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MENTAL STRESS ANALYSIS OF BANGLADESHI JOB HOLDERS DURING
COVID-19 PANDEMIC: A MACHINE LEARNING APPROACH.

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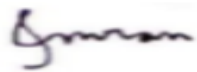
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This Report Presented in Fulfillment of the Requirements for the Degree of
Bachelor of Science in Software Engineering

Approval

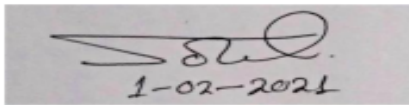
This thesis title on “MENTAL STRESS ANALYSIS OF BANGLADESHI JOB HOLDERS DURING COVID-19 PANDEMIC: A MACHINE LEARNING APPROACH”, submitted by Majharul Islam, (171-35-1846) to the Department of Software Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of Bachelor of Science in Software Engineering and approval as to its style and contents.

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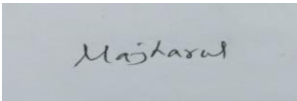


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THESIS DECLARATION

This is Majharul Islam, an undergraduate student from department of software Engineering, Daffodil International University, Dhaka, Bangladesh; do hereby declare that I have duly worked on my thesis paper entitled "Mental stress analysis of Bangladeshi job holders during covid-19 pandemic: A Machine Learning Approach" under the supervisor of Md. Shohel Arman, Senior Lecturer, Department of Software Engineering, Daffodil International University. I therefore state that I have not submitted this work to any other University or Institute for any other degree.



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ABSTRACT

In twenty first century, due to covid-19 pandemic the job sector has been absolutely shifted. Before starting and joining the job environment, company's authorities should ensure job holders are psychologically qualified and suitable or not. To keep maintaining physical distance and protect themselves from the pandemic somebody job holders are working from home and someone are working from office. We spend two-thirds time of the day at office zones. The work is our main hope. Life, live hold, property, fame money all depend on the workplace. Stress is a problem from which it is difficult to get rid of quickly! For various reasons, many of us spend most of the day under stress which also affects our body. Stress can lead to hypertension, insomnia, digestive problems and even nerve problems. So to stay healthy, we must first eliminate anxiety or stress. We got motivation and find out mental stress during Corona-virus. The aim of the of the research paper to help and provide information to job firm authorities, so that they can proper care to reduce mental stress during epidemic based on predicting result us. We used Logistic Regression, K-Nearest Neighbors (KNN), Naïve Bayes and Decision Tree machine learning algorithms. This research paper achieved accuracy almost 80% in Logistic Regression.

Keywords: Machine learning, supervised algorithm, Covid-19, Bangladeshi job field, Psychological stress.

TABLE OF CONTENTS

Approval.....	i
THESIS DECLARATION	ii
ACKNOWLEDGEMENT	iii
ABSTRACT	iv
LIST OF FIGURES	vi
LIST OF TABLES	vi
CHAPTER 1	1
INTRODUCTION	1
CHAPTER 2	3
LITERATURE REVIEW	3
CHAPTER 3	10
RESEARCH METHODOLOGY	10
3.1 DATA COLLECTION	12
3.2 DATA PRE-PROCESSING.....	12
3.3. CLASSIFICATION RULES BASED MACHINE LEARNING ALGORITHMS	12
CHAPTER 4	16
RESULT ANALYSIS AND DATASET DISCUSSION.....	16
4.1 DATASET DISCUSSION	16
4.2 RESULT ANALYSIS.....	16
CHAPTER 5	19
CONCLUSIONS AND RECOMMEDATIONS	19
5.1 FINDING AND CONTRIBUTIONS	19
5.2 LIMITATION	20
5.3 RECOMMENDATIONS FOR FUTURE WORK	20
REFERENCES	20

LIST OF FIGURES

Figure 1: Research Methodology Diagram	11
Figure 2: Classifier Accuracy Graph.....	16
Figure 3: Work Type of Bangladeshi Job Holders.....	17
Figure 4: Mental Treatment of Job Holders	17
Figure 5: Family History	18

LIST OF TABLES

Table 1: Literature Review	9
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CHAPTER 1

INTRODUCTION

According to the World Health Organization (WHO), 450 million people in the world suffer from mental health issues including in Bangladesh [13]. COVID-19 outbreaks have changed the whole world's work format including the life cycle. Especially in Bangladesh, those who work in the house every time they feel more sadness. Someone cannot work properly with high expectation. Is forced to work due to the situation [14]. Those who work in office feel more peace of mind better than who are work stay at home. There is a stress of sitting at home for a long time such as: short sleeping, depressed, lack of concentration, demotivated, threat in financial issue and short tempered. Those who are accustomed to working in the office every day, sitting day after day will create a kind of frustration for these energetic people. From that frustration will gradually come anger and depression [1]. The US Centers for Disease Control and Prevention (CDC) has already stated on its website that long-term home quarantines for coronary heart disease include confusion, anger, depression, and PTSD (Post Traumatic Stress Disorder). Many people's work, studies and various decisions in life are being hampered.

Many students could not finish their examinations, so many may fall behind in the job examinations. Many wedding ceremonies have had to be canceled, which will have multifaceted family, social reactions. Many businesses are going to suffer, people working on a daily basis are in a state of great uncertainty. People returning from exile do not know what future awaits them in the country or abroad. There is a lot of information being exchanged on social media and in conversations, some of which are right, some of which are wrong. It is very difficult to separate this 'miss-information' from the correct information. As a result, people are divided into different groups, blaming each other. As soon as Facebook is opened, one group is angry with the expatriates, another group is talking about the civil rights of the expatriates, a group

doctors are being abused, many are making conspiracy theories. All in all, an atmosphere of extreme disbelief has been created, in which it is difficult to keep one's own judgment. Day after day, in this uncertainty, a fog is created in people's minds. Losing all enthusiasm for the outside world, he

gradually became detached from reality. In psychology it is called 'Detachment', when the line is blurred between what I am thinking in my head and what is happening around me. Psychological symptoms include forgetfulness due to stress, anger, easily, loss of control over one self, anxiety, loss concentration, loss of relationships with people, depression, loss of motivation, etc. As well as physical illness or symptoms that occur. Now, job holders are assumed that new technology do not able replace mental and naturel socializing [2].

There are words – if you get angry, you lose. There is no point in losing by expressing anger. Emotions are an integral part of our lives. Just as emotions like laughter-joy, love- love color our life in colorful colors, so emotions like sorrow-pain, anger, anxiety, fear- fear fill life with bitterness. As a result of the balanced coexistence of these good or bad emotions, we can realize the meaning of life. But sometimes life gets out of balance due to an excess of one or more emotions. Needless to say, it is not uncommon for the abundance of happiness to interfere with normal human life. If the psychological problems for the employees are not solved, they will face horrible physical problems from mental problems. Those who work from home, their mental state is going from bad to worse day by day. And those who are working in the office are feeling some peace of mind. If this continues, the employees will lose interest in mass work. As a result, the unemployment rate in the country or society will increase. And their families will be trapped in extreme financial problems. This requires solving employee mental problems and emotional improvement. It is a quit difficult to improve the mental state all these employees. Seek remedies for problems by meeting with a psychiatrist or psychologist, especially during corona. It is quite difficult to meet them at this time. Many people do not want to be a psychologist because of family and social taboos. So that no one would look down on him. For this reason, it is very difficult to solve this problem. However, in this case, the employee can seek remedies to solve this problem through telemedicine while maintaining their privacy. British Broadcast Corporation reported, According the to the latest Mental Health Survey 2018-19 or the total population in Bangladesh or 20 million adults from various mental illness. They also said, 6 out of 100 people suffer from depression. In order to fix the psychological aspects of these who work from home during office hours, special service center have to set up in socialist institutions and each of them has to be brought under mental health insurance so that they can get uninterrupted financial benefits.

CHAPTER 2

LITERATURE REVIEW

Author	Year	Paper	Method	Keywords	Findings
William S. Shaw, Chris J. Main, Patricia A. Findley, Alex Collie, Vicki L. Kristman, Douglas P. Gross	2020	Exploring COVID-19 stress and its factor in Bangladesh: A perception based study.	Cluster Analysis, Principal Component Analysis, Pearson's Correlation Matrix.	Psychology, Public Health, Stress Crisis Poverty Mental Health.	About 85.60% of the participants related covid-19 infected and hampering schedule work and study plan. Thing like regular hand washing or adhering to safe social distances should not be taken lightly because of wearing a mask.
Indra Prakash Jha MCA, Raghav, Awasthi M.Sc., Ajit Kumar MBA, Vibhor Kumar Ph.D., Tavpritesh Sethi Ph.D.	2020	learning the mental Health Impact of COVID-19 in the United States with Explainable with Artificial Intelligence.	Statistical analysis followed by Bayesian Network inference.	Covid-19, Bayesian Network, Machine Learning	Finally, Using supervised ML models, we predicted the most mentally vulnerable people with ~80% accuracy. One of the

					<p>limitation of the study is that a mental state of either employees is not highlighted here.</p> <p>Psychological symptoms include forgetfulness due to anger, easily, loss of control Over one self, anxiety, loss concentration loss of relationship with people depression, loss of motivation, etc. As well as physical illness or symptoms that occur. Now job holders, are assumed that new technology do not able replace mental and naturel socializing.</p>
William S. Shaw Chris J. Main, Patricia A. Findle Y, Alex Collie Vicki L.	2020	Opening the workplace after Covid-19: What lessons can be Learned	Traditional research such surveys and questionnaires.	COVID-19, Workplace, Jobholders, Public Health.	There is a complexity of multilevel factors that will influence whether

Kristman, Doughs P. Gross.		from to work research.			individual workers will workplace safety risks, trust organization all measures and co-workers, modify work habits, return to shared working space and resume productivity.
Xingzi, Zn, Stepen X. Zyhang, Asghar Afshar, Jishen, Li, Afshana Bagheri, Khaled Nawser Thomas, D.Ranjani	2020	The mental Health of Healthcare Staff during the COVID-19 pandemic: It depends on how much they work and their age.	The survey assessed Staff's distress, depression and anxiety in the COVID-19 pandemic.	Healthcare staff, Mental health, Working days, Age, COVID-19, Pandemic,Iran	Technicians and obstetrics experienced less anxiety. Analysis of interaction between weekly working days and age of the staff indicated the chance of experiencing distress and depression varied greatly by working days among younger but not older healthcare staff.
Calos- Maria, alcover, Sergio, Salgado, Gabriela Nazar, Raul	2020	Job insecurity, financial threats and mental health in the Covid-19 context: the	Here all the information has been taken through questionnaires survey. Data	Road Financial Situation, Mental Health aspects COVID-19.	Thus, in relation to job insecurity and financial threats, the association of

Ramirez-Vielma, Carolina Gonzale Suhr.		buffer role of perceived social support.	analyze, using the confirmatory factor analysis (CFA) through JASP software version 0.11.1		both with the decline in perceived mental health. Authors describe the financial threat, the overall, mental health condition of the employees due to the lockdown by the government during the corona period.
Andrew Stickly, Tetusya Matsubayashi, Hajmi Suki, Michiko Ueda	2020	COVID-129 preventive behaviors among the people with anxiety and depression: Findings from Japan.	Two round of online survey based research.	Anxiety, depression, COVID-19, Health behaviors.	The prevalence of anxiety was 80.9%, while 77.3% of the respondents had depressive symptoms for anxiety.
Kangking Song, Rui Xu. Terry D. Stratton, Yang jiang.	2020	Sex differences and psychological stress: Responses of covid epidemic in china.	Traditional research such as survey and questionnaires.	COVID-19, Psychological, sex differences, Psychological resilience	The average psychological resilience score 88.6. the World is already in a state of panic. Many are worried about sex in corona panic. Experts Claimed that sperm do not spread the

					corona virus. But recently corona is terrified of having sex. Chinese experts have already claimed that covid-19 was found the several corona positive people.
Kustov Saha, Jhon Torous, Munnum De Chowdhury	2020	Social media reveals psychological effect of the COVID-19 pandemic.	Based on Twitter Streaming post using PCR	Covid-19, social media, people expression, Public Heath	In this paper, almost 80% people addicted in social media regarding information during covid-19 pandemic. This thing has been mentioned in the paper.
Faheem Aslam, Tanveer Mumtaz Awan, Jabir Hussain Sayed, Aisha Kashif & Mahwish Parveen.	2020	Sentiments and emotions evoked by news headline of coronavirus disease outbreaks.	Traditional research such as surveys and questionnaires.	Sentiments newspapers, covid-19	In this papers, the authors discussed what kind of corona is reported by the news media during the corona period and how it is affects people's emotions and feelings. Researchers found that 52% of the news reported negative news,

					30% vpositive and 18% neutral news. Especially those who spread negative news put patient and their relative at risk
Felpie B. Schuch, Rugero A. Bulzing, Jacob Meyer, Guillermo F. Lopez-Sanchez	2020	Moderate to vigorous psychological activity and sedentary behavior change in self isolating adults during the covid=19 pandemic in Brazil.	Here datasets are collected through social medium survey and data analyzed using mean and standard deviation and confidence interval.	Public Health, Covid-19, Mental Behavior.	Due this time people feel alone, health and is in the motion are detreated day by day. Where people cannot travel during this epidemic. As a result he has been living in lonely room all day. This seems like a day to a week.
Tony Liua, Jonah Meyerhoff B, David C. Mohrb, Lyle H. Ungara, Konrad P. Kordinc	2020	COVID-19 pandemic: everyday feels like a weekday to most	Traditional research such as surveys and questionnaires	Pandemic, Mental Tension, Phycology	The COVID-19 outbreaks has clear clinical1 and economic 2 impacts, but also affects behaviors e.g. through social sistance3, and many increase stress and anxiety.

<p>Feifei Bu, Andrew Steptoe, Hei Wan Mak, Daisy Fancourt</p>	<p>2020</p>	<p>Time used and mental health during the COVID-19 pandemic: a panel analysis of 55204 adults followed across 11 weeks the UK.</p>	<p>Here datasets were analyzed applying fixed effect and Arellano-Band models</p>	<p>Time use, depression, anxiety, life satisfaction, COVID-19</p>	<p>This thesis paper, the authors have mentioned that during the epidemic, Japanese people have been asked to take various awareness steps to live from mental unrest. Two rounds of online survey based research. Here Japanese company has conducted the survey through set of questions and data analyze with STATA software.</p>
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Table 1: Literature Review

CHAPTER 3

RESEARCH METHODOLOGY

We developed this model applying different types of dynamic machine learning algorithm namely: Decision Tree, K-Nearest Neighbors (KNN), Naïve Bayes and Logistic Regression. Machine learning algorithms applied based on mental health consequence of these features such as: age, gender, self-employed, family history, treatment, work type, leave, coworkers, supervisor, mental health vs physical health and objective sequence. In this research paper, we predicted the mental stress that who are working from office and home.

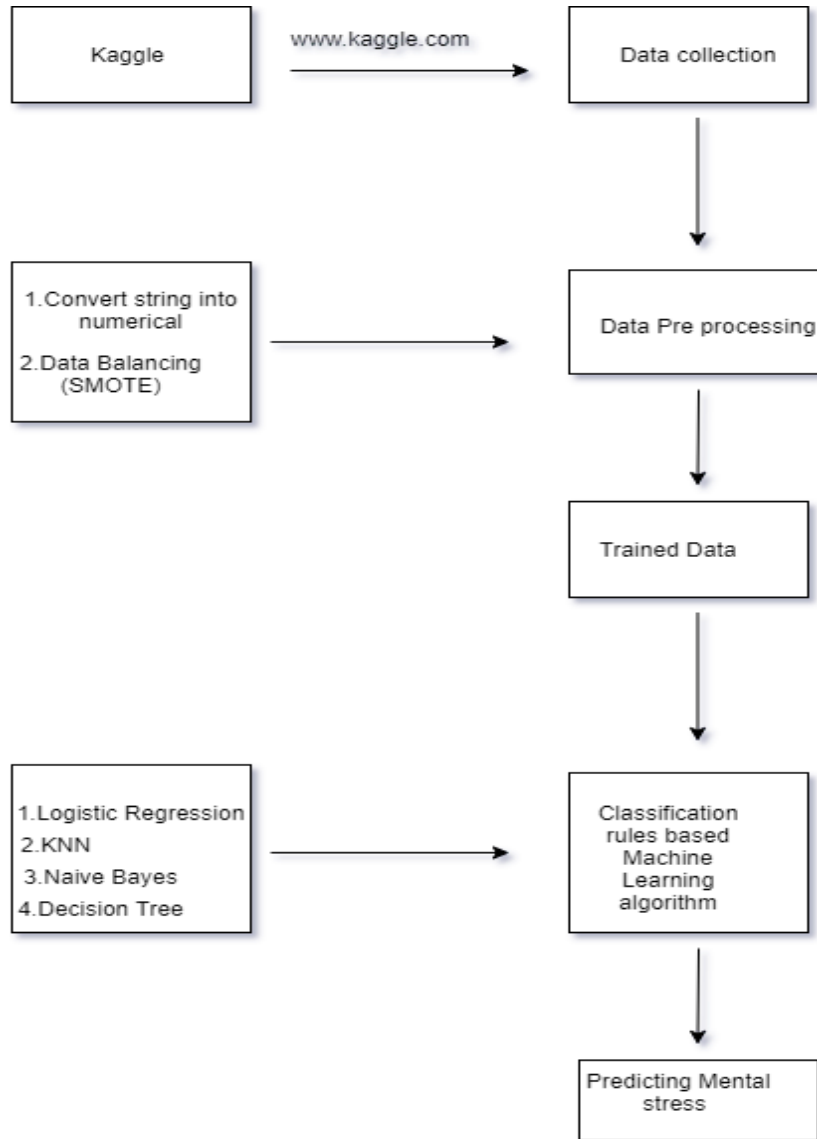


Figure 1: Research Methodology Diagram

3.1 DATA COLLECTION

Large dataset helps the author to derive research properly to get maximum outcome. For highest and authentic accuracy in any research paper more datasets are highly essential. The author of the research paper has collected large dataset from www.kaggle.com, that's one of the most popular machine learning based datasets storage. Here, we collected 1259 participant's dataset based on 12 questions. All of participant's have provided their data from December, 2019 to October, 2020.

Link of the dataset: https://drive.google.com/file/d/1-2hw_jLtvSGCmKWpRDETrn7dPNpoyoTY/view?usp=drivesdk

3.2 DATA PRE-PROCESSING

Datasets preparation is quite smooth. We converted datasets in CSV Files, then removed the unnecessary columns from this dataset. Initially dataset had imbalance. The author balanced the dataset using oversampling technique "Smote". This is to balance datasets and we convert the datasets from string to numerical. Here our main features such as: age, gender, family history, self-employed, treatment, work type, leave, mental health consequence, coworkers, supervisor, mental vs physical. It is quite tough and challenging to ensure hundred percent accuracy of mental illness based on mental health consequence applying different types of algorithms to get precious outcome of who are working at office or outside of the office. We got predicted outcome almost 80% using classifier algorithm based on these features such as: gender, self-employed, family history, treatment, work type, leave, coworkers, supervisor, mental health, mental health vs physical health and objective sequence.

3.3. CLASSIFICATION RULES BASED MACHINE LEARNING ALGORITHMS

3.3.1 DECISION TREE

In computer science, Decision tree learning refers to the decision about the target value by observing an item using the Decision tree model. It is a predictive modeling method applied in Statistics, Data mining and Machine learning. In this model, where the target variables are taken in a set of discrete

values., it is called classification trees. In this tree structure the node expresses the class labels and the branches convey the properties of the conjunctions that manage their class labels. In the tree model, where the target variable can have a continuous value, it is called regression tree. In de4cuosmn tree analysis, the decision tree clearly implements in decision making. In datamining, Decision tree used describe the data.

Here, Entropy using then frequency table of the attributes

$$E(S) = \sum_{i=1}^c -p_i \log_2 p_i$$

Here P_i is the possibility of any target variable

3.3.2 K-NEAREST NEIGHBOR (KNN)

K-Nearest Neighbor (KNN) is a supervised learning algorithm. The value of k is basically the number of around the data that we want to classify. Find the distance of all the remaining data points from unknown data points. Depending on the value of the distance, the data points need to be sorted from ascending to descending order. The first K number of the points must be taken from the sorted data points. Out of these k number of data points. The class with the most number of the points must be identified unknown data points in that class. For this research paper, we applied and implemented the Euclidean distance formula to find out the distance. Euclidean distance is calculated by,

$$(x, x') = \sqrt{(x_1 - x'_1)^2 + (x_2 - x'_2)^2 + \dots + (x_n - x'_n)^2}$$

3.3.3 NAÏVE BAYES

Naive Bayes is a classification that predicts the future by relying on conjecture and probability. In general, the case of conditional probability, we find out what the probability of the next event is in relation to what happened in the previous corner. For example, if it has rained, what is the probability of mud water on the road, or if has cancer, what is the probability of his/her death. However, the base theorem, the opposite possibility of found. We have to find out the probability of an event on the previous corner.

Naïve Bayes functions on

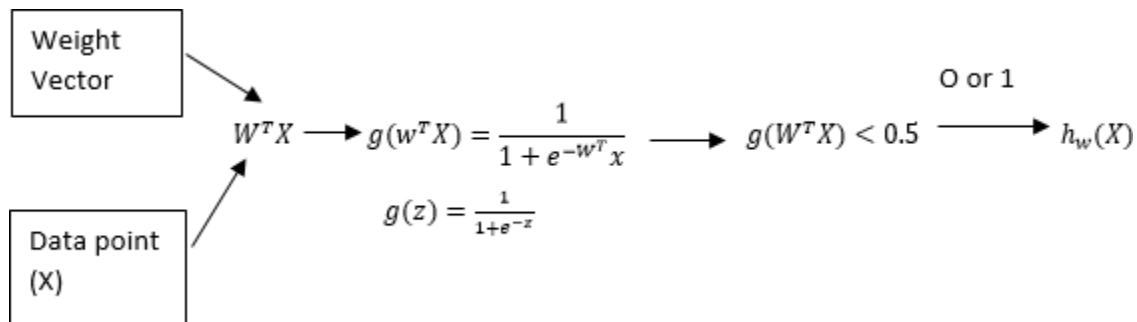
$$\text{posterior probability, } P(a|b) = \frac{P(b|a) * P(a)}{P(b)}$$

Here the probability of “a” being true given that “b” is true.

3.3.4 LOGISTIC REGRESSION

Our goal on logistic regression will be to keep the output from the hypothesis within 0 and

1. If the output is less than 0.5, then the last output of our logistic regression will be 0, and if it is equal to or greater than 0.5, then the last output of Logistic regression will be 1. The reasoning behind keeping its value from 0 to 1 is that it basically gives the value of probability of output. Here is another feature of Logistic regression. Logistic regression only if our data is taken to higher dimension and it becomes Linearly separable. Here the Logistic Regression equations: - $g(W^T X)$ = Sigmoid Function and $g(z)$ = Sigmoid/ Logistic Function.



CHAPTER 4

RESULT ANALYSIS AND DATASET DISCUSSION

4.1 DATASET DISCUSSION

Our model achieved accuracy almost 80% using Logistics Regression classifier based on predicting work type of job holders. By applied and implement we found that four model works so enough on predicting the work type of the datasets. We found that who are working from home during covid-19 pandemic, their mental condition more vulnerable. Because, they are stay at home majority time and do not move here and there.

4.2 RESULT ANALYSIS

In this research paper, we applied four supervised machine learning algorithm such logistic regression, K-nearest Neighbor (KNN), Naïve Base (Bernoulli) and Decision Tree. Among algorithm we got highest accuracy in Logistic regression.

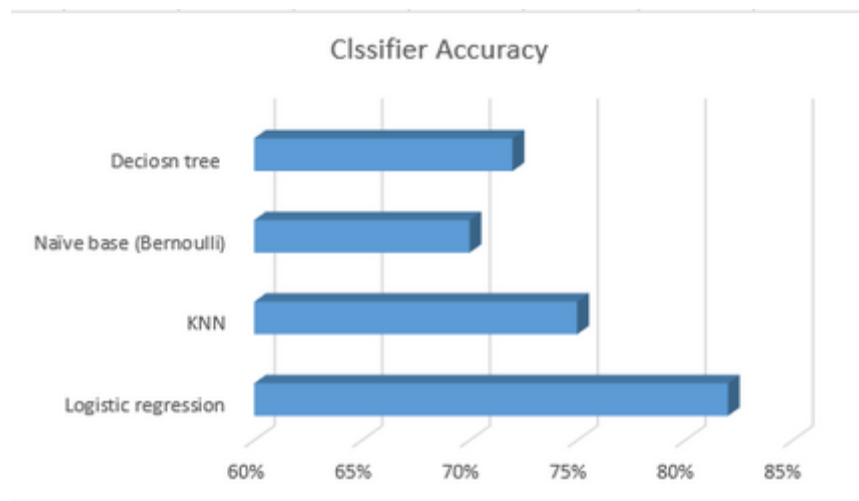


Figure 2: Classifier Accuracy Graph



Figure 3: Work Type of Bangladeshi Job Holders.

We found that work in office 70% and work in home 30% job holders provide data in this datasets and who are working from home their mental situation is more vulnerable better that who are working from office during covid-19 pandemic.

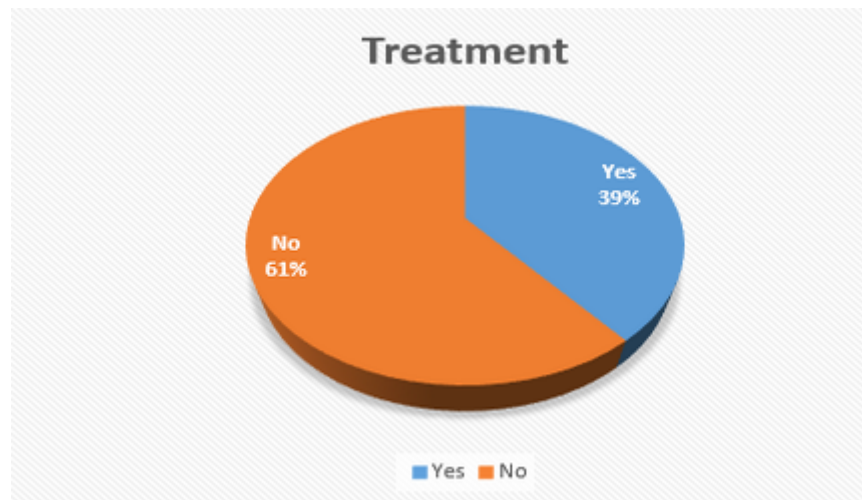


Figure 4: Mental Treatment of Job Holders.

We also found that 39% job holders still didn't take medical treatment against mental stress and 69% taken mental treatment during corona virus.

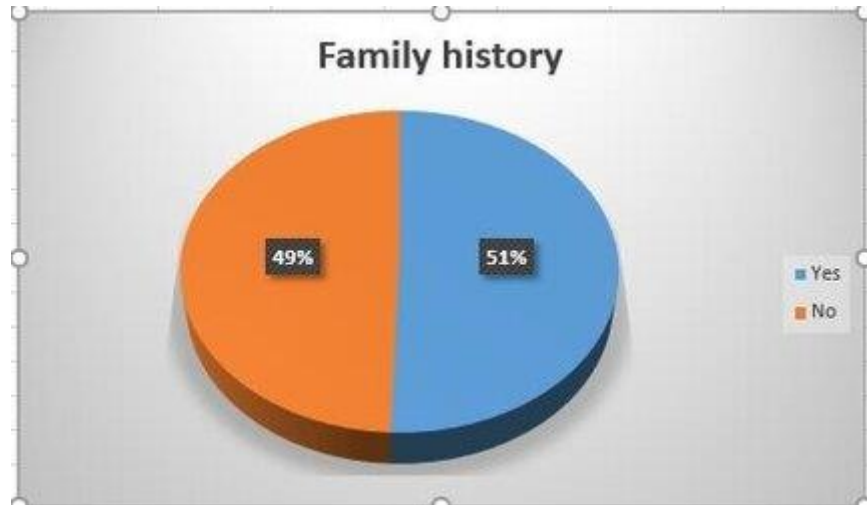


Figure 5: Family History

Here, we detected that 49% job holders carry mental illness inherently 51% fallen downmental illness during covid-19 epidemic.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 FINDING AND CONTRIBUTIONS

Nowadays, Mental stress is considered a challenging issue around the world during pandemic. Particularly it's hamper the normal activity of job holders. Each of jobholders have to disaster at some point in our carrier or personal life. Many times, when have to challenges, we have to suffer from mental exhaustion and depression. The question of mental illness comes to the fore when we see when our normal functions being disrupted. It turns out that we are not as conscious about mental health as we are about physical health. But poor mental health can have a divesting effect on physical health. Because physical and mental health are inextricably linked. Those who work with mental health in Bangladesh say that due to some ingrained social stereotypes, many people still do not want to seek professional medical attention for mental health problem. According to the latest mental health survey 2018-19, 16% of the total population in Bangladesh or 20 million adults suffer from various types of mental illness [15]. And 6 out of 100 people suffer from depression. Surprisingly, 92% of them are out of treatment. Based on Machine Learning algorithm if the Bangladeshi job authorities can take a proper step to eradicate mental illness during covid-19 pandemic that will be great decision and assist job holders to mitigate their problem.

Mainly this research paper will help job authorities and job holders that which types of measurement can to convey during any type of pandemic. In future, we will apply more classifiers algorithm to predict and ensure that what kind of psychological change can to come in Bangladeshi people during epidemic that will be more effective.

5.2 LIMITATION

Unbalancing dataset had quite challenging for the author of the research papers. World Health Organization (WHO) encourage the job holders to take break during work. So it was quite difficult balance dataset to get highest accuracy.

5.3 RECOMMENDATIONS FOR FUTURE WORK

In future work, we can to more features that related mental stress. We will apply more algorithm to get better accuracy. So that all job holder's and job firms can to take proper steps to minimize and arrange treatment for job holders.

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