PREDICTING DEPRESSION AMONG UNIVERSITY STUDENTS USING MACHINE LEARNING

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

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I hereby declare that this project has been done by us under the supervision of Professor **Dr. Md. Fokhray Hossain, Department of CSE** Daffodil International University. I also declare that neither this project nor any part of this project has been submitted elsewhere for the award of any degree or diploma.

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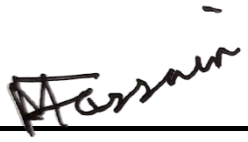

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ABSTRACT

Depression is a major disorder and a growing problem that impacts a person's way of living, disrupting natural functioning and impeding thought processes while they might remain oblivious to the fact that they are suffering from such a disease. Depression is especially prevalent in the younger population of underdeveloped and developing countries. Youth in countries such as Bangladesh face difficulties with studies, jobs, relationships, drugs, family problems which are all major or minor contributors in a pathway to depression. Furthermore, people in Bangladesh are not comfortable in speaking about this illness and often misinterpret this disorder as madness. This research, besides predicting depression in university undergraduates for the purpose of recommendation to a psychiatrist, focuses on gaining valuable insights as to why university students of Bangladesh, undergraduates in particular suffer from depression. The data for this research was collected by a survey designed after consultation with psychologists, counselors and professors. The survey was carried out through paper and Google survey form. The data was analyzed to find out relevant features related to depression using Random Forest Algorithm and then predict depression based on those features. A best method for predicting depression among Bangladesh undergraduates was found after using six algorithms to train and test the dataset. Deep Learning was found to be the best algorithm with the lowest number of false negatives, closely followed by Gradient Boost Algorithm both with an F-Measure of 63%. Generalized Linear Model, Random Forest, K-Nearest Neighbor and Support Vector Machine were the other four algorithms used for comparison. The objective of this research is to determine reasons for depression and to check whether depression can be successfully predicted with the help of related features. Depression is an illness that people in Bangladesh tend to ignore and hence it builds up and worsens with time. This research aims to identify depression in its early stages and ensure a fast recovery for victims so that heartbreaking incidents like suicide can be avoided.

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CHAPTER 1

INTRODUCTION

1.1 Background of the Research

Depression is a clinical condition that is usually represented by (i) low mood, (ii) lack of pleasure, (iii) sleep disturbance, (iv) changes in weight, (v) fatigue, (vi) impaired attention also concentration (vi) activity changes (vii) guilty feelings (viii) thoughts of suicide, and (ix) daily functioning. Depression is one of the leading causes of ill health and disability, affecting people of all ages. More than 300 million people are estimated to suffer from depression across the world, and the rate is more prevalent in lower-and-middle income countries like Bangladesh. Depression may be a common upset moving higher than 350 million individuals globally and is characterized by unhappiness, loss of interest or pleasure, feelings of guilt or low self-worth, disturbed sleep or appetence, feelings of fatigue and poor concentration [1] .Research done in some low and middle-income country found out that students in universities, colleges, and medicals are more prone to depression and the result is an alarming signal that should be taken care quickly [2]. It is also responsible for both suicide attempts and completions. This paper identifies the educational problem in university students. But private university students are facing many problems. Family problems, financial, and academic results, relationships, etc.

Psychological problem is one of the most important factors that may cause depression. The low-income country's university's undergraduate students face with psychological morbidity like financial problem, tension about career, drug and physical abuse, academic pressure and workload which may lead to depression [3]. According to the article, the high levels of depression among students are for problems in social life like family problems, depression in family members, drug and alcohol addiction. Along with that problems in academic life also may trigger depression like poor academic results and poor performance.

For this purpose, I collected the raw data and tried to collect output by data mining process. Data mining is a kind of technique to identify information or knowledge that is useful for decision-making among data, so they can be used in decision-making, forecasting, prediction, and estimation [4].

1.2 Problem Statement

In many countries, mental illness is not welcomed in a positive way, despite the fact that everyone is open to new ideas and the world is progressing. Because it seems to be taboo, particularly in many Asian regions, those who are suffering tend to keep their issues to themselves, conceal their illnesses, and attempt to treat themselves. As a result, their sickness may develop, endangering their physical and emotional well-being as well as causing them to experience severe depression, which in turn will encourage them to damage themselves or take their own lives. Additionally, the majority of individuals don't realize they have a depression problem and don't treat it with the same seriousness as other illnesses because they think it would instantly go away if they just try harder. Contrarily, some people experience depression despite not actually having it. They may become depressed because they believe they are depressed. During the course of this study, we discovered that the majority of students behave in this manner and are not vocal about their issues. Some of them believe they are depressed, which is affecting their academic performance, but they are not actually depressed, and some students are unaware that they have symptoms of moderate and severe depression. Another issue is that while some students openly discuss their melancholy, there is another set of students who are unsure of their mental health and want to know if they are depressed or not in order to get professional assistance. However, the difficult scales in the questionnaire and their concern with disclosing all of their private information to counselors discouraged them from taking action to address their mental illness.

Therefore, there is no effective platform that allows students to assess their level of depression simply by answering a few straightforward questions in a comfortable manner. In addition, no specific method or research has been done to identify the underlying causes of depression in university-bound, undergraduate students.

1.3 Aim of the Study

The aim was to see into the prevalence of depression, anxiety, and stress among Bangladeshi students, also because of the connected risk factors, and to produce them with a treatment plan to help them overcome this unsettling disease. Depression has become a very common mental health issue for people. Nowadays it has become an unbearable and unexpected mental health issue

among the students of Bangladesh. This study was conducted to get a ratio of depressed students in Bangladesh. For the proper study, we surveyed the students of Bangladesh in different places. Compared to other academic years, first-year students had slightly greater rates of depression. In contrast, earlier, less representative. Bangladeshi research did not find any evidence of a connection between the academic year and depression. First-year students may have a higher incidence of depression because of their unfavorable academic environment. For instance, first-year students must spend the night in residence halls with up to 50 other first-year students. Additionally, the threatening "ragging" culture, which includes senior students' bullying, taunting, and rudeness, is more prevalent on Bangladeshi university campuses and may result in physical harm or mental anguish. The current data lend credence to the idea that bullying-related mental health issues exist.

1.4 Research Methodology

- I have provided a literature review, where we gave a summary of various related algorithms.
- I have constructed a survey questionnaire to collect data.
- I have constructed a dataset of having symptoms of depression and associated facts.
- I have reduced the accuracy by applying different algorithms at different times.
- I have made the expected output.

1.5 Research Question

The survey was carried out by a self-administered structured pre-tested form. Questionnaires were distributed to the students in their categories. The form was in four parts: Socio-demographic information, problem-related information, educational performance and also the family drawback for the activity of depression. Variables in the socio-demographic information enclosed gender, age, standing status, country of origin, Degree class, supply of funding, residential arrangements and satisfaction with living conditions. Issues or agent variables embody problems with adapting to food, accommodation, health and monetary problems, perception of snug living as well as the impact of family problems or nostalgia. Educational connected variables embody perceptions of

issues concerning study at the university, quality of the study, teachers' cooperation, attending of categories and exams, also as current Grade points (CGPA) of the students.

1.6 Proposed Solution

Depression is one in every of the foremost common styles of psychological state conditions and infrequently develops aboard anxiety. It's important to know that much can be done to help students who are thinking about suicide. I need proper data. First, I need to research questions and prepare a question sheet. Then I need data collection. Then I run a machine-learning model and some algorithms. Then I predict whether students are depressed or not. Due to the very nature, structure, and functions of these institutions, life is incredibly difficult and unpleasant there. It is commonly known that university students all around the world are highly susceptible to a number of mental diseases, including stress, anxiety, and depression. However, nothing is known about how common the condition is in a developing nation like Bangladesh. A person can be depressed in any way depending on his life. Depression disorder is a common problem for a human being. But the main problem is that in our country people are not aware of mental health problems. People can't understand that they are depressed. They don't go to the doctor or psychologist. So based on humans' daily activity or lifestyle it needs to detect whether a person is depressed or not. That's why we think to create a way or system to find a person's mental health condition, where machine learning can perform a great deal.

1.7 Conclusion

Depression is the common mental health problem. Their square measures several issues faced by these students like educational, food, monetary and health issues. Most students suffering from depression do not complain of depression but vague unexplained symptoms. And people issues were found to possess important big a major relationship with having symptoms of depression and conjointly significant association was found between educational performance and depression. I tried to collect data related to the symptoms of Depression. And that helped to generate an expected result based on the given dataset. In this system, I used 70% of the training to get more accurate predictions. How accurate the result is, it depends mainly on the training dataset. I applied five needed algorithms to collect the desired outcome. In society, I have to deal with a lot of people. I often notice that some of my acquaintances have wrapped themselves up. They are no longer

participating in any work of the society. The number of those people but not less in the society. This paper will help with the detection of considering the mental state of the people.

After completing all the needed procedures of the overall system, our system has been ready for coming out on the given dataset. I have applied many strategies to achieve the desired outcome. I got 95% accuracy from the decision tree among all that I have used.

CHAPTER 2

PROBLEM STATEMENT

2.1 Introduction

In this section, I will discuss Data preprocessing, Attributes Selection, Classification of algorithm, Related Work and Challenges that we'd faced about this research. I will also present the overall research summary. In the data preprocessing sector, I will discuss the steps I followed for processing data. In the attribute selection section, I will discuss the attribute which we'd used in our research. In the classification of algorithms section, I will discuss the algorithms that we applied in data processing. In the related work section, I will discuss other research papers and their respective works. I will discuss their methods and accuracy which are related to my work. In the challenges section, I will discuss the challenges that I'd faced throughout the time of making this paper. Today, there is a global concern about the poor mental health of college students. Students at universities are frequently affected by depression, anxiety, and stress, which has an adverse effect on their quality of life, academic performance, and accomplishment. [31] Previous studies showed that psychological morbidity, particularly sadness and anxiety, is common among university students worldwide. Over the past few decades, as Bangladesh's economy has expanded, the need for skilled laborers and subsequent demand for postsecondary education have both increased. It is estimated that Bangladesh has 158 universities by the University Grants Commission (UGC). Of those, 105 are private institutions and 53 are state universities. A competitive climate has developed in the nation's tertiary education system as a result of intense competition for jobs. Additionally, parents, who are mainly from the middle and upper income classes, see sending their children to a private university as an investment in their social security in the future. While this is going on, parents have high hopes for their children to take over the family's management soon after graduating. [32]

Negative mental health consequences are experienced by university students in Bangladesh in addition to the competitive academic environment, familial expectations, and financial pressures. Due to the very nature, structure, and functions of higher educational institutions, life there is extremely difficult and demanding. [30]

The prevalence of many mental diseases, such as stress, anxiety, and depression, is generally known to be high among university students all around the world. However, nothing is known about how common the condition is in Bangladesh and other underdeveloped nations. [33]

2.2 Problem Statement

When I communicate to relatives and friends and mention that we are depressed, I frequently use the term "depression." But not all instances of sadness and loss fall under the umbrella of depression. According to the American Psychiatric Association, depression (major depressive disorder) is a frequent and significant medical condition that has a negative impact on our feelings, thoughts, and behaviors [5] . They claim that around one in fifteen individuals (6.7%) may be predicted to have depression at any one time. Additionally, 16% of people, or one in six, experience depression at some point in their lives. One of the main reasons we decided to conduct our research among undergraduate university students is that studies have shown that people often suffer depression around the age of 20. According to statistics, roughly one-third of women experience a depressive episode at some point in their life, making them more likely than males to experience depression. In essence, my research involves building a model using machine learning techniques to analyze provided data. The model I've suggested can identify depression. People in the society will be significantly affected by this work. In contemporary culture, there are a lot of people who struggle with mental illnesses. However, they are unaware that they are depressed. They isolate themselves because they are unsure of what to do. They therefore erred in their judgment at the time. He requires a system that will enable him to identify his issue and determine if he is truly depressed or not. Finally, tell him what he should do by giving him directions. The outcomes of recent machine learning applications for disease prediction and a variety of object detection are quite good. I consequently made the decision to develop a model of depression detection using machine learning.

2.3 Discussion about depression in university students

The Center for Collegiate, Mental Health research indicates that sadness and anxiety are the two main conditions for which students seek counseling, with 1 in 5 college students reporting depression. Student depression is higher than that of the general population [6]. Another study found that both developed and undeveloped countries with generally low incomes have high rates

of depression among undergraduate university students [3]. Every day, more college students seek counseling for their anxiety and melancholy [7]. The majority of them either tried to injure themselves or commit suicide, and some of them found it impossible to function normally and some of them discovered significant anxiety problems. The article [8] "Prevalence of depression and its related variables using Beck Depression Inventory among students of a medical college in Karnataka" reveals that depression is very common among medical students based on their findings. According to the study, out of 400 students, 71.25% were determined to be depressed, with 80% having mild or moderate depression, 7.5% having severe depression, and 6.7% having profound depression. The findings also imply that the university students' participation in private instruction is a crucial element in comprehending the growing frequency of sadness and anxiety among them. In Bangladesh, many students work part-time jobs like private tuition to pay for their school costs and occasionally to help their families, and their reliance on private tutoring as a part-time job is progressively rising [39]. Depending on his or her life, a person may feel depressed in any way. Being depressed is a typical problem for people. However, the biggest issue is that few individuals in our nation are aware of mental health issues. People struggle to comprehend their depression. They avoid seeing a physician or psychologist.

2.4 Data Preprocessing

In the present time, there are a lot of sources from where we can collect our necessary data. Among that internet, sensor, processing surveys, and databases are the most common sources to collect data. In this research, data is collected from both online and offline through surveys and questionnaires with clinical information as our topic is related to medical science. Data preprocessing is the primary and most important step for any research or project work. Data preprocessing is a manifest method of performing the problems related to the data collection process [9]. For our purpose, we take some steps to collect data and analyze those properly. These steps are: (1) Filtering, (2) Cleaning, (3) Processing, (4) Storing, (5) Testing. Regarding data analysis they require a suitable data format. Sometimes data preprocessing is known as data wrangling. Because data wrangling refers to a set of procedures which transforms raw data into suitable expected data format. In this research, I have applied five most valuable algorithms on the dataset to achieve better accuracy

2.5 Attribute Selection

I have nominated a set of attributes to catch depression and associated factors. So, I selected the attributes related to the symptoms of depression and associated factors to do our work easily. I have selected a total 21 attributes. And all of them are necessary to random students. Most important attributes our survey age, sex, family income, university result, smartphone addiction, social media addiction, psychoactive substances, relationship difficulties, mental illness bye others. There are some information based other information. Family income is the most important every student because private university huge of cost. Every student has less than 30 thousand expenses every month. Due to this, the family faced many problems. University results show many effects. The low CGPA effect of students. After a bad result they don't know how to move to the next step.

2.6 Classification of Algorithms

If I try to analyze a dataset or build any predictive model, it is totally impossible to do. If it can be possible by any chance, surely there will be a lot of faults. So, I can do that task easily by applying machine learning algorithms. Machine Learning method or classification algorithm can produce desired results and can be done by computation early. Data which are used for machine learning are basically of two types. These are: unlabeled data use for unsupervised learning and labeled data use for supervised learning.

The various supervised learning and unsupervised learning of Machine learning algorithms are given in the Table below. Supervised learning algorithms are more useful than the unsupervised learning algorithms for their processing. The accuracy rate can be easily calculated by using supervised learning algorithms.

Supervised Learning
Decision Tree
Naïve Bayes
Support Vector Machine
Random Forest
K-Nearest Neighbor

Figure 2.1: Different Machine learning Algorithms

2.7 Literature Review

In this section on the literature review, I'll describe related studies on depression detection and recognition that have been conducted by other researchers, as well as machine learning applications in this field. I have examined and followed their procedures, as well as the advancement of their published studies. Depression is a common term that we use often when we talk to family and friends and say that we are depressed. However, not all feelings of sadness and grief can be classified as depression. According to the American Psychiatric Association, depression (major depressive disorder) is a frequent and significant medical condition that has an adverse impact on our feelings, thoughts, and behavior [5] . Health line, and US-based leading provider of health information says that only profound sadness that persists for more than two weeks and restricts us from functioning properly may be a sign of depression [10]. Another research carried out among second year college students in the city of Rawalpindi, Pakistan, showed that depression had a negative effect on the academic performance of the students and that their performance differed considerably depending on their level of depression [11]. Anxiety, on the other hand, is the body's response to a perceived threat that is brought on by a person's thoughts, feelings, and emotions. It is characterized by worrying feelings, tension, increased blood pressure, heart rate, breathing rate, sweating, difficulty swallowing, dizziness, and chest pain. [12] There are 5858 possible reasons of depression, such as issues with job, abuse, a lack of love, conflict, a lack

of familial relationships, affection, and political upheaval. People are engaging in horrible crimes like suicide as a result. Depression is one of the most prevalent implicit diseases. Major or mild depression affects 30% to 70% of suicide victims [42]. Khan, M. R. H. et al. [43] have studied the Bengali depression dataset for machine learning-based sentiment analysis. Data is gathered from social media posts, a variety of poems, multiple novels, as well as quotes from several honorable people. Support vector machines (SVM), multinomial naive Bayes, random forest, k-nearest neighbors (kNN), decision tree, and xg boost are just a few of the many techniques they employ. And they achieved an accuracy of 86.67% with Multinomial Naive Bayes.

2.8 Challenges

I have faced so many challenges in the processing of our research work as it's my first experience of writing a thesis paper. Data collection is one of the big challenges for getting an expected predicting accuracy. Without collecting necessary data any type of prediction is impossible. I have collected data from online and offline platforms. Then, another challenge is preprocessing. After preprocessing the data set helped us to get a good early prediction of depression and associated factors. Then, Attribute selection helps to take all attributes values properly. At last, a different algorithm has been applied to find the good accuracy. I have done the process by applying various algorithms. And finally, the implementation process has been processed to get accurate value. I faced several challenges in our working procedure. I have tried to increase and get a better result for our research by an algorithm of Decision tree. Despite its limitations, this study provides the first empirical proof that the current epidemic has caused a significant number of Bangladeshi university students to experience symptoms of sadness and anxiety. Financial instability is a factor in the growth in depression and anxiety among university students, in addition to academic and professional uncertainties. The government and universities should collaborate to provide speedy, accurate, and cost-effective psychological care to the university students in order to reduce the developing mental health issues.

2.9 Conclusion

Many factors increase the risk of depression. The most critical component of society is students. Common mental health issues are considered public health concerns, and they can lead to risky behaviors among students, such as suicide in extreme cases. Students' mental health problems have

a negative impact on society. When a student suffers from an unexpected psychological problem, he can't focus on his studies. This unbearable disease impacts their normal regular life. The student becomes unconscious in every sphere of his life. When a student suffers from a psychological problem in his life he goes far away from his family, friends as well as society. Then, a student can't properly do his duty for society.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

I have done my work with a data mining process and five well known machine learning algorithms. I thought that if it is possible to apply algorithms for the purpose of early prediction of myocardial infarction, the heart attack rate will be turned down. In my research work, first of all I have divided my work stage in some steps. I have collected a dataset based on some questions related to symptoms of myocardial infarction. Then select the algorithms and observe the performances of the algorithms and find out which one is better.

The overall process is given bellow:

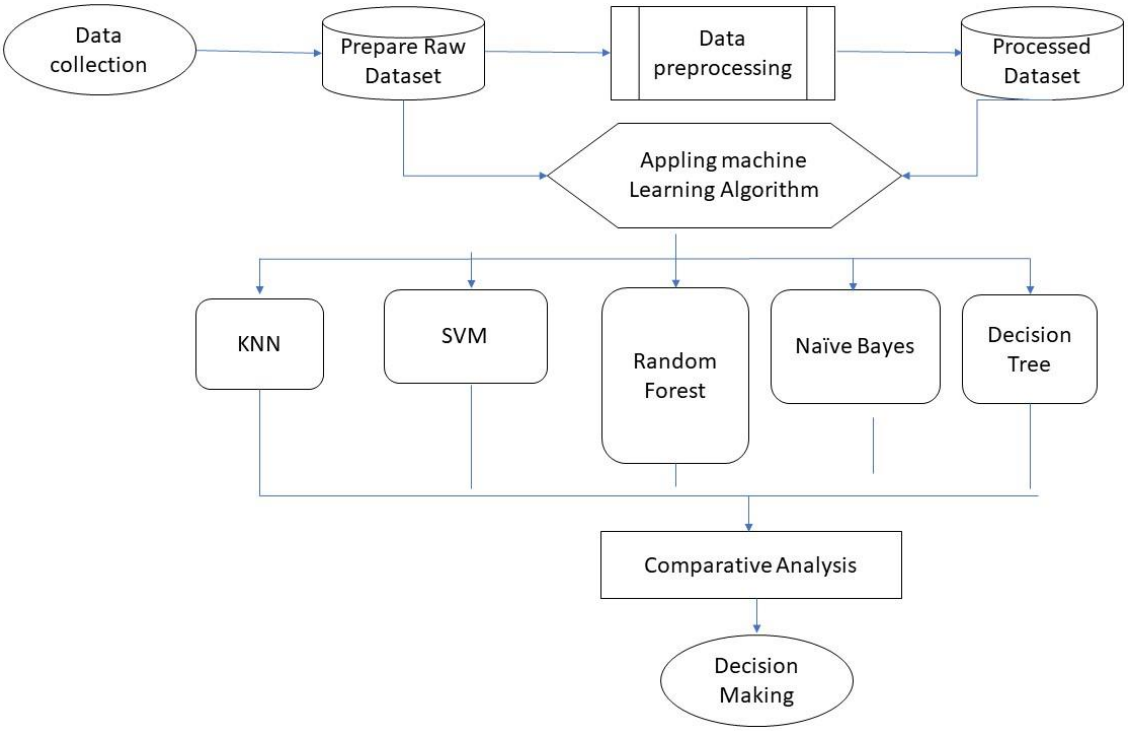

Figure 3.1: The overall process of implementation

As methodology first of all, I have collected my needed data from the data sources. Then data processing has been done. Then from the collected data, I have selected the appropriate attributes. Attributes are used to test algorithms.

3.2 Data collection procedure

The data-set consists of a huge number of features or factors which are directly or indirectly connected with depression. I did not succeed in collecting the required data as we went to the hospital because the authorities said that if they provide patient information that could damage patients' privacy and might have an effect on their rules and that the additionally aforementioned that generally it's not accessible as a prepared dataset. That’s why I think I need to create my own datasets which are collected from face-to-face questionnaires, google forms online, and a paper with a list of questions. Hopefully, we were successful in collecting 503 people’s data based on 21 factors which are basically daily activities of a person. After collecting all the data the main challenging part came to focus is data leveling into depressed people and nondepressed people. I consult many doctors to seek help and find patterns to find out. Finally, with the help of one doctor. And combining their three decisions into final leveling outputs with emphasis on the opinion of the majority. Among those data, there are 295 depressed information and 205 non-depressed people's information. All the data I have collected from an Online Survey, Daffodil International University (DIU).

Table 3.1: Data Collection table and its description

Categories	Type	Description
Age	Continues	Age in year
Sex	Discrete	0=male 1=female
Smoking	Discrete	0=No 1=Yes
Exercise habits	Discrete	0=No 1=Yes
smartphone _addiction	Discrete	0=No 1=yes
Games addiction	Discrete	0=No 1=Yes
physical illness	Discrete	0=No

		1=Yes
mental illness	Discrete	0=No 1=Yes
Stressful life	Discrete	0=No 1=Yes
Relationship difficulties	Discrete	0=No 1=Yes
ragging	Discrete	0=No 1=Yes
Family problems	Discrete	0=No 1=Yes
suicide history	Discrete	0=No 1=Yes
suicidal attempts	Discrete	0=No

		1=Yes

3.3: Attributes Explanation

The causes for depression diagnoses vary across teens, adults, and older individuals in general, despite the fact that the symptoms of sadness may be the same throughout age groups. Of course, this can be inferred from the fact that people lead quite diverse lifestyles at different stages of their lives and thus deal with very different issues. Since the focus of our study is on undergraduate university students, a large portion of the background research we did to identify the pertinent causes of depression focused on studies of depression in younger people. They are explained in the following.

1. Mental illness: Mental illness in the family a increased chance of depression exists in descendants if depression runs in the family. Grandchildren with two preceding generations affected by depression were at the highest chance of being diagnosed with depression, according to a 30-Year Study of 3 Generations at High Risk and Low Risk for Depression [12]. It has been demonstrated, according to Myrna M. Weismann, PhD, of Columbia University and colleagues, that children of depressive parents have a higher chance of developing mental problems. They wanted to know if depression in grandchildren persisted over two generations. A longitudinal retrospective cohort family sample of 251 grandchildren was questioned by the researchers on average twice, their biological parents on average 4.6 times, and grandparents up to 30 years old [13]. The results showed that parents with major depressive disorder (MDD) had a considerably increased chance of their children developing depression, and that risk rises even more if grandparents have a history of depression. The chance of developing the majority of psychiatric diseases increases in those who have biological relatives with a history of mental illness [14]. Another research shows that the risk for depression in biological children increases from 12.6% to 41.4% if grandparents or Data set description 33 great-grandparents had depression [15]. Thus, we can see that a history of this disorder in the family contributes towards depression in later generations.

2. Academic standing: Academic standing A Boston University student named Varsha Srivastava discusses how her subpar grades caused her tension and anxiety, which ultimately led to depression [16]. Even though I haven't found enough support in the research to claim that low academic performance causes depression, it is widely recognized and established that depression can cause academic failures or a decline in CGPA for university students. In research by Heisenbugs, Hass, and Rowland (2005) of Western Michigan University undergraduate students, it was shown that those who were given a depression diagnosis at the university Health Center had a GPA that was 0.49 points or half a letter grade worse than their peers., as compared to a control group who had not been diagnosed with depression [17]. Another study conducted among second-year college students in the Pakistani city of Rawalpindi revealed that depression had a detrimental impact on the students' academic performance and that the performance varied significantly depending on the amount of depression [18]. I thus believed that this aspect merited being covered in my research.

3. Addiction or substance: According to several research, depression has a high correlation with drug addiction or substance misuse. In America, persons who have at least once been diagnosed with depression use 84 percent of the country's cocaine and 69 percent of its alcohol, according to a National Bureau of Economic Research analysis [19] . It is generally known that drug misuse and depression often coexist [20]. Abuse of substances can change a person's central nervous system in ways that lead to depressive symptoms like sadness and hopelessness. Drugs, on the other hand, are used by depressed persons to reduce tension and revive their spirits. Thus the two conditions can persist and worsen each other in a state defined as Dual Diagnosis. One in four people suffering from dual diagnosis are at the risk of committing suicide [21]. According to the Journal of Clinical Psychiatry, one out of three adults who are addicted to drugs also suffer from depression [DualDiagnosis.org]. Research conducted among college students finds out that alcohol and substance abuse is associated with Major Depressive Disorder (MDD) [22] . Hence there is sufficient evidence that there might be a relation between drugs and depression. .

4. Relationship Problem: Relationship/Affair Depression might affect couple relationships and vice versa. There is proof that people who have relationship problems are three times more prone to depression than people who are not and 60% people suffering from depression consider relationship difficulties to be the main cause. On the other hand, the National Institute of Health

alerts people that being single increases the risk of depression [Butler]. It is quite natural for people to be troubled due to problems with their partners. However, if irritations, pessimism, restlessness and other symptoms remain for a long time, someone may go into depression. Single people on the contrary, may also face symptoms like loneliness, fatigue etc. and eventually plunge into a state of depression. University of Waterloo psychologist Uzma Rehman and colleagues (2015) say that people who have clinical depression are not content with their relationships [23]. Breakups too, can cause temporary sadness and sleep problems but only if these and other problems persist for over two weeks, can someone be affected by depression. I have considered all these factors in a sequence of questions in our survey form.

5. Financial problem: Financial problems in your family in an increasingly materialistic world, money or the lack of it dominates much of what we feel and do. Hence, it is no surprise that financial problems in the family in turn leading to stress and the feeling of burden on children and less money to spend on enjoyable activities can thrust a university student into depression. Debt in the family can further worsen the situation. A study reveals an alarming 24% rise in depression 3.2 Data set description 35 symptoms with a 10% increase in short-term debt [24]. While parents will definitely be more affected by such scenarios, the effects on children cannot be ignored. This might also turn into a vicious cycle where poor financial health leads to poor mental health, which leads to increasingly poor financial health, and so on [25]. Research conducted by the University of Southampton and Solent NHS Trust among 454 first year British undergraduate students confirm an increasing risk of mental health problems such as depression and alcohol abuse due to financial problems and worrying about debt at university [26]. Therefore, as can be observed, the link between depression and financial problems in the family is well known.

6. Sadness caused: Sadness caused by loss or death everyone feels sadness and loss after losing a loved one, and these emotions are normal. However, persistent sadness and hopelessness that interferes with a person's capacity to function normally and causes them to start to prefer seclusion might be an indication of depression [9]. The American Psychiatric Association expressly classified mourning as an exception to the diagnosis of clinical depression and advised physicians not to diagnose severe depression in patients who had just lost a loved one, but they are now

contemplating eliminating that exclusion [27]. The grief phase is linked to a higher risk of certain psychiatric diseases, according to a study that also examines the range of potential future research on the topic [28]. According to the findings of a different study, children who lose a parent young in life may experience financial difficulties that lead to drug misuse in the family, and bereaved groups were more likely to experience sadness and anxiety than non-bereaved groups [29]. They also come to the conclusion that children who lose loved ones are still at danger, even when the existence of additional risk factors increases the likelihood of psychological and behavioral health issues. Therefore, despite the fact that some psychologists' say that depression due to death of a loved one cannot be classified as clinical depression, there is evidence in literature to suggest that the contrary is also a possibility. [38] [39]

3.4 Research Subject and Instrumentation

In recent years, machine learning algorithms, data mining, and deep learning techniques are immensely acceptable and in vogue for any kind of prediction, recognition, and also detection. I will try to apply several machine-learning algorithms to our collected dataset to see which algorithms will fulfill our will and perform best. We apply several machine learning algorithms which are k-nearest neighbor (KNN), naïve Bayes, Support Vector machine (SVM) Linear, random forest, , Decision Tree. Recently 'Python' is one of the most famous and used programming languages which is mostly used for research purposes by researchers. So, we use 'Python' as our programming language and for data mining tools or platforms, we use 'Google Colab', 'Jupyter notebook', with that 'Microsoft Excel' as our dataset. The method of creating a model of classes from a collection of records containing class levels is known as classification. The aim of the Decision Tree Algorithm is to figure out how the attributes-vector behaves in a variety of situations. The classes for the newly created instances are also determined using the training instances.

3.5 Data Preprocessing Process

When I successfully end up collecting a sufficient amount of data, I notice that there are some missing values in some of the data, and there are also different types of data like categorical data, numerical data. So I made the decision that I will process my data according to my needs. I will make this data compatible with algorithms. Data processing has the power to convert data into appropriate formats after data collection. Processed data in a specific type helps to best output easily. Data preprocessing process is shown below here in

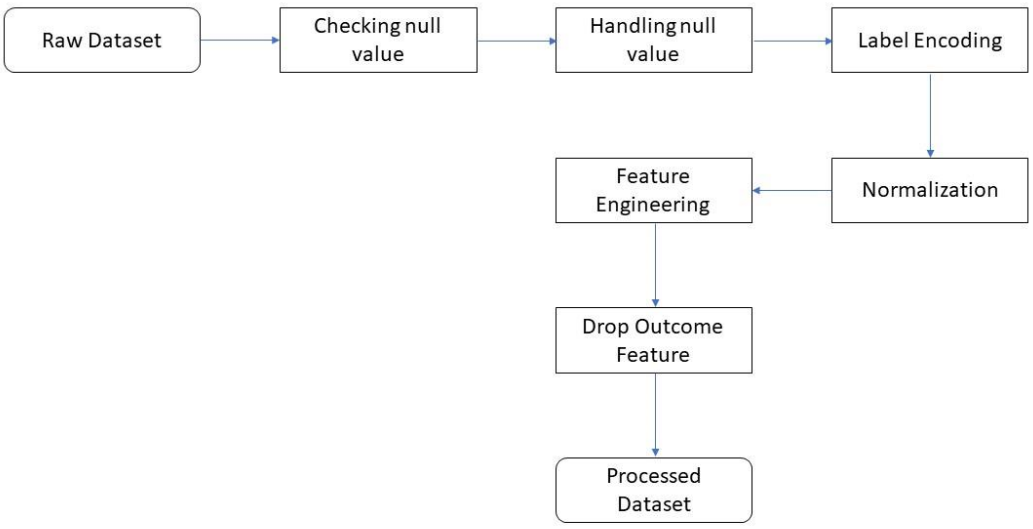

Figure 3.2: Data preprocessing process

3.6 Selective Algorithms

Applying algorithms is an important issue in data mining and machine learning techniques when I do any research work because the accuracy of the expected outcome depends on applying algorithms. When I have turned to the point to select algorithms, at first, I find out the most valuable algorithms and then I have selected five algorithms.

These are:

1. Random Forest (RF)

2. Decision tree

3. Naïve Bayes (NB)

4. Support Vector Machine (SVM)

5. K-nearest Neighbor (KNN)

3.6.1 Random Forest (RF)

A scalable, user-friendly machine learning approach called random forest frequently produces excellent results even without hyper-parameter adjustment. It is currently one of the most used algorithms due to its versatility and simplicity. Accuracy is the highest of all currently used algorithms. It effectively handles very large data collections. It can support thousands of input variables without variable deletion it provides estimates for the classification's relevant variables. As the forest develops, a generalization error estimate is produced that is intrinsically impartial. It has an effective method for calculating partial data that maintains precision when a sizable amount of the data is missing. It has techniques for balancing mistakes in population-class unbalanced data sets. For later usage, created forests can be saved from other data. Data on the connection between the variables and the classification are provided by prototypes that are computed. It determines distances between examples that can be used to group cases together, identify outliers, or produce intriguing data visualizations (by scaling). The capability described above can be used on unlabeled files to produce unsupervised clustering, data visualizations, and outlier identification. It offers a method for tracking vector interactions through experimentation. Recognizing and utilizing the various options requires more understanding of how they are computed. The majority of the possibilities are used by two data artifacts produced by random forests. Due to sampling with substitution used to create the training set for the current tree, about one-third of the instances are excluded from the dataset. To obtain a fair running assessment of the categorization error when adding trees to the region, this out-of-bag data is employed. Forecasts with changing relevance are

frequently made using it. After each tree is built, all the data is routed down it, and proximities are calculated for each pair of cases. The proximity of a terminal node increases by one if it is occupied twice. At the conclusion of the run, approximations are normalized by dividing by the total number of trees. Proximities are used to provide illuminating low-dimensional data representations, replace missing data, and identify outliers.

3.6.2 Decision tree

In order to partition the dataset into many smaller sets based on a particular query, a decision tree model is one that performs a series of comparison questions. Therefore, the dataset can be processed in stages. Additionally, the activity is continually repeated with various sets of questions at various levels of the readily accessible essential subsets. It keeps going until all of the dataset's accessible attributes can cover it. Based on our research-based questions, our decision rules, and the characteristics of the data set, such as its district value or continuous value, I can construct several forms of decision trees. The decision tree j48 algorithm is one of the most widely used ones. It serves as a single variable related to the structure.

3.6.3 Naïve Bayes (NB)

Naïve Bayes (NB) algorithm works by following the given theory:

$$P(B|A) = P(A|B)\, P(A)/P(B)$$

We have elements A and B here. Their likelihood of occurring, P(X), is determined, where P(A) denotes the likelihood that element A will occur and P(B) denotes the likelihood that element B will occur. The conditional probability of element A appearing given element B is denoted by P (A|B), and the Naive Bayes method will be used to apply this theorem. Therefore, the aforementioned theory would directly multiply the likelihood of each characteristic occurring for independent attributes.

3.6.4 Support Vector Machine (SVM)

Support Vector Machine, sometimes known as SVM, is one of the most widely used supervised learning algorithms for classification and regression problems. However, classification issues are the key use cases for it in machine learning. The SVM algorithm's objective is to establish the best boundary, or line, that will divide an n-dimensional space into the predetermined future teams, allowing us to conveniently assign fresh data to the appropriate cluster. A hyperplane is the name given to this limit of the correct judgment. SVM selected the acute points/vectors that make it easier to construct the hyperplane. Really severe situations. The rule is therefore noted using the Support Vector Machine because square measures are designated as support vectors. The important thing to keep in mind is that all of these squares are scientific calculations that have been simplified as much as possible to give you the most elaborate response. SVMs differ from other classification algorithms in that they select the decision limit that optimizes the distance from the closest data points.

A set of data with N qualities is present in the SVM algorithm system. The Support Vector Machine (SVM) classifier must locate an appropriate hyper plane in N-Dimensional space that categorizes the dataset with the greatest possible margin of error. It divides the available sets of points into the two primary classes' hyper plane and line and is regarded as a supervised machine learning approach that can be applied to classification systems.

3.6.5 K-nearest Neighbor (KNN)

KNN is within the controlled adaptive category of calculations. This essentially means that we are provided a marked dataset of expectations (x, y) that are being prepared and that I will be attempting to identify the relationship between x and y. More technically, I can potentially take in a power h:X-Y with the goal that given a secret perception x, h(x) will undoubtedly, forecast the associated yield y. The K-NN classifier is a non-parametric, occasion-dependent measure of learning. The utilitarian form of h is non-parametric since it forbids any explicit presumptions, avoiding the dangers of incorrectly modeling the simple distribution of the data. Assume, for instance, that although if our data is unusually non-Gaussian, the learning model we choose has a Gaussian form. Taking everything into account, our assessment would significantly lower the

prediction. [41] [42] A model is not expressly taken up in our estimation while using case-based learning. Instead, it keeps the planning-related occurrences alive and uses them as "learning" in the prediction stage. This essentially means that the measurement would only disclose an answer when a query is made to our database, using the planning opportunities. In the arrangement environment, the K-closest neighbor measure basically means establishing a larger piece of the vote between the K most comparable occurrences to a certain "concealed" interpretation. . A distance between two informational focal points serves as the definition of similarity. Given by d(x,x')=(x1-x'1), the Euclidean separation 2+(x2-x'2) 2+...+(xn-x'n) A notable choice is 2....(1). The K-NN classifier performs the two steps below when given a positive integer K, an unobtrusive perception x, and a similarity metric d from equation 1. It first scans the entire dataset, noting the relationship (d) between each perception of planning and x. We will identify the K focuses in the preparation information that is most similar to x the package. Keep in mind that K frequently behaves unusually to avoid tie situations. The isolation of one information point from all other gathering information focuses is essentially what it establishes. The K-closest focus of data is selected at that time, where K may be any number. Now, it is likely to be thought about how to choose the vector K and what effects it will have on this classifier. Like most machine learning algorithms, the K in K-NN is a hyper parameter that you, as a developer, must choose in order to obtain the knowledge index's best possible fit. Naturally, K should think about controlling the current condition of the previously described option limit. [40] When K is low, we limit the scope of a forecast and direct our classifier to the general transportation to be "more visually impaired." The suit with the highest degree of adaptability, which will have low tendency and high fluctuation, gives K some encouragement. Visually, it will be even more ragged my limited. On the other hand, a greater K midpoint in each forecast has more voters, making exceptions better. The smoother option limits of K's larger estimates would indicate a decreased shift but an enhanced predilection. K, the group quantity, must first be solved. Its drawback is that because the following bunches rely on, it does not produce an exact result with every run. Even if we use the same information, if we input it into a different request, it can produce a different group if there is little information available. As far as we are aware, the datasets are pretty much set up for the KNN display structure. Since KNN is a non-parametric approach, we won't obtain model parameters but nevertheless recover a vector with elements of test set characterizations. [34]

The terms "depression," "anxiety," and "stress" are now often used by students. The majority of the 500 Students from various districts across Bangladesh participated in our survey. My analysis of the data revealed that at least 95% of students are depressed. Most of the students between the ages of twenty and twenty-four are depressed. Teenage students are experiencing second-level mental health problems. Students' family, peers, and friends are impacted by their psychological issues. The surroundings of a student's family, academic institutions, and society are all impacted when they have mental health problems. Students are dealing with depression on some level in their lives.

3.7 Statical Analysis

In the system dataset, I have collected 500 students' data predictions for depressed. I have selected 70% dataset to train and 30% dataset to test. In my system work I have used five algorithms to have a higher accuracy level. I have tested the performance of those algorithms.

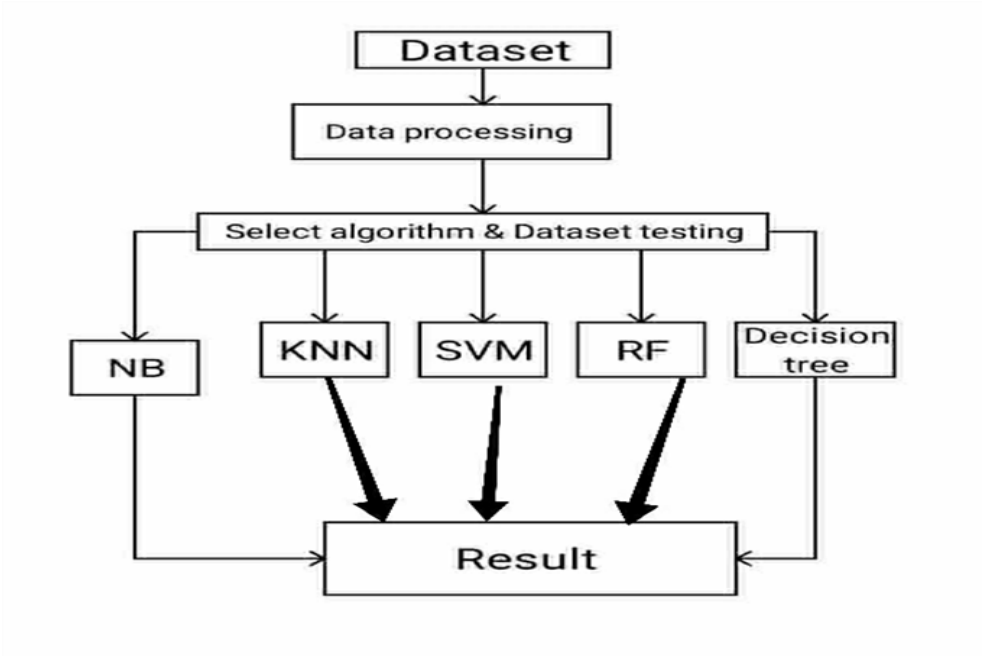

Figure 3.3: Process of testing different algorithms

3.8 Conclusion

One of the most prevalent disorders in primary care is depression, which is frequently not detected, diagnosed, or treated. When untreated, depression has a significant death and morbidity rate. Anhedonia or other nebulous, inexplicable symptoms are more commonly reported by depression sufferers than actual depression. All medical professionals need to be on the lookout for depression in their patients. There are a number of depression screening methods that are reliable and practical in primary care settings. If untreated, depression has a high rate of morbidity and mortality. The majority of depressed people report anhedonia or other nebulous, unexplained symptoms rather than feeling depressed. All doctors need to be on the lookout for depression in their patients. Another major issue I discovered during my research is that simply determining whether or not a student is depressed will not aid in their recovery and healing from this mental disease. One of the top priorities should be to identify the underlying issues or causes of depression in university students.

CHAPTER 4

THE MODEL FOR PREDICTING DEPRESSION AMONG UNIVERSITY STUDENTS

4.1 Introduction

One of the most prevalent mental health diseases is depression, which frequently co-occurs with anxiety. Depression can range from moderate and transient to severe and persistent. While some people may only experience depression once, others may do it several times. Suicide can result from depression, but it can be avoided with the right help. It's critical to understand that there are several ways to support young people who are considering suicide. Depression is a mood illness that results in a constant sense of melancholy and boredom. It affects how you feel, think, and behave and can cause a number of mental and physical issues. It is also known as major depressive disorder or clinical depression. You can struggle with performing routine daily tasks, and you might occasionally think life isn't worth living.

4.2 Selected Algorithms

I applied five algorithms named Random Forest, decision tree, Naïve Bayes, Support Vector Machine, K-Nearest Neighbor and got their Classification Accuracy. Because our starting point is classification accuracy. It is the number of accurate predictions made, multiplied by 100 to translate it into a ratio, divided by the overall number of predictions made. The accuracy percentage of these algorithms are shown below with a bar chart:

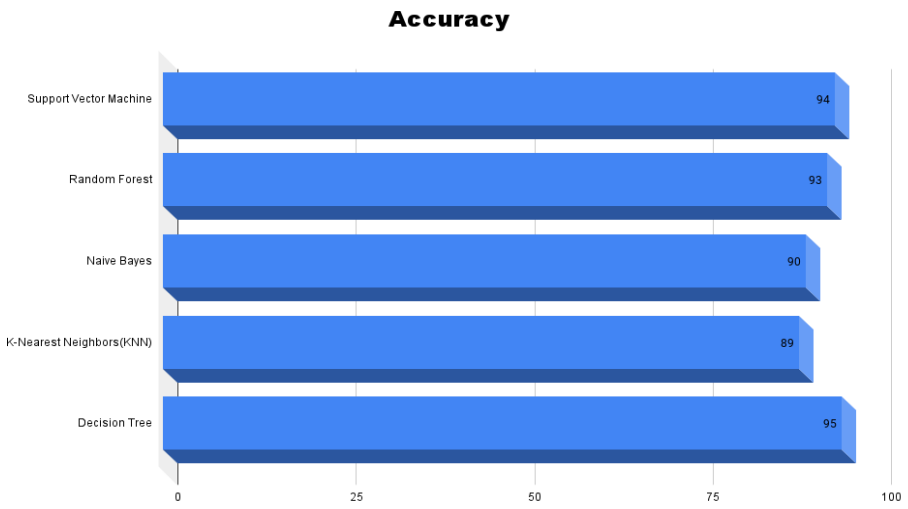

Figure 4.1: Accuracy of different algorithms

Here we can see that support vector machine are 94% accuracy, Random Forest are 93% , Naïve Bayes are 90%, KNN are 89%,and the best accuracy decision tree are 95%. In the given figure, I have displayed five algorithms with their accuracy level. I have to contrast the models with one another and select the algorithm with best accuracy which is 95% and achieved by applying Decision tree. The Decision tree algorithm works in following steps:

1. Selecting K data points randomly from the training dataset.

2. Constructing a decision tree regarding these data points.

3. Selecting the N tree subset from the trees and executing step 1 & step 2.

4. On the basis of the majority's vote they determine.

4.3 Applying Algorithm

My research tries to determine whether or not a pupil is depressed. My data collection is based on binary categorization, which allows for either of two possible results. To display our data, I also utilized histograms. I employed a handful of the most popular methods for both of the aforementioned cases because my data is binary classified and some of the questions contain a small number of missing values. To determine my prediction model's accuracy, precision, recall, and f-measure, I employed 5 methods. The system will perform better the higher the accuracy and

f-measure. Another crucial element is accuracy, which is defined as the total number of accurate yes predictions. For my system, this indicates a student who is actually depressed as a result of all the depressed results that were predicted. Keep in mind that the proportion of true positives in actual yes results is another crucial component of the prediction system. According to my system, a student who is actually depressed out of all the other actual depressed students. I'll then compare the accuracy and f-measure of each algorithm in an effort to determine which one will best fit my model. False Positive and False Negative are two additional significant words that are crucial to our system. Better model performance results from lower False Negative and False Positive values. Furthermore, if both are lower and there is a reasonable balance between them, the model will be regarded as being good. Lowering the False Negative is crucial since my method predicts depression and doing so implies that it will either identify a person who is sad as not being depressed or, in the case of a False Positive, would identify a person who is not depressed as being depressed. It is crucial to distinguish between someone who is actually depressed and someone who isn't depressed but is being labeled as such, therefore for my system, I'll strive to obtain at least better False Negative than False Positive results. Chapter 5 I will discuss experimental analysis. The Confusion Matrix is a practical machine learning technique that lets you assess Recall, Precision, and Accuracy. The phrases True Positive, True Negative, False Negative, and True Negative are shown using an example below. You anticipated a favorable outcome, and it came to pass. It is a performance measure table which is mostly used to represent the performance of a machine learning model based on a set of test output data. It checks the performance by calculating four terms such as, True Positive (TP), True Negative (TN), False Positive (FP) and False Negative (FN). I will describe briefly about this in the experiment and result segment.

Decision Tree:

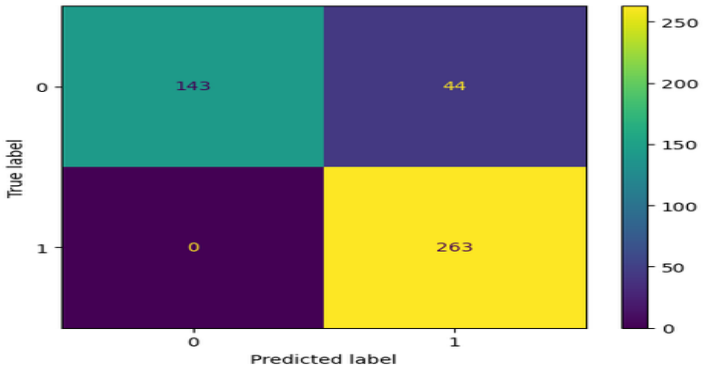

Figure 4.2: Confusion matrix of Decision Tree

Figure 4.1 accuracy 85% Precision, Recall 90%, f1-score 95%.Decision Tree Classification Accuracy 95%.

K-Nearest Neighbors (KNN):

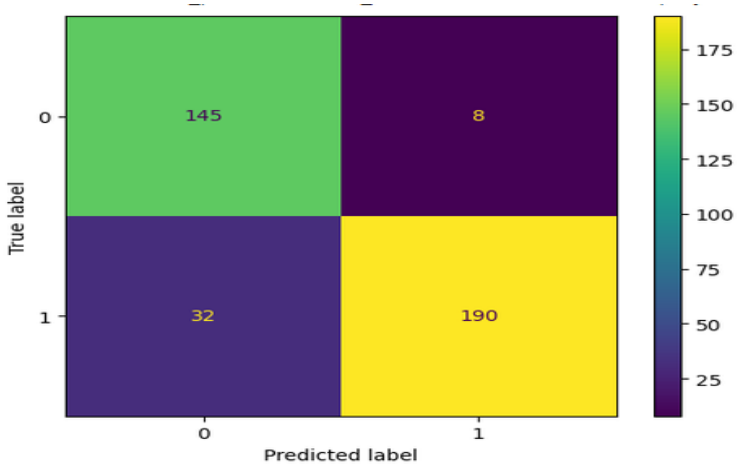

Figure 4.3: Confusion matrix of KNN

Figure 4.3 accuracy 82% Precision, Recall 95%, f1-score 88%.K-Nearest Neighbors Classification Accuracy 89%.

Naive Bayes:

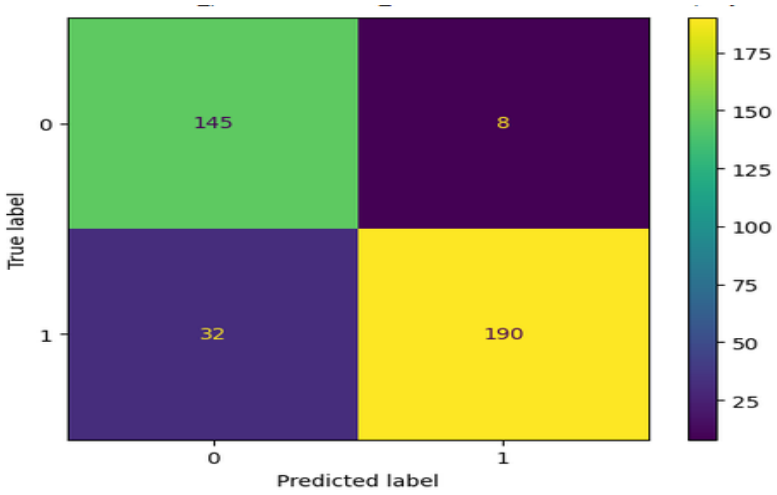

Figure 4.4: Confusion matrix of Naïve Bayes

Figure 4.4 accuracy 86% Precision, Recall 76%, f1-score 92%.Decision Tree Classification Accuracy 90%.

Random Forest:

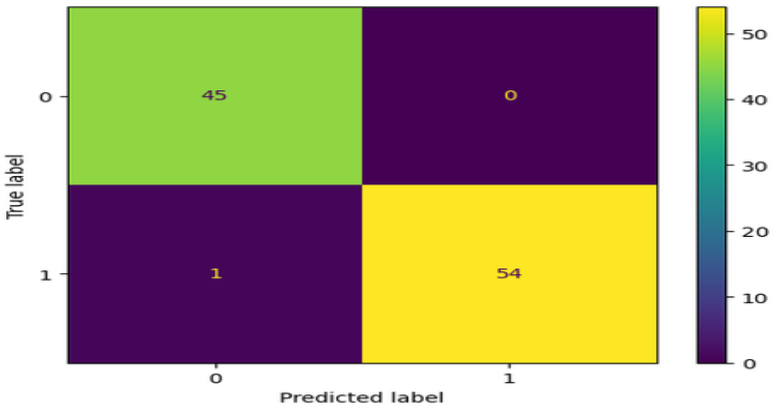

Figure 4.5: Confusion matrix of Random Forest

Figure 4.5 accuracy 86% Precision, Recall 76%, f1-score 92%.Random forest Classification Accuracy 93%.

Support Vector Machine (SVM):

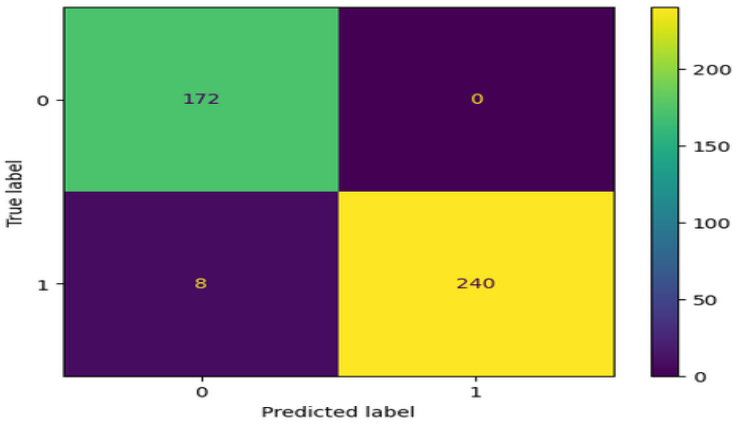

Figure 4.6: Confusion matrix of Support Vector Machine

Figure 4.6 accuracy 82% Precision, Recall 95%, f1-score 88%.Support vector Machine Classification Accuracy 94%.

A machine learning classification problem can be predicted using the confusion matrix technique. This contrasts with the precise target values that the machine learning algorithm had projected. We can see a general picture of how well my classification model is performing. Additionally, I can learn what kinds of mistakes I make. It is essential for evaluating the effectiveness of any classifier.

4.4 Experimental prediction

In the histogram I represent the total number for bars in the y-axis where each bar represents a special information written in the x-axis. Therefore, I will represent every feature in a histogram and try to understand the data. Here the red bar represents “depressed” and the blue bar “Not Depressed”. I will see the number of students depressed or not depressed.

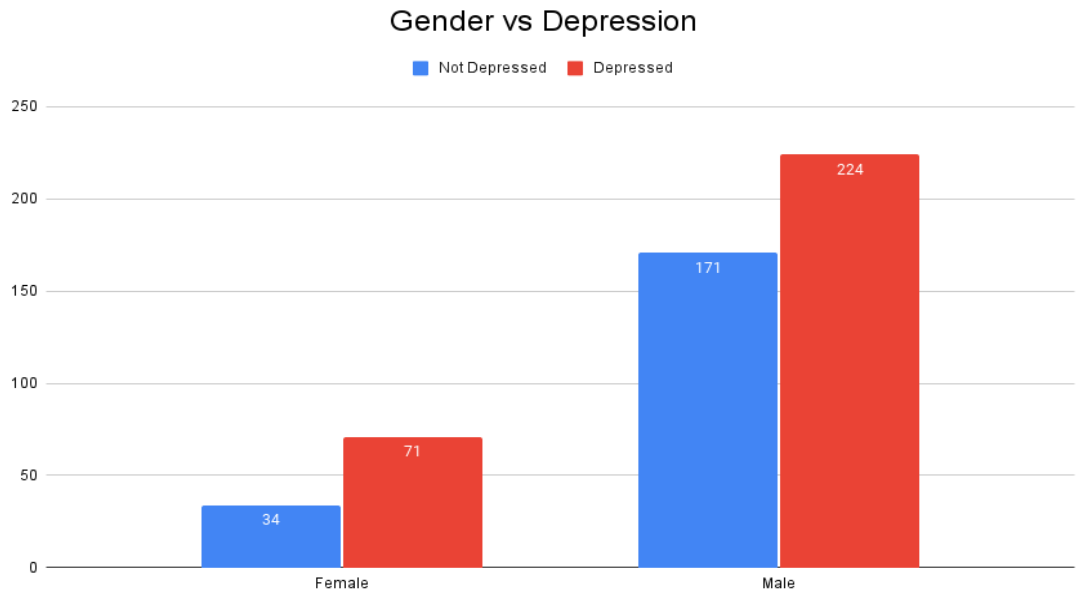

Figure 4.7: Data Corporation for Gender vs Depression

There are 500 hounded students in the data set. I see that male are more depressed than female students. We can see we have more number of students who said they do not have any depression. Therefore 59% students are depressed and 41% not depressed.

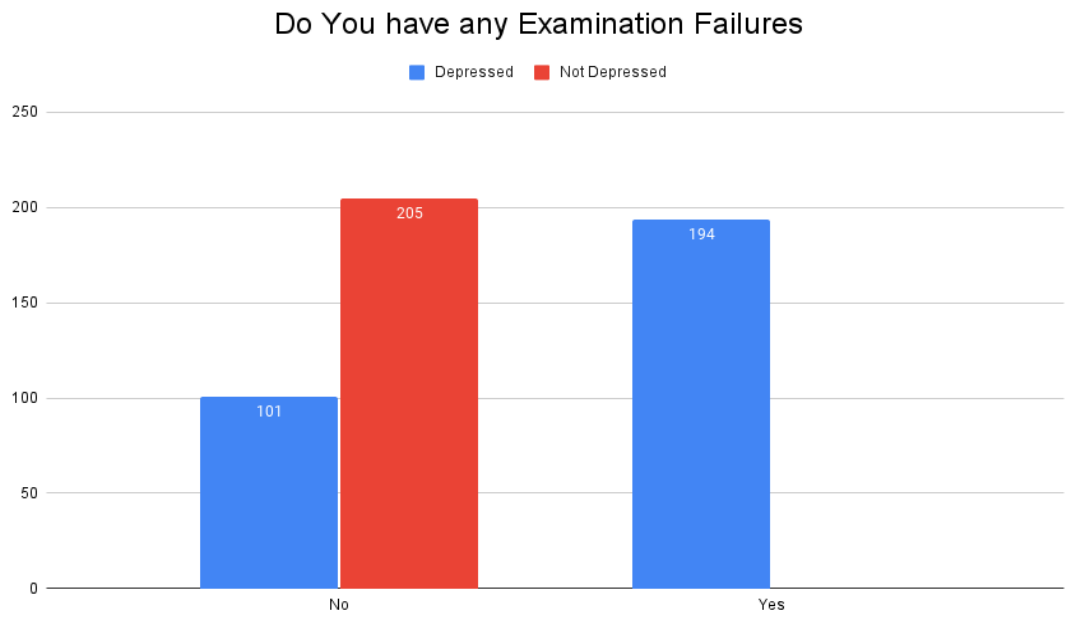

Figure 4.8 : Data Corporation for Examination failures

family pressure on grades, a massive amount of homework, and comprehension of regular lessons. We can observe from the visual representation that the majority of those who answered "yes" to this question are depressed. About more than 50% students are 101 out of 205 are depressed when they say No to this question. Therefor I can say that this question is one of the mejor factors that help in predection depression.

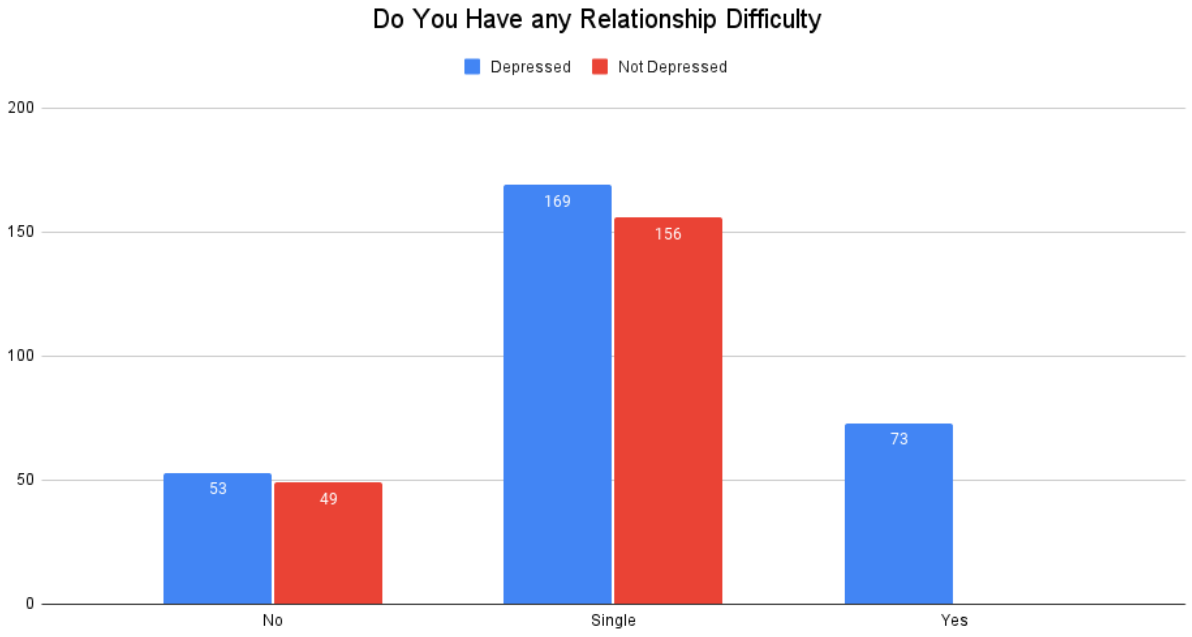

Figure 4.9: Data Corporation for relationship Difficult

Figure 4.3 this figure question is do you have any relationship difficulty ther 325 out of 156 and 53 out of 49 are not depressed. Then we can see the graph 70% students are relationship difficulty.This is the mejor problem of depression.

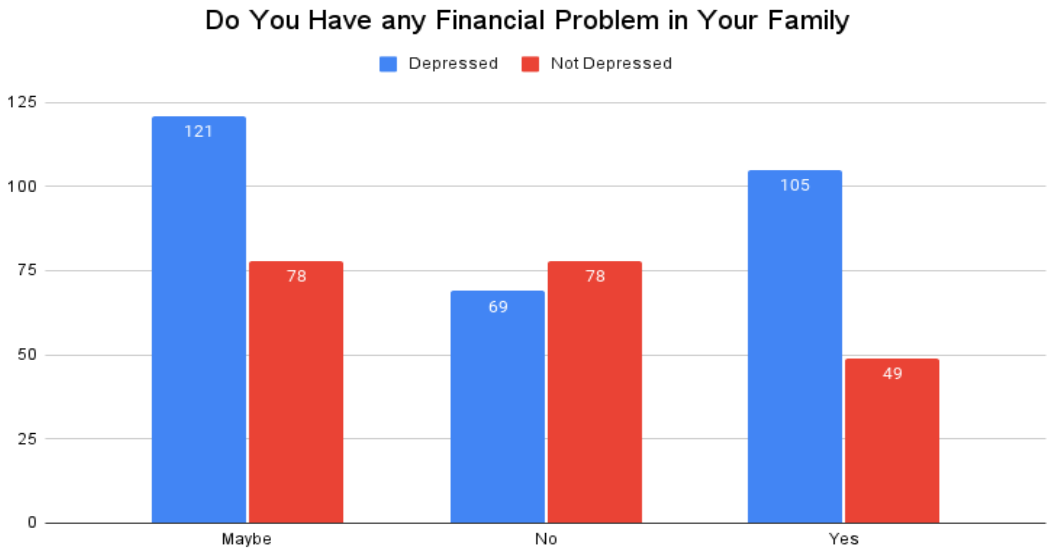

Figure 4.10: Data Corporation for Financial problem in your family

Figure 4.5 by looking at the “Yes”, “No” and “maybe” responses to the next question, I can draw that conclusion. Students that answered "yes" to family financial issues are generally depressed. Around 68%, or 105 out of 154 people, are depressed. Then students are “Maybe” to family financial problem “yes” 121 out of 199 that is 60% of this number. This question is the major factor on predicting depression.

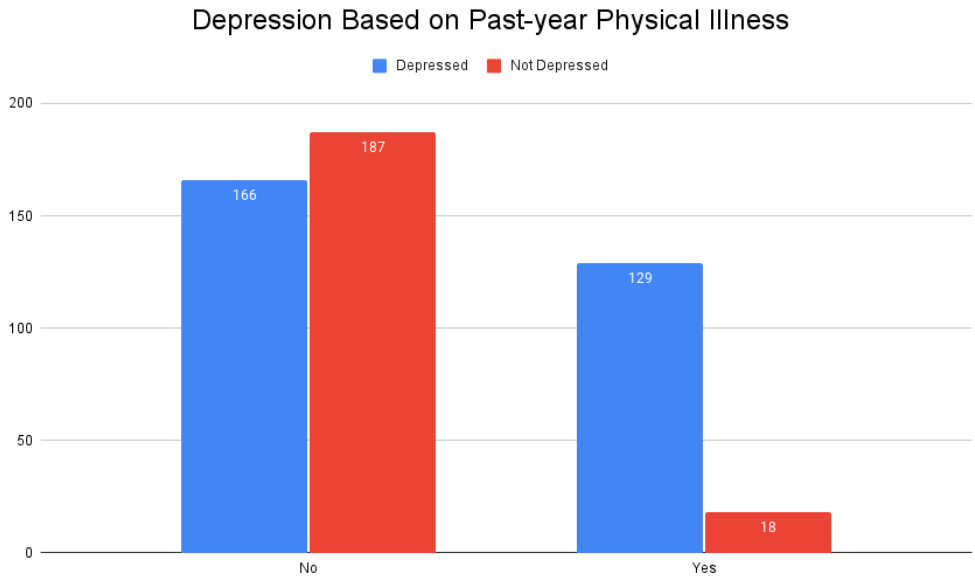

Figure 4.11: Data Corporation for past year physical illness

Figure 4.6 we can see the past-year physical mental illness 129 out of 18 not depressed. That the prediction number no 187 and those 166 is depressed. In this question 70% students are predicting depression. Its effect of mental health.

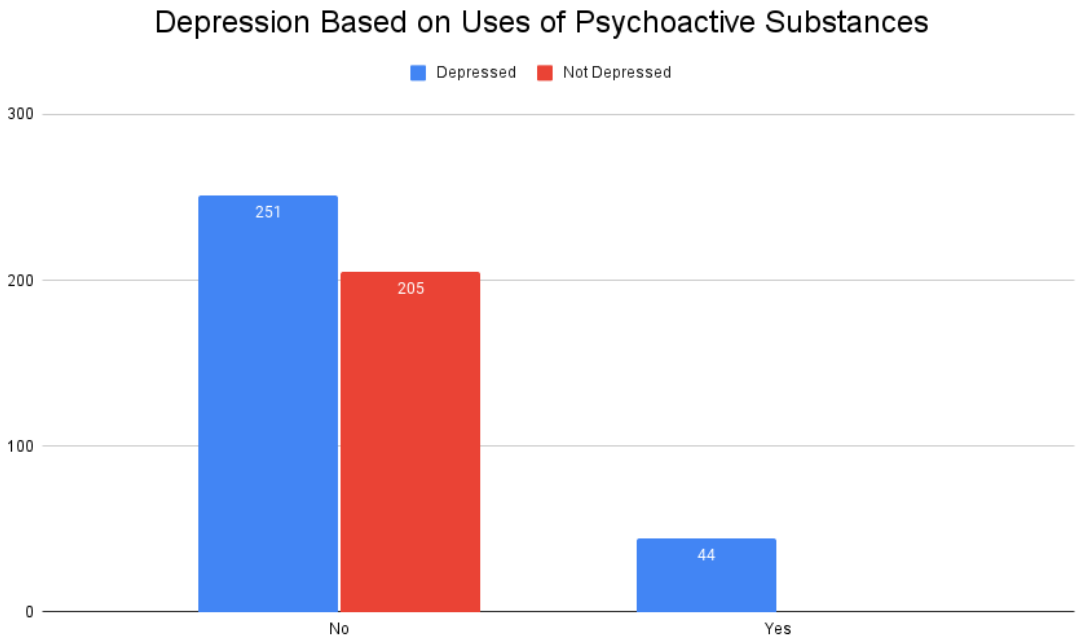

Figure 4.12: Data Corporation for psychoactive substances

Many times, psychoactive substances cause subjective changes in consciousness and mood that the user may find rewarding and pleasant or advantageous in a way that is objectively observable or measurable. Figure 4.7 we see that psychoactive substances data no predicting 205 are not depressed and 251 are depressed.

Some psychoactive substances may be used in detoxification and rehabilitation programs for people who may have become dependent upon, or addicted to, other mind or mood altering substances.

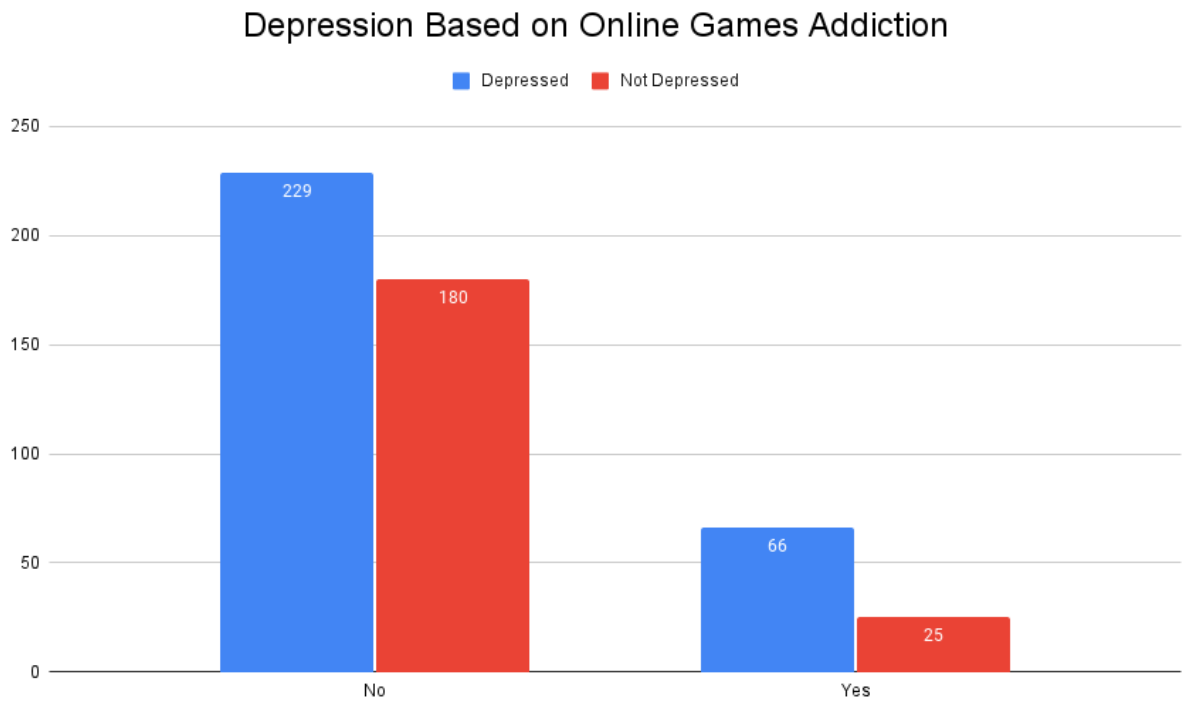

Figure 4.13: Data Corporation for online games addiction

The illness known as "online game addiction," sometimes known as "online gaming disorder," is defined by drastically diminished control over gaming behaviors, which has a negative impact on many areas of your life, including self-care, relationships, relationships with others, school, and job. This figure yes predicting 66 are yes not depressed 25. Therefore no predicting 180 are not depressed and 229 are depressed. It’s the major question because excessive games are reducing the interaction with people around us.

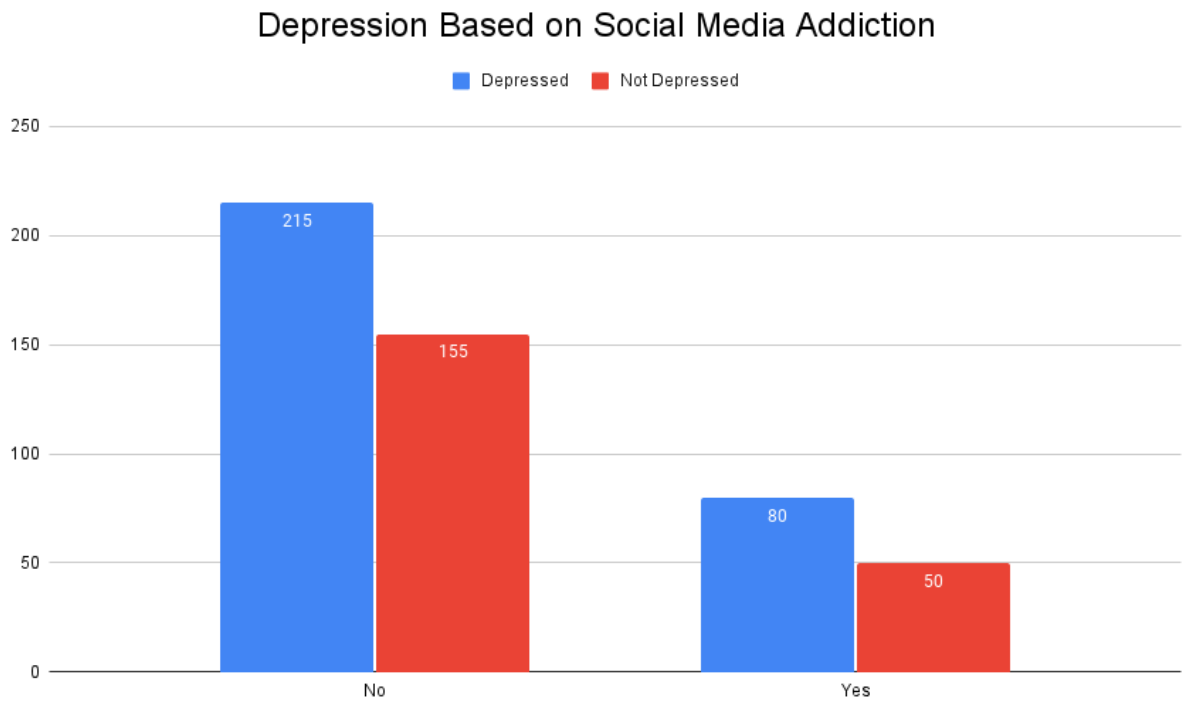

Figure 4.14: Data Corporation for social media addiction

I assume that using social media too much makes students depressed. As I can see, the percentage of depression grows as the amount of hours increases. This is due to the fact that those without a social life and those who spend too much time on social media in search of friends tend to be more lonely and depressed than those who spend less time online and go out to enjoy their lives. Figure 4.9 we can see the result yes depressed are 80 and not depressed 50. Therefore no depressed 215 and not depressed 155. So,65% students are social media addicting.

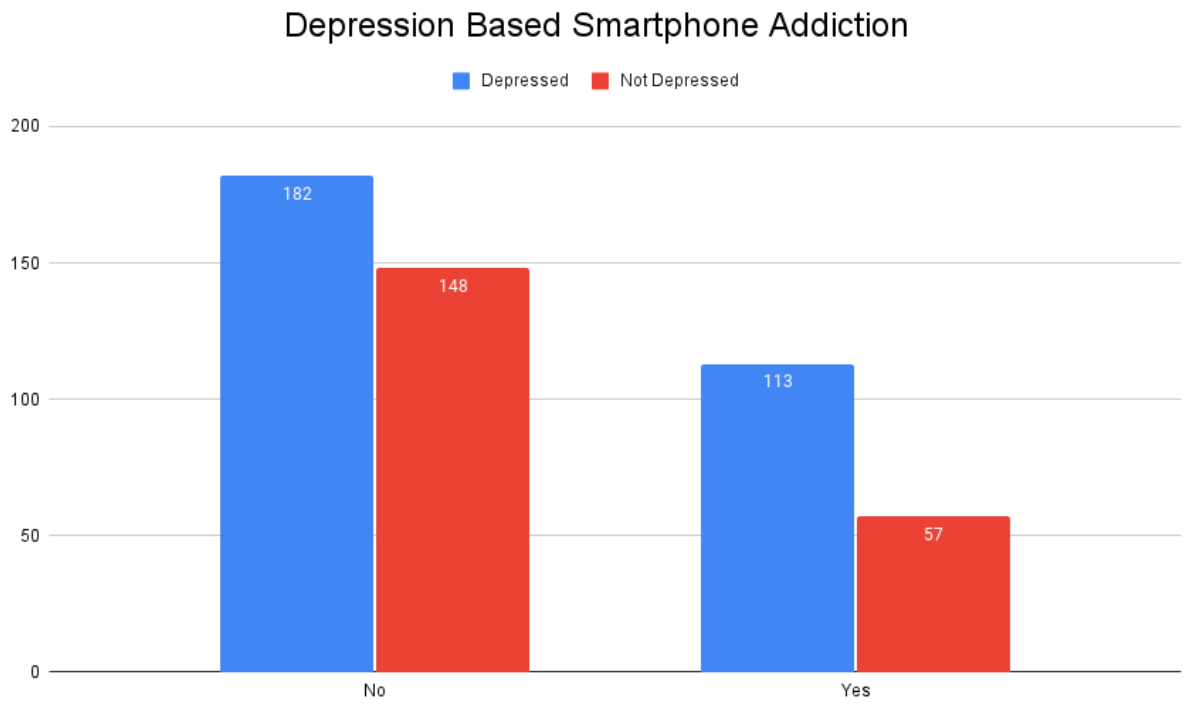

Figure 4.15: Data Corporation for smartphone addiction

In this figure data corporation for smartphone addiction. Here yes 113 out of 57 and No predicting 182 out of 148. Total data set 70% students are addicting are smartphone. According to study that was just published in the Canadian Medical Association Journal, excessive smartphone and social media usage can increase "mental distress, self-injurious conduct, and suicidality among children," with the effect being greater in females. People who are attached to their smartphones frequently feel more lonely. The problems that a person with a mobile addiction may experience include headaches, impaired vision, sleep disorders, depression, stress, social exclusion, aggressive conduct, financial difficulties, strained relationships, and little to no professional advancement.

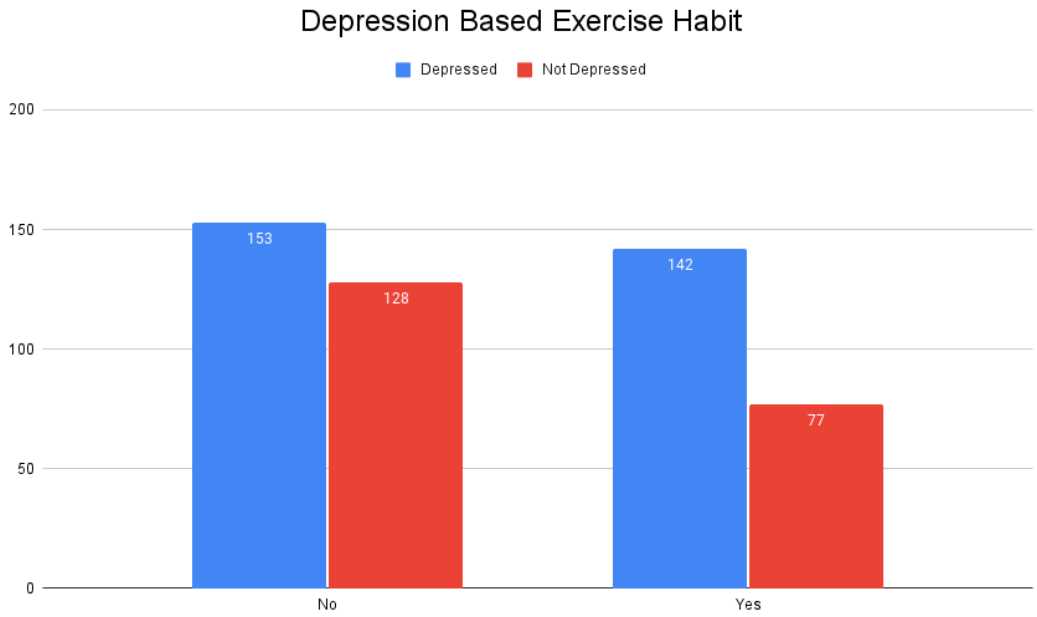

Figure 4.16: Data Corporation for exercise habit

In this figure for exercise habit data corporation. Here yes 142 out of 77 are no. And 153 out of 128 are not depressed. In total data set 65% data are depressed and 35% are not depressed.

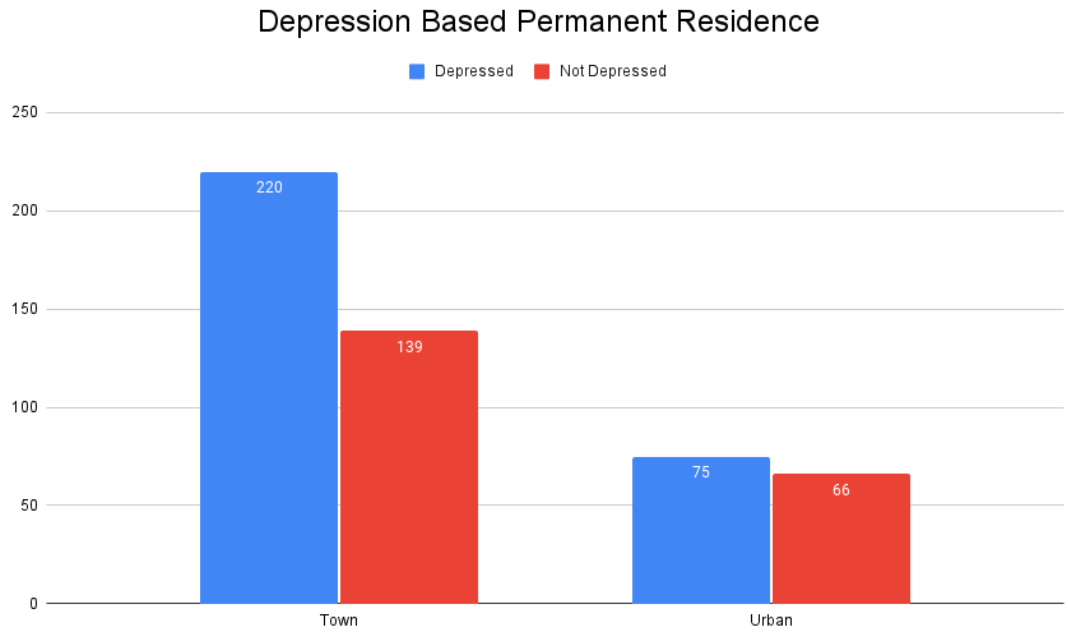

Figure 4.17: Data Corporation for permanent Residence

I can see the data corporation urban students are 75 out of 66 are not depressed and town 220 out of 139 are not depressed. Town students more than depressed for urban students.

4.5 Conclusion

Sadness and grief can occur multiple times during life due to the loss of a loved one, issues in both the personal and professional life, or for no particular reason at all. However, sadness frequently causes people to feel worthless, which makes them despise themselves. My research doesn't concentrate on cases of people who are generally depressed and unhappy or on illnesses like thyroid issues, brain tumors, or vitamin deficiencies that mimic the symptoms of depression. Rather, I focus on real-world examples of persons who have been identified as having or in need of a diagnosis of clinical and psychological depression. The many signs and symptoms of depression range from continuous sorrow and anxiety, pessimism, loss of interest, and laziness to trouble sleeping, weight changes, and in severe cases, suicidal thoughts. All of these factors were taken into account while I prepared our survey, some of which were incorporated into the main set of questions as characteristics for machine learning classification and others into the two depression measures. More information on them is provided in the paper's subsequent sections.

CHAPTER 5
EXPERIMENT RESULT AND DISCUSSION

5.1 Introduction

Any person can experience depression. Low self-esteem and anxiety have been linked to it. Having the impression that you never perform well. You could think that enjoying the moment is impossible or improper. If you don't express these emotions, they will consume you from the inside out. At some point in their lives, about 1 in 5 persons will experience depression. Thus, you are not alone. Sometimes there is no clear cause for depression. However, it's still a good idea to talk to someone you can trust about your thoughts even if you're melancholy for an embarrassment-inducing reason. For instance, if you have experienced abuse or have acted in ways that you know are improper. You can consult a trained counselor if you don't have any close friends or family members you can rely on. Finding early signs of depression and encouraging those who might experience it to see a psychiatrist or consultant was one of the study's key goals. Professionals can also utilize my system to pinpoint the reasons why particular people are depressed. The five algorithms were then utilized to predict depression in Bangladeshi undergraduate university students.

5.2 Experimental Procedure

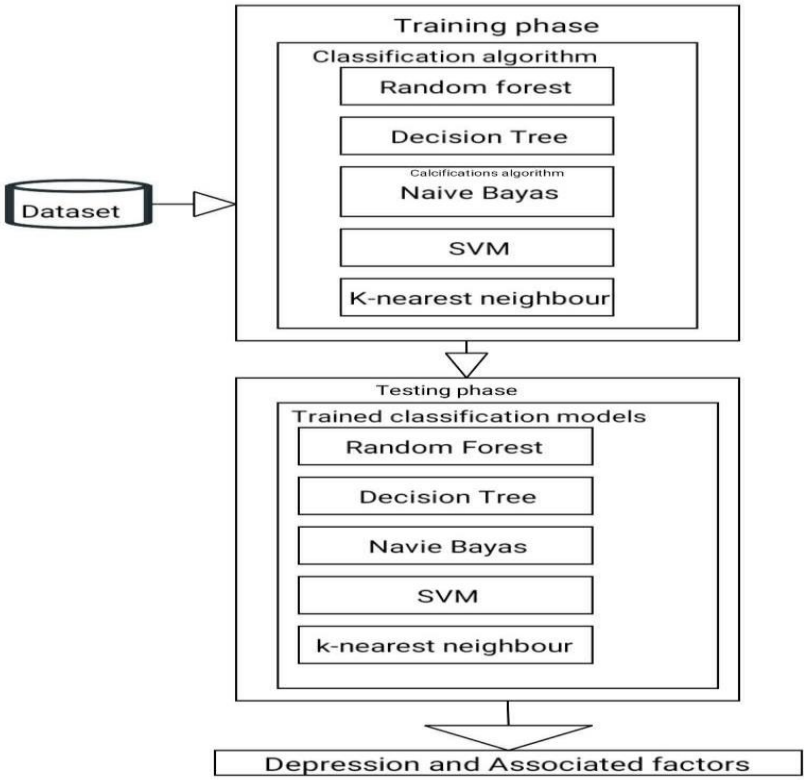

Figure 5.1: Processing of Experimental procedure

In this paper I have used both manually and Google form data that consist of 21 significant features. So, I have done my work with a data mining process and five well known machine learning algorithms. I thought that it is possible to apply algorithms for the purpose of depression and associated facts. [37] In my research work, first of all I have divided my work stage in some steps. I have collected a dataset based on some questions related to symptoms of depression. Then select the algorithms and observe the performances of the algorithms and find out which one is better. Again, I used recursive feature elimination with cross validation and random forest classification to find out the optimal features that show that some features in our data set are co-related and we can omit those features for our prediction system [25].

5.3 Experimental Analysis

For better accuracy I used a classifier in Python. I used five different recent popular algorithms to get the best algorithm with the best accuracy. I tested my data for precision, recall and F-measure because the classification accuracy is not enough for performance measurement. Precision, Recall and F1 Score is also significant.

Accuracy: Accuracy is that which is used to measure how much a classifier correctly classifies the test set. Machine learning algorithms work as classifiers. So, their performance level depends on their accuracy level. The formula that is given to the classifier,

$$\text{Accuracy} = (TP + T\,N)/ (P + N) \qquad 1$$

Precision: Precision refers to the percentage of correct positive features. The formula is:

$$\text{Precision} = (TP/ (TP + FP)) \qquad 2$$

Recall: Recall is that which is converted in percentage and it measures which are actually positive features. The formula is:

$$\text{Recall} = (TP/ (TP + F\,N) = TP/P \qquad 3$$

F1 Score: The F1 Score is the 2*((precision*recall) / (precision + recall)). It is additionally referred to as the F Score or the F live. Place in our own way, the F1 score conveys the balance between preciseness and recall. The Formula is:

$$\text{F1 Score} = 2*((\text{Precision}*\text{Recall}) / (\text{Precision} + \text{Recall})) \qquad 4$$

The following couple of tables will show the results of Precision, Recall and F1 Score of different algorithms.

Table 5.1: Results for Random Forest Algorithm

Techniques/method	CA	Precision	Recall	F1-Score
Random Forest	93%	91%	97%	94%
		98%	93%	96%

Table 5.2: Results for Decision tree

Techniques/method	CA	Precision	Recall	F1-Score
Decision Tree	95%	85%	99%	93%
		99%	91%	95%

Table 5.3: Results for KNN Algorithm

Techniques/method	CA	Precision	Recall	F1-Score
K-Nearest Neighbors(KNN)	89%	82%	95%	88%
		96%	86%	90%

Table 5.4: Results for Support Vector Machine Algorithm

Techniques/method	CA	Precision	Recall	F1-Score
Support Vector Machine	94%	91%	96%	95%
		96%	93%	96%

Table 5.5: Results for Naive Bayes Algorithm

Techniques/method	CA	Precision	Recall	F1-Score
Naive Bayes	90%	96%	76%	87%
		86%	96%	92%

Above all tables the third row represents the weighted worth. Based on our accuracy the support vacation machine algorithm has the highest accuracy but also its F1 Score and Recall and Precision is greater than any other selected algorithm. So, we can say by our algorithm test that Random Forest is the algorithm with highest accuracy 95%.

5.4 Conclusion

Depression is a prevalent condition that leads to pain, functional impairment, an elevated suicide risk, higher medical expenses, and decreased productivity. Both when depression develops on its own and when it co-occurs with other general medical conditions, there are effective therapies available. Another hereditary issue is depression. Students who have depressed symptoms may therefore also inherit this issue from their parents. Another factor that may contribute to students' psychological issues is cyberbullying. Depression that goes untreated can lead to emotional, behavioral, and health issues that have an impact on every aspect of your teen's life. Academicals results and relationship are two possible complications of teen depression. Chronic illnesses and depression frequently co-occur. [35] [36]

CHAPTER 6
CRITICAL APPRAISAL

6.1 Introduction

How you see your circumstances is a significant factor in depression. You run the risk of having an overly self-centered thought pattern if you are prone to depression. Self-pity is a common emotion in a depressed individual. The path to depression is paved when difficult circumstances give rise to rage, irritation, and self-pity. Not everyone can overcome depression by themselves. This frequently necessitates the assistance of family members or a specialist. Depression is neither a personality flaw, a mental illness, nor a downturn in emotions. Sometimes it's caused by past errors or severe emotional wounds. Then, it is frequently necessary to seek professional assistance and occasionally, medications to recover from depression. However, doing so may result in merely treating the symptoms rather than getting to the root of the issue. You must look for the reason why you are here in order to truly understand the situation.

6.2 Impact on Society

The use of a machine learning model for depression identification will benefit society. People must participate in all social activities since they are social beings and must live in society. Walking together gets difficult because of depression. Anyone can experience depression at any time. I have seen from the discussion above that people experience depression when they have problems falling asleep, when they become angry, when they lose energy, when they lose their appetite, and when they are unable to cope with stress. The aforementioned factors are widespread social issues that might lead to an individual experiencing increasingly challenging mental health issues. Numerous people in our nation have killed themselves, which is terrible for our nation and community. With our model, I have made an effort to improve the nation's and society's situation. Everyone in the family ought to look out for one another. Parents should look out for their children's needs and monitor their actions. Children ought to be expected to get along with and assist their parents in their employment. I'll be able to use some crucial data from our model to confirm your current mental condition if you ever feel mentally ill. I can make the appropriate decisions at the

appropriate times in this way, returning our lives to normal. Many members of our society are currently dealing with depression, I believe that our methodology will help those people's mental health because of this. According to the findings, there are a number of contributing variables that make private university students more prone than students at public institutions to experience melancholy, anxiety, and stress. In comparison to male students, female students at both public and private institutions are more likely to experience severe or extremely high levels of depression.

6.3 Impact on Environment

The purpose of the study was to examine the prevalence of stress, anxiety, and depression among Bangladeshi students, as well as the associated risk factors. People that are depressed want to avoid conversation. They feel solitary. The relationship with everyone suffers as a result. People feel poisonous. There is less communication with everyone. The ecology and society both suffer from it.

6.4 Ethical Aspects

This depression detection model does not infringe human rights in any manner and is not immoral. The model does not gather any identifiable information about you. This concept contributes significantly to making a decision, rather than undermining someone's right to use or enjoy. Being alert. There are no issues with managing the depression detection model.

6.5 Sustainability Plan

The property gives us practical suggestions for each endeavor and our future goals. Our model's goal is to determine the likelihood of depression. It is important to be aware of this concept so that individuals can quickly adapt. Additionally, it's crucial to make sure that people understand their positions before applying this paradigm. This paradigm can help psychologists, psychiatrists, and mental health organizations complete their tasks more quickly.

6.6 Conclusion

My research result in a machine learning algorithmic program that serves as a way for detecting depression. There are certain restrictions and defects in my work and models. Although I just used a small portion of the dataset, it would be better to use it divided into many layers. They were unable to gather data on several groups of people as a result of specific restrictions. The dataset is also not that big. A range of highly developed, cutting-edge methods and models can be employed for data processing and preprocessing, and the model or system can then be beautifully displayed utilizing a variety of cutting-edge and well-liked algorithms. With the aid of our given model, it is undoubtedly possible to recognize the depressive state. When this model is finished, I firmly believe that people will be able to use it more readily and comprehend its significance and worth in ensuring emotional state. They are hopeful and confident that this model will accurately portray depression, causing people to become aware of their illness and make.

CHAPTER 7

CONCLUSION

7.1: Conclusion

In the current study, depression was a common occurrence among university students. The most severe forms of depression can diminish quality of life, lead to loss of self-control, disrupted learning, and social interaction, all of which can lead to decreased productivity, subpar academic performance, and even harmful attempts. Government and nongovernmental organizations should design strategies for preventing and managing depression, paying special attention to students returning from rural families, those who are stressed out, and those who have trouble sleeping, in order to improve students' academic performance and social interaction with their friends or the surrounding population. Methods could include providing life skill coaching to help people deal with the environmental issues that affect their daily lives. Five methods for classifying data from data mining, including Naive Bayes, Decision Tree, Random Forest, Support Vector Machine (SVM), and K-NN have been applied. It has been found that Decision tree give much accuracy which is better than other classifiers with 95%.

Due to several contributing factors such family structure, academic performance, and habit of engaging in sports and physical activities, students attending private institutions are more likely than those attending public universities to experience melancholy, anxiety, and stress. Comparing male and female students, it is more common for female students at both public and private institutions to have severe or extremely high levels of anxiety. According to the findings, there are a number of contributing factors that make private university students more prone than students at public institutions to experience melancholy, anxiety, and stress. In comparison to male students, female students at both public and private institutions are more likely to experience severe or extremely high levels of anxiety. In my study, I developed a machine learning algorithm for depression identification. There are certain restrictions and defects in my work and models. The dataset I used had a pretty low level; it might be better to use one with more levels. I'm unable to get data on various groups of people due to specific restrictions. The dataset is also not that big. A range of highly developed, cutting-edge methods and models can be employed for data processing

and preprocessing, and the model or system can then be beautifully displayed utilizing a variety of cutting-edge and well-liked algorithms.

The risk factors for depression, anxiety, and stress vary in certain ways. Due to the high frequency of mental diseases among university students in Bangladesh, the government should establish an efficient support system, including counseling centers, campaigns to encourage seeking treatment, and policies to lessen stigma on college campuses. In Bangladesh, mental diseases are very common among university students. The university administration should create a strong support network by establishing counseling centers, promoting asking for help, and taking steps to lessen stigma on campuses.

7.2 Further Suggested Work

Modern technology, data science, and artificial intelligence have recently sped up, simplified, and improved every aspect of human life. In the future, I intend to develop our concept as a web or Android application. I'll work to improve our models' accuracy in the future. I'll build a bigger database with a ton of data about people and add more classification layers to the datasets. Additionally, the website or mobile application created for the model can be made available to everyone, including doctors, by providing an immersive user-friendly GUI. The model can be made far more effective and practical by implementing new algorithms, adding new parameters, and adding additional features. A powerful dataset can be produced by gathering data from more diverse classes of people in the future according to their location, age, and activities. Additionally, the Department of Mental Health can aid in expanding the. On the populations of overseas students in Bangladesh, more research should be done with larger samples and more diverse populations. Other influencing factors for depression, such as prior bouts or family history of depression, were not taken into consideration.

Therefore, it is challenging to identify what secondary factors, if any, were involved in the occurrence of self-reported depression symptoms. Assessments of depressive symptoms before, during, and after school may be included in later studies. This study has several restrictions. First off, because of the cross-sectional nature of the current study, it is impossible to draw conclusions about the causes of stress, anxiety, and depression from this information alone. The study was additionally restricted by the convenience sampling method's very small sample size. As a result,

since the data were gathered from just one university, no generalizations can be made to students who reside outside of Dhaka or Bangladesh in general. The current study needs to be reproduced using additional, larger, and more representative samples from both inside and outside of Bangladesh.

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Depression

ORIGINALITY REPORT

3%	%	%	3%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to Griffith College Dublin Student Paper	<1%
2	Submitted to University College Birmingham Student Paper	<1%
3	Submitted to Asia Pacific Instutute of Information Technology Student Paper	<1%
4	Submitted to Liverpool John Moores University Student Paper	<1%
5	Submitted to Arab Academy for Science, Technology & Maritime Transport CAIRO Student Paper	<1%
6	Submitted to University of Witwatersrand Student Paper	<1%
7	Submitted to University of Bedfordshire Student Paper	<1%
8	Submitted to Jordan University of Science & Technology Student Paper	<1%