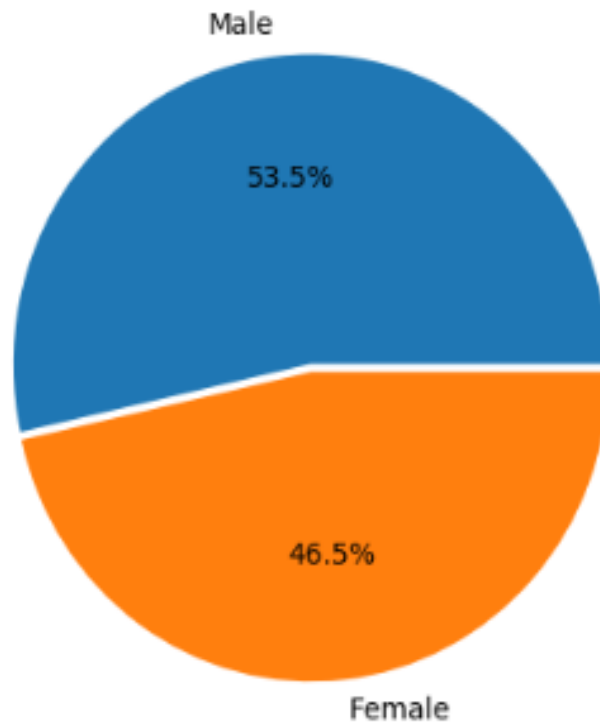


Fig. 3.4.1. Male vs. Female Disease

In our survey, we have worked with both male and female students. The graph represents the percentage of diseases they have suffered for doing online classes. Here, from the data, we can see about 53.5% male students have suffered from several diseases for doing online platform classes and 46.5% female students have suffered from doing online classes.

The percentage of students think its harmful and not harmful are given below-

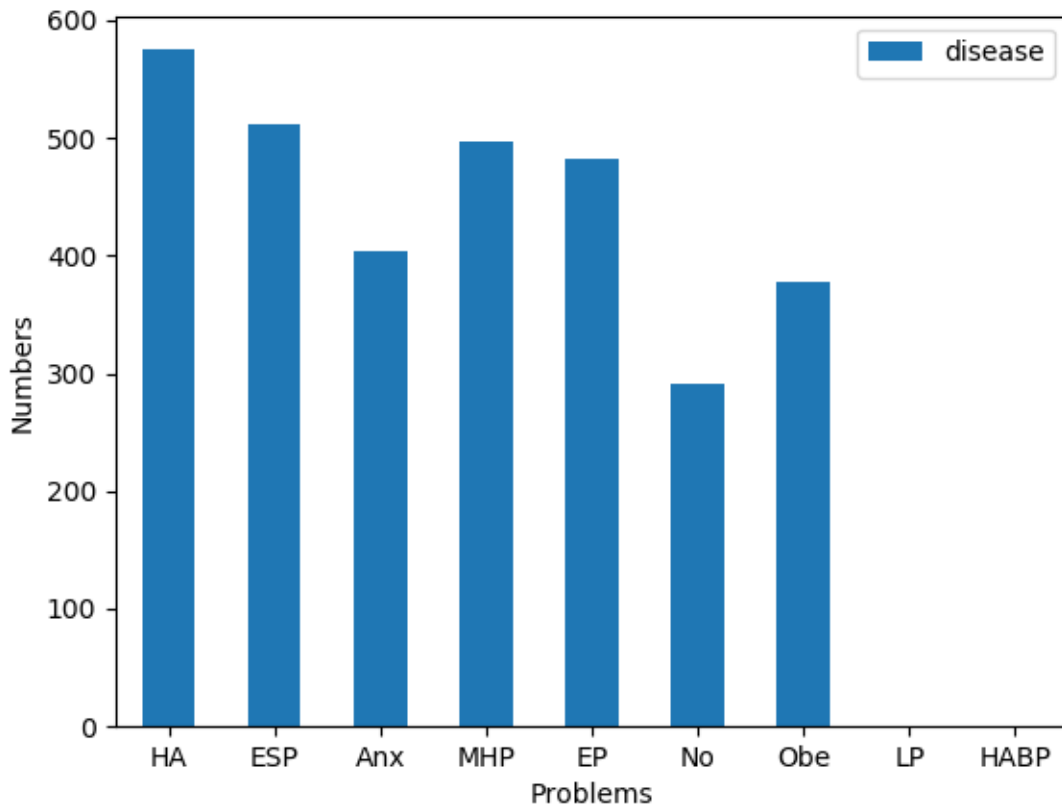


Fig. 3.4.2. Dataset Representation

In our survey, we have worked with 9 different types of disease. The graph represents, among all the diseases, which disease occurred for the maximum number. In our collected data, about 69.7% male and female students have suffered from these diseases, and the rest students were good. About 300 students had no diseases. The most occurring disease was headache. More than 550 students suffered from it.

3.5 Classification

We have applied 7 classification algorithms to predict how many students are suffering from several diseases and how many of them have no problem.

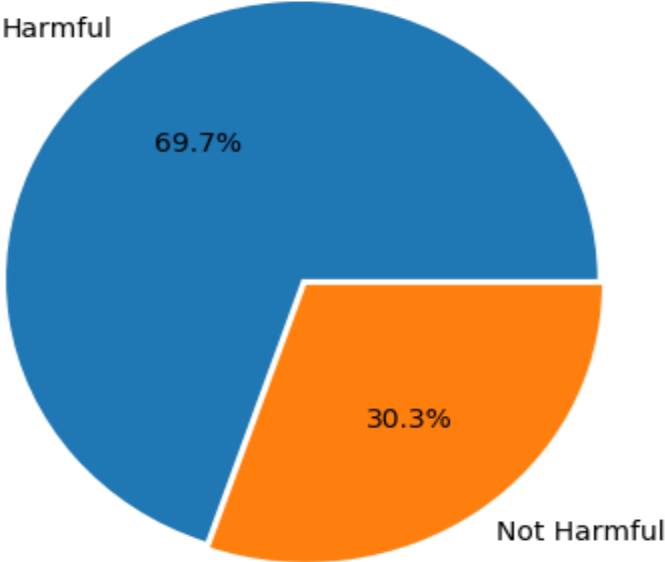


Fig. 3.5.1. Classification

From our collected data, we have divided them in 2 classes. One is harmful and another is not harmful. Harmful is- students are thinking that online classes are not good for them and the rest is thinking that it is good. Here, 69.7% students are thinking that it is harmful and 30.3% students are good with it.

3.6 Algorithm implementation

We have implemented 7 machine learning classification algorithms.

They are- k-nearest neighbors algorithm (KNN), Naive Bayes, Decision tree, Support vector machine (SVM), Neural Network, Random Forest, AdaBoost

Here, Neural Network gave the best prediction for 85.45% and for f1-score is 85.65%.

3.6 Evaluation

For our research, we initially gathered data from a convenient source. Then we estimated our data using seven machine learning algorithms to see which one was the most efficient.

CHAPTER 4

RESULT COMPARISON AND ANALYSIS

To predict a student's happiness or frustration, we used a number of Machine Learning algorithms. For forecasting, we used KNN, Naïve Bayes, Decision Tree, Support Vector Machine (SVM), Neural Network algorithm, Random Forest, and AdaBoost. Based on accuracy and F1 score, we evaluated these algorithms. From the accuracy table, for 30% data usage rate, we got 76.16 for Naïve Bayes, 83.99% for SVM, 85.45% for Neural Network, 81.49% for Random Forest. For 40 % data usage rate, we got 79.14% for KNN, 70.32% for AdaBoost and for 60% data usage rate, we got 78.97% accuracy in Decision Tree.

Table 4.1.1 **ACCURACY TABLE**

Data usage rate	Algorithms						
	<i>KNN</i>	<i>Naive Bayes</i>	<i>Decision tree</i>	<i>SVM</i>	<i>Neural Network</i>	<i>Random Forest</i>	<i>AdaBoost</i>
30%	76.87%	76.16%	75.09%	83.99%	85.45%	81.49%	69.04%
40%	79.14%	75.94%	72.19%	83.42%	84.22%	79.14%	70.32%
50%	76.07%	73.72%	73.93%	81.62%	82.48%	79.49%	69.87%
60%	76.11%	74.33%	78.97%	82.17%	83.96%	79.68%	69.88%
70%	78.32%	74.50%	78.47%	82.75%	85.34%	79.54%	69.77%

From the F1-score matrix table, or 30% data usage rate, we got 77.05 for Naïve Bayes, 83.84% for SVM, 85.65% for Neural Network. For 40 % data usage rate, we got 78.77% for KNN, 58.07% for AdaBoost. For 60% data usage rate, we got 80.84% accuracy in Random Forest and for 70% data usage rate, we got 78.84% accuracy in Decision Tree. We selected the Neural Network for its excellent performance after analyzing the effects of all the algorithms.

TABLE 4.1.2. **F1-SCORE MATRIX TABLE**

Data usage rate	Algorithms						
	<i>KNN</i>	<i>Naive Bayes</i>	<i>Decision tree</i>	<i>SVM</i>	<i>Neural Network</i>	<i>Random Forest</i>	<i>AdaBoost</i>
30%	76.57%	77.05%	75.38%	83.84%	85.65%	78.87%	56.39%
40%	78.77%	76.85%	76.14%	83.23%	84.50%	79.27%	58.07%
50%	75.53%	74.70%	74.60%	81.51%	82.58%	78.31%	57.48%
60%	75.98%	75.46%	77.82%	82.14%	84.20%	80.84%	57.48%
70%	78.39%	75.57%	78.84%	82.86%	85.61%	79.82%	57.35%

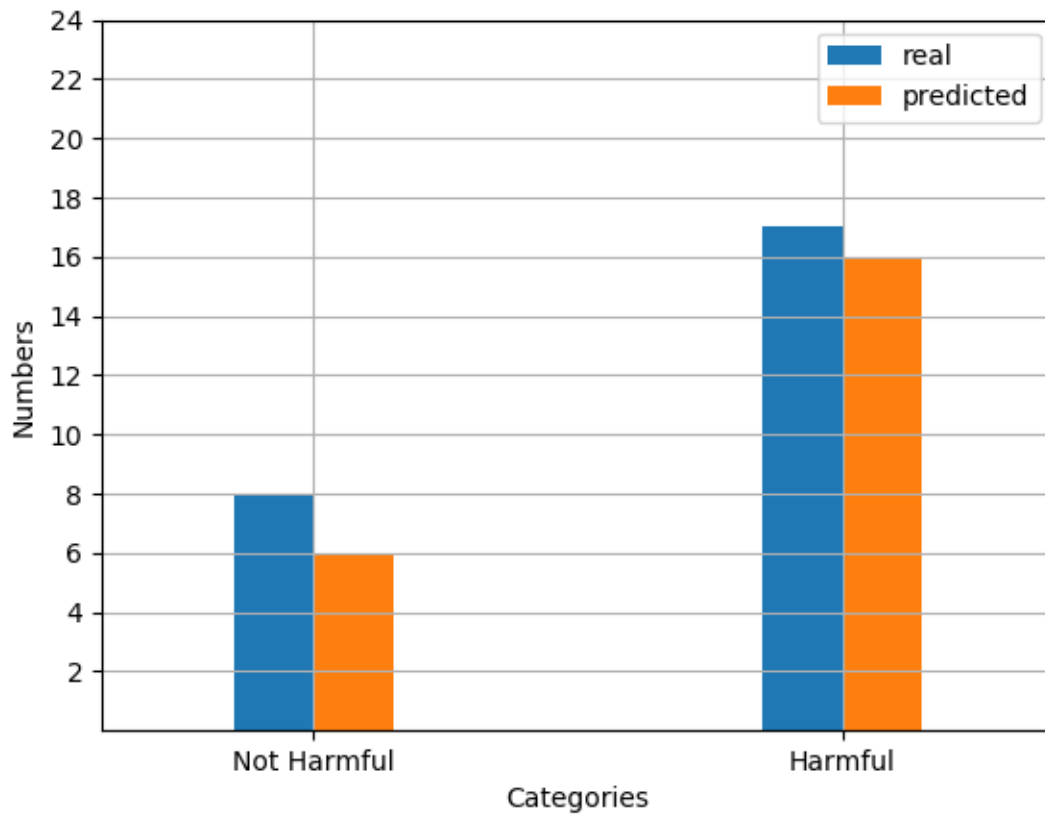


Fig. 4.1.1. Comparison between real and predicted class

Fig. 4.1.1 Illustrates, the blue color is for real data and the orange is for predicted data. Here, not harmful and harmful, for both, we can see the numbers are almost the same between real and predicted. Most of the students have suffered from several diseases and a few percentage of students had no problem.

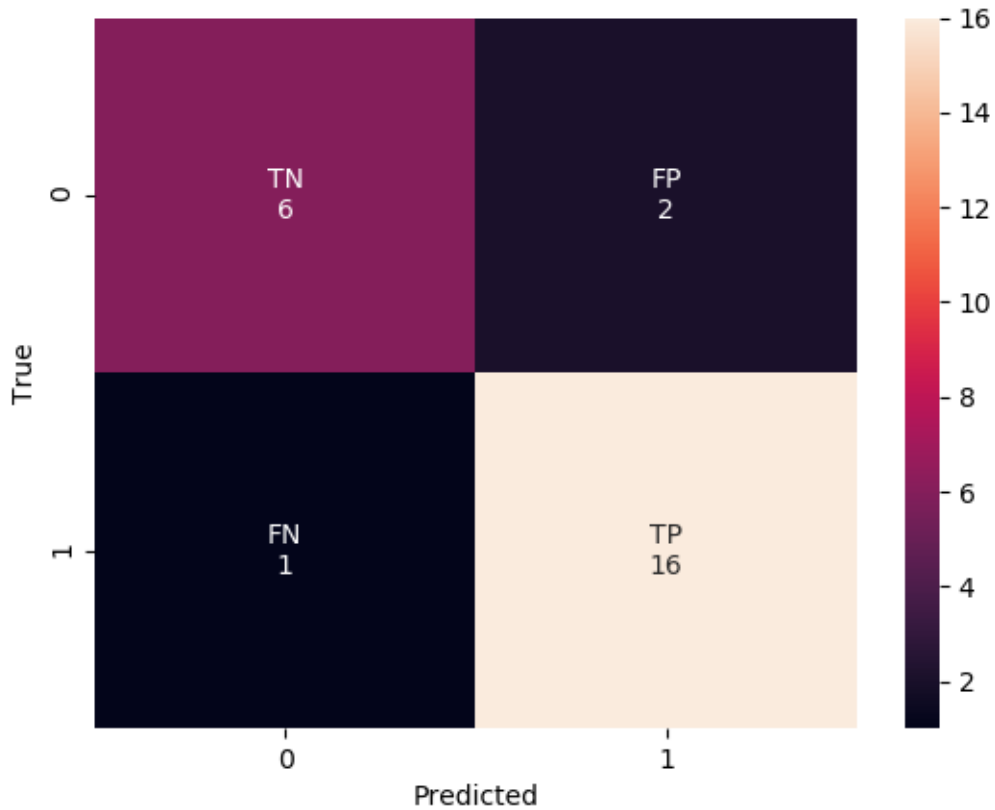


Fig. 4.1.2. Confusion Matrix

In the graph, x-axis (Predicted) indicates prediction and y-axis (True) is for real numbers. Here we can see, TN, FP, FN, TP indicated the difference between the real and predicted data. Here, TN (True Negative) value is 6, which means our algorithm has detected 6 True negative values which were matched with our dataset. Then, FP (False Positive) value is 2, which means our algorithm has predicted false positive for 2 values, where the values were negative, which is wrong prediction. Here, TP (True positive) has 16 values, which is similar with our valid dataset. It shows 16 true positive values. Then, FN (False Negative) has 1 value, which means in our dataset the value was positive, but our algorithm predicted it wrong.

So, we can see from the graph, the 2 black boxes are wrong predictions and the other 2 boxes are true prediction.

CHAPTER 5

IMPACT ON SOCIETY, ENVIRONMENT AND SUSTAINABILITY

5.1 Impact on Society

The social influence of online education is one of the most significant aspects of it. When you enroll in an online course, you can do so from the convenience of your own home. There's no need to wake up early or prepare for school; instead, you can complete the course on your own time and in your own setting. However, this also means that you can study from the comfort of your own home and never have to leave the house. You never have to interact with your instructor or other students face to face. Your education's social component vanishes. Face-to-face contact with others can become obsolete as a result of online education. It can also hamper self-discipline. The issue is that you don't have the time management and organization skills you need to keep on top of your work, allocate enough time to each job, and align your coursework with other goals in your life.

5.2 Impact on Environment

The influence of online education on the community, or rather the effects it has on the environment, is the second most important factor. If we take an example-

In a class there are 100 students, so simply the temperature of the class will be higher because of Co₂. The more people stay in the room, the hotter the room will be. Which is also bad for environment. But for online classes, students are in their home, there is no crowd or anything. As the level of Co₂ does not increase. So we can say, it has a good impact on environment.

5.3 Ethical Aspects

Some online courses have pre-programmed software that requires students to read or listen to a lecture before taking a test or quiz. The tests are scored by the machine (or software), and the student is either passed or not. What prevents students from cheating or making someone who can

read and understand the material better take the tests for them if these courses are not closely monitored?

Other online courses have an actual instructor who runs the class and sets deadlines for assignments and discussion questions. Since the online classroom does not have a physical presence, students are less likely to engage in outside conversation about the teacher's actions or the substance of his or her "lectures." This opens the door for online teachers to use the virtual classroom to impose their political, social, or other viewpoints on students.

Online courses can be extremely useful in some situations. However, as with anything, too much of a good thing can be harmful. Using online education to complete a degree or diploma can have unintended consequences for the student.

5.4 Sustainability Plan

It's safe to say that online education is here to stay. It can have negative effects on society, though good for environment. In the end, the negative impacts of online education on culture outnumber the positive ones. Though universities are providing online class learning more than 1 years, but online education isn't expected to completely replace in-classroom learning, but it is expected to continue to evolve and be hamper society but beneficial for environment.

CHAPTER 6

CONCLUSION AND FUTURE WORK

6.1 Conclusion

The COVID-19 epidemic has wreaked havoc on educational systems around the world, with schools, universities, and colleges all but shut down. To combat the spread of COVID-19, most governments agreed to temporarily shut down educational institutions. The COVID-19 pandemic has wreaked havoc on significant facets of national and global culture, including educational institutions. Even now, school administrators must balance the health problems associated with the in schooling against the academic welfare of students, which could be best met when children are in their physical schools. Through online education, many children are successful and many people are suffering from failure. That is why we are trying to reduce the student problem through satisfaction and dissection predictions using machine learning technologies. In our proposed system, we implemented seven traditional classification ML algorithms to achieve the best outcomes. We discovered that the resolution of these algorithms differed after applying them to the data set. In terms of precision, the Neural Network algorithm produced the best outcomes. In addition, the Neural Network had the best accuracy, which we used for predicting student satisfaction and statistics of student activity. This study will assist the government and the general public in becoming more knowledgeable of such issues.

6.2 Future Work

We focused on how to produce the best possible result, despite the fact that we still face a few challenges. The fact that we did not sample the whole nation is one of the survey's major flaws. In the future, we will create an intelligent framework that will predict whether online education is beneficial or harmful based on student activity. We'll also try to improve our information gathering by collecting information from all over the country and creating an Android app that's easier to use.

6.3 Limitation

We made every effort to achieve the best possible outcome, but there are still a few obstacles in our path. One of the major limitations of our research is a lack of data. The knowledge we had gathered was limited to a few places. We'll try to boost our data collection in the future by combining data from around the country and spanning a longer time span.

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APPENDIX

Appendix A: Data collected from Survey.

The first challenge we faced while performing the research was deciding the methodological methods for our report. It wasn't standard work, and nothing had been accomplished in this area previously. As a result, we weren't able to get much help from any source. We have started gathering data by hand. After a long period of hard work, we might be able to do it.

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