PREDICTING MENTAL HEALTH DISORDER ON TWITTER USING MACHINE LEARNING TECHNIQUES

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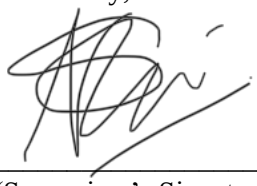

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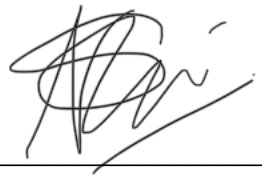

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Thesis submitted in fulfillment of the requirements
for the award of the degree of
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ABSTRAK

Media sosial memberi tempat kepada golongan muda untuk menyuarakan kesukaran mereka dan bertukar pendapat tentang peristiwa semasa dalam era digital. Oleh itu, adalah mungkin untuk menganalisis tingkah laku manusia menggunakan media internet. Walau bagaimanapun, penyakit gangguan mental adalah perkara biasa tetapi sering diabaikan. Media sosial memungkinkan untuk mengenal pasti gangguan kesihatan mental dalam populasi yang besar. Banyak usaha telah dibuat untuk menilai penyiaran individu menggunakan teknik pembelajaran mesin untuk mengenal pasti orang yang mempunyai masalah kesihatan mental di media sosial. Kajian ini cuba meramalkan gangguan kesihatan mental di kalangan pengguna Twitter menggunakan teknik pembelajaran mesin. Support Vector Machine (SVM), Decision Tree dan Na ïve Bayes ialah tiga contoh pendekatan pembelajaran mesin yang digunakan dalam kajian ini. Untuk menilai algoritma, prestasi dan ketepatan ketiga-tiga algoritma ini dibandingkan.

ABSTRACT

Social media gives young people a place to voice their difficulties and trade opinions on current events in the digital era. Therefore, it is possible to analyze human behaviour using internet media. However, the illness of mental disorder is common yet often ignored. Social media makes it possible to identify mental health disorders in large populations. Many efforts have been made to evaluate individual postings using machine-learning techniques to identify people with mental health conditions on social media. This study attempted to predict mental health disorders among Twitter users using machine learning techniques. Support Vector Machine (SVM), Decision Tree, and Nave Bayes are three examples of machine learning approaches applied in this study. To assess the algorithms, the performance and accuracy of these three algorithms are compared.

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LIST OF ABBREVIATIONS

SVM	Support Vector Machine
DT	Decision Tree
NB	Naïve Bayes

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Social networks have altered how people communicate their thoughts and points of view. This change is made available through written publications, internet discussion boards, product review websites, etc. This user-generated content is significantly relied upon by people. Social networks provide a sizable volume of user-generated content, which is crucial for research. They also offer additional services tailored to users' demands (Birjali et al., 2017). The most widely used source of information for user opinions and feelings expressed on this platform is Twitter, which can be retrieved and examined. Social networking sites are altering people's lives and why they communicate or connect with the rest of the world. According to recent studies, many people use social networking sites like Facebook and Twitter for various activities, including finding and sharing information, making new friends, joining existing ones, and simply having (Faryal et al., 2021).

More research is being done on social media and mental health, connecting social media use and behaviour with stress, anxiety, depression, suicidality, and other mental diseases (Guntuku et al., 2017). The majority of this study is focused on mental illness. Being balanced inside oneself explains why mental health is a critical and fundamental component of total health. Additionally, the ability to form and maintain emotional attachments with other people, engage in social activities and cultural obligations, and recognise and accept emotions and sentiments like happiness or sadness are all indications of a person's mental health. It is referred to as mental illness when this essential functioning is absent. Numerous social, biological, and psychological factors

can impact mental illness, just like they do mental wellness. According to experts, internal issues ranging from a lack of emotional resilience to low social standing and solitude make mental health susceptible. Mental health may be defined more simply as a person's thinking about themselves and their lives. It is essential not to ignore one's mental health because of its vital role in maintaining one's health (Suvarna, n.d.).

Sentiment analysis will be used in this study to identify people with mental health disorders by focusing entirely on tweets on such conditions on Twitter. Text mining, machine learning (ML), and natural language processing are all used in sentiment analysis (NLP). The goal is to extract sentiment and private information from the text. Additionally, it aids in concluding disorganised and poorly structured content. Finding patterns in large amounts of textual data is a technique called text mining. NLP processes the underlying metadata, whereas text mining processes the text itself. Machine learning will forecast the future based on historical data. Computers can now learn without explicit programming thanks to machine learning (ML). It tries to create updated computer programmes in response to new information. The processes of teaching and forecasting prohibit the usage of specific algorithms. Instead, an algorithm is fed the training set of data, and that algorithm uses that data to make predictions about a fresh collection of test data (Saxena, 2022). Python's Natural Language Toolkit (NLTK) will be used for this study. Since there are numerous terms in a tweet, and it is hard to read every tweet and identify the ones individually connected to a mental health issue, dealing with a wide variety of data sources is challenging. Therefore, it is vital to employ the keywords technique to crawl mental health disorder tweets to ascertain which textual information is significant in the study's planned sentiment approach to detecting mental health condition tweets based on the Twitter dataset.

1.2 PROBLEM STATEMENTS

A mental ailment that impairs cognition, emotion control and behaviour is a mental disorder. Effects of various mental diseases range from the severe rejection of social interaction to constant sorrow. Patients may display different symptoms, including an accelerated heart rate, nausea, panic attacks, alexithymia, sleeping problems, and suicidal thoughts. Social media give users a place to express their emotions. Social media's high levels of accessibility and anonymity allow users to freely express their feelings and researchers to keep tabs on individuals with mental illnesses (Qiao, 2020). However, it is hard to recognize social network mental health disorders because online social activity logs cannot be used to assess mental health conditions accurately (Ramya, 2022).

The second problem is when different machine learning algorithms have been employed to build the model, the result of evaluation metrics of each existing study differs, as well as their problem-solving skills. In this paper, the evaluation metrics of the machine learning algorithms were noted compared with the other algorithms (Ramya, 2022) and the best machine learning algorithms were chosen according to their performance.

1.3 OBJECTIVES

This study aims to predict the tweets that contain mental health disorder content on Twitter.

i. To study the prediction of mental health disorders using Twitter data.
ii. To develop a machine learning algorithm model to predict mental health disorder.
iii. To evaluate the developed model's accuracy.

1.4 SCOPE

The scopes are listed as follows to get the study result:

Research scope:

i. The study used a dataset from a social media platform (Twitter).
ii. Datasets divide into training (70%) and testing (30%).
iii. This study will run the testing multiple times.
iv. The result will show the accuracy of the prediction of mental health disorder tweets.

Development scope:

i. Python's NLTK, PANDAS and MATPLOTLIB will be used as tracking tools to analyse the data.

1.5 REPORT ORGANIZATION

This thesis consists of five chapters. Chapter one discusses the introduction to the research, including the introduction, problem statement, objectives, scope, and significance of the project. For the summary of chapter one, we state that people nowadays live in a stressful era that can cause mental health problems. Many of them would instead choose to speak out on social media than others beside them. So, this research aims to predict the Twitter tweet that contains mental health disorders. Learning about mental health disorders tweets early and treating them before the tragedy happens is essential. This research will use NLTK to predict the result.

Chapter two discusses the literature review of the research. This chapter includes a discussion of the previous research relevant to the proposed study, a comparison of the study and the technique used, advantages and disadvantages of each previous research compared to a few standards.

Chapter three is the methodology of the proposed research. This chapter discusses the research framework, research requirement, and research method for the study, including the flowchart, data design with dataset description, evidence of early work, testing plan and explanation of potential use of the proposed solution in real-time solution.

Chapter four explains the result and discussion of the projects. It details the study's results and describes the outcome attained using the implemented method and technique.

Chapter five focuses on the conclusion part. It explains the research's limitations and future work. Lastly, this study paper's appendices and references are added at the rear.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

Many studies have been conducted recently to predict mental health disorders due to social media use. As a result, this section will describe and compare prior studies on mental health disorder prediction on Twitter.

2.2 PREVIOUS RESEARCH WORKS

The Kaggle dataset was used in this study's (Ramya, 2022) suggested efficient machine-learning technique for mental health prediction. By utilizing machine learning techniques, it aims to quantify Twitter traits and trends to understand the signs and risk factors of mental diseases. Machine learning algorithms are used to predict mental health, and their accuracy rates are compared independently with categorization algorithms. Support Vector Machine (SVM), K-Nearest Neighbor (KNN), and Convolution Neural Networks are the algorithms used for processing (CNN-LSTM). The supervised learning method, SVM, is utilized for classification or regression problems, especially for classification problems. The CNN-based text analysis approach may get the vital textual elements by pooling. The KNN classification algorithm outperforms a technique already in use that is based on the SWM classification algorithm. Using Natural Language

Toolkit, the URLs, mentions, numerals, punctuation, and stop words are removed (NLTK).

The study (Suvarna, n.d.) was done to identify the best model that could be used for such data and to forecast Twitter users' mental states using deep learning and machine learning models. According to its authors, the purpose of the study is to develop a rapid yet reliable method that would give early warnings on the health of such people. A publicly accessible dataset from the Kaggle online repository was employed for this investigation. Data cleaning and pre-processing methods were performed to eliminate it since online-posted tweets include many unique characters, numbers, and emotions. Lemmatization, feature extraction, sampling, count-vectorization, and SMOTE are all examples of data pre-processing. SVM separates the data based on various classification possibilities before selecting the one that best fits the classification hyperplane among them. Random Forest builds multiple decision trees and combines them to produce more accurate predictions. Naive Bayes is popular due to its simplicity and faster training time than other models. Gradient-boosted decision trees are typically used for supervised learning problems and are forward feed networks and neural networks with an input, hidden, and output layer. MLP classifiers are used for classification tasks, and XG Boost is all applied in the ensemble technique, which boosts performance.

This study (Katarya & Maan, 2020) suggests using machine learning to anticipate mental health issues in both technical and non-technical workplaces. People eventually feel the effects of the industrialized lifestyle and workload, which makes them more vulnerable to mental illnesses, including anxiety and mood disorders. Therefore, this study has been investigated to address the potential that mental health problems would become more prevalent among working professionals. The information, which includes more than 70 personal and professional characteristics of the employees, was donated by the nonprofit OSMI (Open source mental illness). Seven of the 70 traits were chosen to help predict the mental health issue. Support Vector Machine (SVM), Logistic Regression, K-Nearest Neighbours (KNN), Decision Tree, Random Forest, and Naive Bayes were the machine learning algorithms used in this work. The effectiveness of a classifier was evaluated using precision, recall, and F1-score calculations.

Table 2.1 Comparison between existing research papers.

Elements	Research 1	Research 2	Research 3
Research and Author	An Effective Approach for Mental Health Prediction Using Machine Learning algorithm (Ramya, 2022)	Prediction of Mental Health among Twitter users (Suvarna, n.d.)	Predicting Mental health disorders using Machine Learning for employees in technical and non-technical companies (Katarya & Maan, 2020)
Domain	To quantify Twitter traits and trends to understand the signs and danger signs of mental problems.	To issue early warnings regarding the state of such people.	To deal with the risk of mental health problems arising among working professionals.
Technique	Pre-processing: Python Natural Language Toolkit (NLTK) Machine learning: Support Vector Machine (SVM), K-Nearest Neighbor (KNN), Convolution Neural Network (CNN-LSTM)	Support Vector Machine (SVM) Naïve Bayes Random Forest XGBoost MLP Classifier Neural Networks	Support Vector Machine (SVM) K-Nearest Neighbor (KNN) Logistic Regression Decision tree Random forest Naïve Bayes
Data	Kaggle dataset	Kaggle dataset	Provided by OSMI (Open source mental illness) organization
Advantages	Improved comprehension of the classification and dictionary-creation model.	The parameters of the models were hyper-tuned to enhance the models' performance and reduce overfitting.	The features chosen will provide the business with a quick concept of how to enhance employee working circumstances and offer mental health care to the employee.
Disadvantages	SVM requires extensive training on sizable datasets.	The lack of additional characteristics impacts the performance of the models.	Additional data is required to increase the accuracy of the outcome.
Limitation	-	Some models underperform because they are chosen for a dataset with few characteristics.	Not significant enough to conclude why some persons are more susceptible to mental illnesses than others.

2.3 SUMMARY

According to **Table 2.1**, each of the prior studies used distinct approaches, each with its benefits and drawbacks. The most reliable research we study is Research 3 because it uses the techniques that are more likely to this research that we want to use. Machine learning algorithms involved in this research are support vector machine, decision tree and naïve Bayes, same as machine learning used in existing research 3.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This chapter explains how the study carries out to satisfy all of the objectives. It is presented as a flowchart since it is easy to comprehend. It also ensures that the progress is on track.

3.2 RESEARCH FRAMEWORK

This section derived a study methodology for predicting mental health disorder from Twitter data.

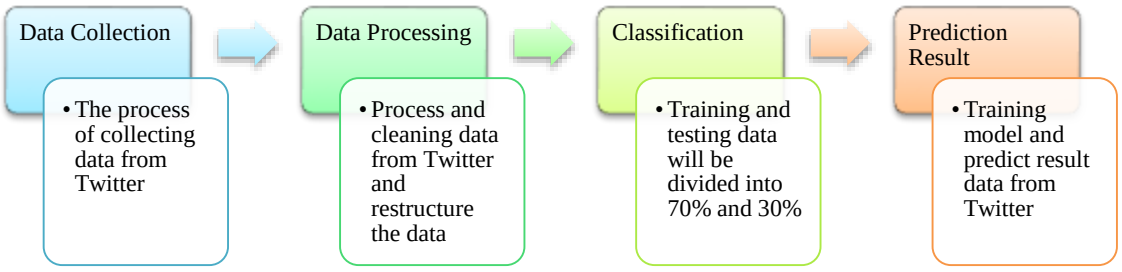

Figure 3.1 Research Framework

3.2.1 Data Collection

Due to the public availability of a mental health disorder dataset, Twitter data will be obtained by repurposing a dataset from Github dataset that has previously been collected and published as a usable dataset. This dataset contains tweets contents and labels from users on Twitter. The dataset contains 16158 tweets, of which 8282 were labelled with “1” representing mental health disorders and 7876 with “0” representing non-mental health disorders.

3.2.2 Data Processing

Various techniques such as tokenization, stop word removal, stemming, lemmatization, tokenization, and unique symbol removal may be used to pre-process data. For example, tokenization generates a set of unique tokens to encrypt the text and aid in developing a vocabulary from the training package. Stop word removal removing words such as it, are you and me.

3.2.3 Classification

The dataset will be separated into two parts: training and testing. Training the model requires pre-processing; 70% of the training data is needed, depending on the experiment’s requirements. The training data comprises the input and the expected result, which contains both input and expected output. For testing data to evaluate if the trained model performs effectively on unseen data, 30% of the data is required. The information is utilized to forecast the outcome once thoroughly trained.

3.2.4 Prediction Result

A prediction experiment will be carried out using machine learning algorithms and training and testing data. Accuracy, precision, recall, and F1-score are all part of the outcome. The proportion of correctly anticipated outputs is given by precision, the recall provides the percentage of positively predicted results, and the F1-score, the average of precision and recall, considers both false positive and false negative outputs (Katarya & Maan, 2020). Data will go through the training phase to determine which machine learning model would produce the best prediction results. Support vector machine, decision tree, and naive Bayes model are the three machine learning techniques that will be employed. By disclosing the precise outcome, we will compare the results. The outcome will demonstrate which model best fits our data. Diagrams and charts will be used to visualize the results.

S.no	Algorithms	Accuracy (%)	Precision	Recall	F1
1.	KNN	74%	76	82	79
2.	SVM	76%	75	88	81
3,	Logistic Regression	84%	82	94	87
4.	Decision tree	84%	83	92	87
5.	Random Forest	77%	81	80	81
6.	Naïve bayes	79%	78	90	83

Figure 3.2 Sample Prediction Result

3.3 PROJECT REQUIREMENT

This section will mainly talk about the input, output and process description.

3.3.1 Input

This section will mainly discuss the input, output, and input will be the Twitter data collected from Github. The dataset from Github will be used to predict mental health disorders through tweets contents in this study. The dataset will be divided into two columns: text from the tweets and the label for the mental health disorder or non-mental health disorder. Other columns in the dataset will be removed because of unused data. The dataset contains 16158 tweets which 8282 are labelled with "1", representing mental health disorder tweets and 7876 with "0", describing non-mental health disorders.

3.3.2 Output

The output will provide the three algorithms' accuracy, precision, recall, and F1-score for predicting mental health disorders on Twitter. The first factor is precision. Classification accuracy is frequently calculated as the ratio of the model's accurate predictions to the total number of input samples(S & S. Raj, 2021). The formula for calculating accuracy is:

$$Accuracy = \frac{Number\ of\ predictions\ that\ are\ correct}{Total\ number\ of\ predictions}$$

In classification terms, accuracy is denoted as follows:

$$Accuracy = \frac{TN + TP}{TP + FP + TN + FN}$$

which the confusion matrix can be described in the form of the

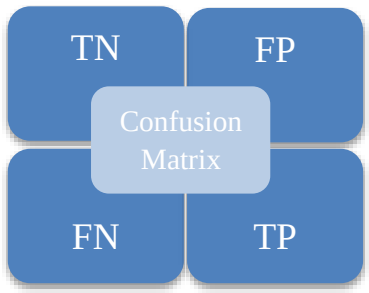

Figure 3.3 Confusion Matrix

where,

TP stands for true positive, which means the output was positive or 1 and was predicted correctly.

TN stands for true negative, which means the output was negative or 0, and it was predicted correctly.

FP stands for false positive, which means the output is negative or 0, but it is predicted as 1 or positive.

FN stands for false negative, which means the output is positive or 1, but it is predicted as 0 or negative.

The second parameter is precision. This parameter measures the accuracy with which the model recognises a class. Our objective is to pinpoint areas where mental health may be at risk while ensuring that mental health is stable (Suvarna, n.d.). Precision can be formulated as below:

$$Precision = \frac{TP}{FP + TP}$$

The third parameter is recall. This study relates to the percentage of instances when the model correctly predicted stability despite the person's mental instability and the total cases of mental health disorders (Suvarna, n.d.). The ratio of true positives to all true positives and false negatives is the value for this metric. Therefore, recall can be formulated as below:

$$Recall = \frac{TP}{TP + FN}$$

Forth parameter is the F1-score. The harmonic mean of recall and accuracy is the F1-score. Since precision and recall are considered in the computations, F1-score often has a lower value than accuracy(Aldarwish & Ahmad, 2017). The formula of the F1-score:

$$F1 = 2 \times \frac{Precision \times Recall}{Precision + Recall}$$

This study's three machine learning methods are Support Vector Machine (SVM), Decision Tree, and Nave Bayes also serve as outputs. As a result, the most appropriate algorithm will yield the most accurate results to predict mental health disorders.

3.3.3 Process Description

Data collection, pre-processing, categorization, and prediction results are the five steps of the project's procedure. First, we'll get Twitter information from the Github website, which offers datasets related to mental health disorders. Next, we will clean and normalize the data from the obtained datasets using tokenization, normalization, stop-word removal, and lemmatization. After the data has been cleaned and placed in a structured manner, we will divide it into 70% train data and 30% test data, where the former comprises the input and the anticipated result, and the letter involves performing on data that has not yet been seen. Finally, we shall compare the results by accurately reporting them. The outcome will demonstrate which model best fits our data. Diagrams and charts will be used to visualize the results.

3.4 PROPOSED DESIGN

3.4.1 Flowchart

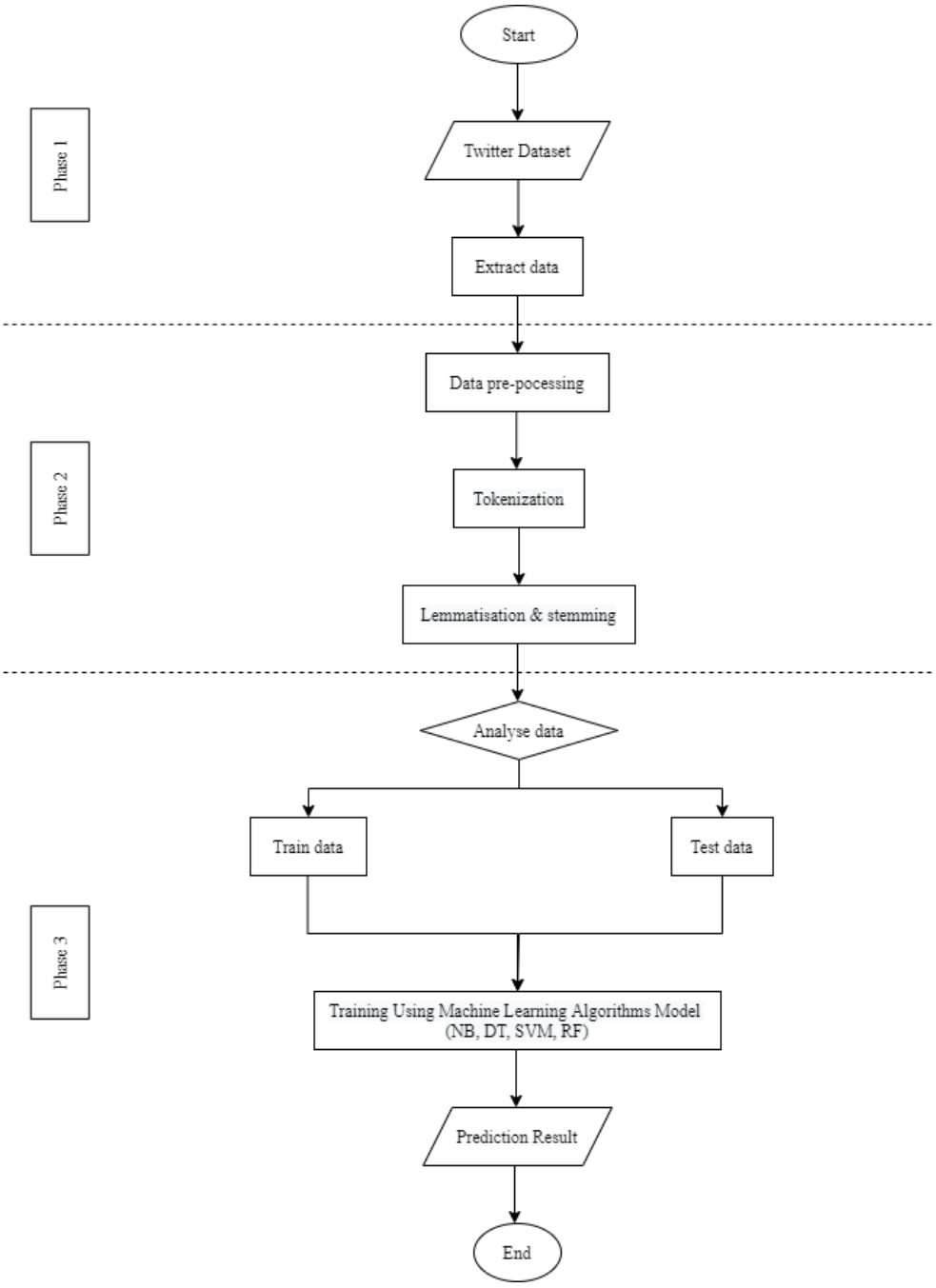

Figure 3.4 Flowchart of research

3.4.1.1 Phase 1

The system will start with the process of extracting data. Data extraction is the process of collecting or retrieving disparate types of data from a variety of sources. Data will be downloaded from GitHub Dataset https://github.com/somya22/Twitter-Mental-Health-project, which the dataset named combined_tweets.csv, which tweets scraped from Twitter. On 23 July 2022, this dataset was uploaded. The dataset will go through the extraction process to become a dataset used in this research. The extract process will start with connecting to GitHub API and interacting with datasets.

3.4.1.2 Phase 2

Phase 2 is a data-cleaning process. Although this dataset has been cleaned, we will also do the cleaning to ensure it is clean. First, the data will be cleaned by removing special characters, punctuation, numbers and links. After that, continue the process by eliminating work endings, extra spaces, and stop words in data cleaning. Then data will go through the process of replacing negation, contraction and emphasized words. The last step of data cleaning is tokenization, lemmatization and stemming. The data cleaning process is cleaning and filtering the data to make it suitable for analysis. Natural Language Toolkit (NLTK) will be used in this process.

3.4.1.3 Phase 3

Next, the data will be analyzed by dividing it into training and testing data. Training data is used to run algorithms, while testing data use algorithms to process sentiment analysis. After sentiment analysis, data will be predicted, and the prediction result will be produced.

3.4.2 Data Design

In this research, the dataset was chosen according to characteristics related to mental health disorder tweets and labelled. This is because, based on the label, we can train the classifier to check the quality of the data and then test the data with different algorithms to predict the output with higher accuracy. After that, the prediction for a new tweet can be made in the prototype with the classifier model that was designed with the help of a machine learning algorithm.

3.4.2.1 Dataset Description

This dataset was uploaded on 23 July 2022. The dataset contains 16158 tweets, of which 8282 were labelled with "1" representing mental health disorders and 7876 with "0" representing non-mental health disorders. The dataset named "combined_tweets.csv" was downloaded from the GitHub website: https://github.com/somya22/Twitter-Mental-Health-project.

Figure 3.5 Twitter Dataset from Github

3.4.3 Machine Learning Algorithms

Three machine learning algorithms will be used in this research to get the results prediction of mental health disorders: Support Vector Machine (SVM), Decision Tree and Naïve Bayes. These three machine learning algorithms use label datasets to train algorithms that accurately classify data or predict outcomes. As the dependent variable or result variable in this study, there are two possible outcomes: mental health disorder and non-mental health disorder.

3.4.3.1 Support Vector Machine

SVM is a machine learning classifier that may be used in classification and regression. It is one of the most well-known supervised Machine Learning methods for depression identification (Dey et al., 2020). SVM using a single kernel is frequently used for data analysis in various disciplines, including social media and linear regression. SVM is recognized as one of the most influential text categorization algorithms (Hassan et al., 2017). Because of its remarkable classifying power and presentation quality, this classifier has recently been used in many applications, splitting data linearly into two independent classes with the largest distance between them (Priya et al., 2020). When a hyperplane that divides the two classes with the most significant distance to the nearest data points is determined, the optimum separation is achieved (Alghamdi et al., 2020).

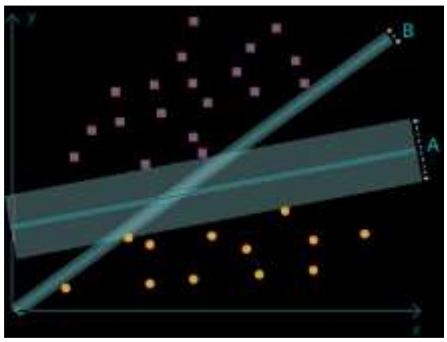

Figure 3.6 Support Vector Machine representation

3.4.3.2 Decision Tree

A decision tree is a layer-based, supervised learning technique (S & S. Raj, 2021). Machine learning's decision tree approach uses a tree data structure to make judgments at various levels. Because the design is steady and the data is straightforward to read, this is a good choice for prediction issues. It includes both classification (tree models with a volatile objective for specific values) and regression (tree models with an explosive target for an infinite range of values). A comparable group is utilised to create an emotion-monitoring algorithm containing essential data. This feature selection is determined based on entropy (Priya et al., 2020).

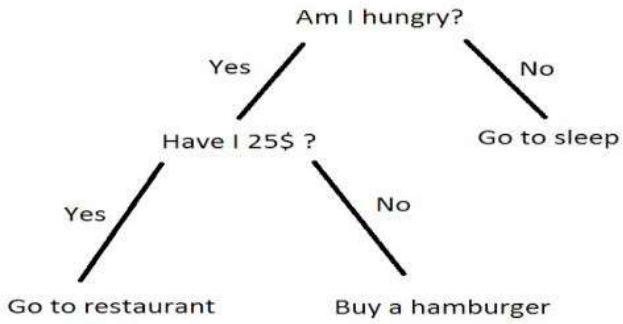

Figure 3.7 Decision Tree example

3.4.3.3 Naïve Bayes

Naive Bayes classifiers are a set of characterisation algorithms based on Bayes' Theorem (Asad et al., 2019) to solve classification and regression problems (Hassan et al., 2017). It's a probabilistic classifier model with a scalable algorithm and a widely used text classification approach. Particular academics have used this approach to yield higher efficiency with less training data (Dey et al., 2020). Using the probability model approach, the Bayes theorem is used to forecast additional membership probabilities with each class. This change is based on a more dynamic message with more user statuses. This prediction assumption states that specific characteristics in the group are present in the presence of any other feature (S & S. Raj, 2021).

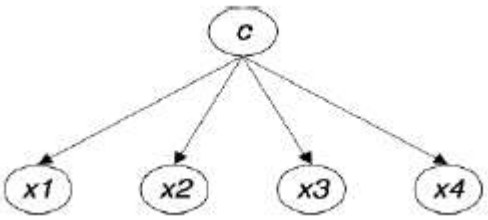

Figure 3.8 Basic structure of Naïve Bayes approach

3.4.3.4 Summary

After the prediction of mental health disorder results, the result will show which model is the most compatible with our data. Then, we will choose the best machine learning algorithm for this research and describe why we choose that machine learning algorithm.

3.5 SOFTWARE EQUIPMENT

Software equipment used in this research are as shown on the table below:

Table 3.1 Software equipment and its specification.

Software	Specification	Purpose
Microsoft Office Word	Version 2013	Used for report writing documentation
Microsoft Office PowerPoint	Version 2013	Used to prepare slide for presentation
Microsoft Office Excel	Version 2013	Used to store the dataset with format .csv file
Draw.io	Version 14.1.8.0	Used to draw flow chart for the research
Google Chrome	Version 96.0.4664.110	Assist with the search for research for the project
Anaconda Navigator - Jupyter Notebook	Version 2.2.0	To modify, debug and generate code, and then run for the research dataset
Visual Studio Code	Version 1.74.1	To run coding and made a prototype

3.6 HARDWARE EQUIPMENT

This research specifies the hardware requirements for the investigation. The hardware used must be highly efficient and capable of programming and storing large datasets and having built-in dataset processing and modelling methods.

Table 3.2 Hardware equipment and its specification.

Hardware	Specification	Purpose
Laptop	Asus X570Z-DDM395T CPU : AMD Quad Core R5-2500U Processor, up to 3.6GHz VGA : NVIDIA® GeForce® GTX 1050 VRAM : 4GB GDDR5	Used for development, documentation, and research completion
Smartphone	Vivo Y33s CPU : Octa-core, 2x2.0GHz Cortex-A75 GPU : Mali-G52 MC2 OS : Android 11, Funtouch 11.1	Used to aid in the search for information needed to complete the research

3.7 EXPECTED OUTCOME

Through this research, we can predict mental health disorders among teenagers using Twitter Data.

Developing a machine learning algorithm model would predict mental health disorders. Hence, we will create the machine learning algorithm model using 70% of the training data. After the trained model comes out, we will use 30% of the test data to process sentiment analysis and get the prediction result.

We can compare the classifier model with the machine learning classifier, which would bring a more accurate prediction. Then, we will compare three machine learning algorithms: support vector machine, decision tree and naïve Bayes model. After comparison, we will choose the most suitable machine learning algorithms for the final result of our prediction.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 INTRODUCTION

An explanation of the results is what this chapter aims to do. This chapter will also include developments that have been put into practice utilizing tools, techniques, and appropriate methods for the project. Last but not least, the result and discussion section displays the purportedly successful project outcomes.

4.2 RESULT

Python is used by the machine learning method in the Jupyter notebook to generate the model. Data be tested in the model algorithm after training, and the prediction outcome is shown. For the following output:

Table 4.3 Result of machine learning algorithm.

Algorithm	**Train data**				**Test data**			
	Accuracy (%)	Precision	Recall	F1-score	Accuracy (%)	Precision	Recall	F1-score
SVM	99.80	100.00	99.60	99.80	98.43	99.88	97.06	98.45
Decision Tree	99.27	99.98	98.60	99.29	98.18	99.06	97.38	98.21
Na ïve Bayes	95.06	91.54	99.57	95.38	92.20	87.20	99.36	92.88

According to the table, machine learning approaches predict mental health illnesses on Twitter with accuracy, precision, recall and F1-score in train and test data.

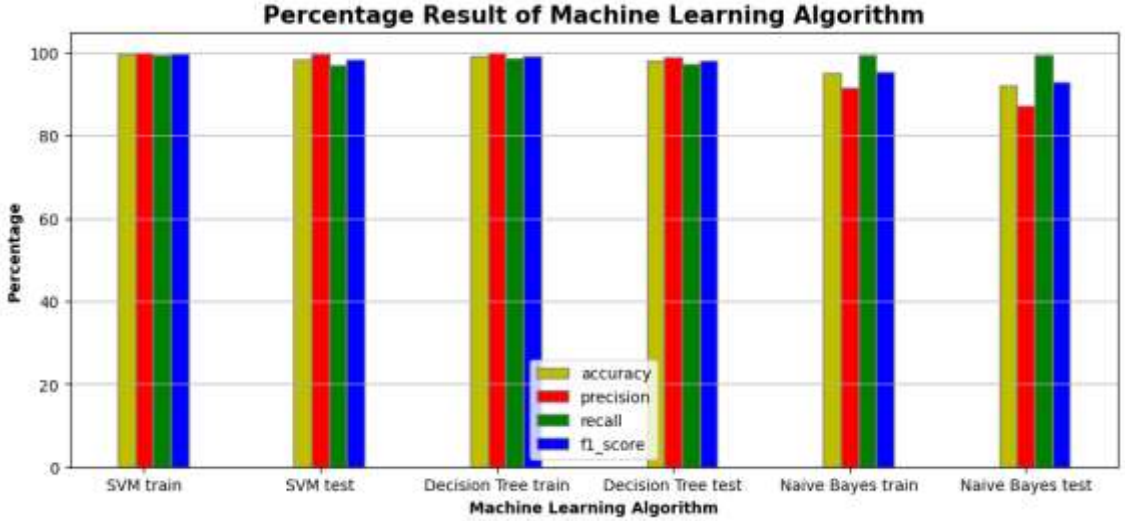

Figure 4.1 Bar chart of result of machine learning algorithm

After the study, we found that the performance of the support vector machine classifier is the best. As a result, it is the most accurate and precise, having an accuracy of 99.80% and precision of 100.00% for the train data and an accuracy of 98.43% and precision of 99.88% for the test data, respectively. A decision tree is next, having an accuracy of 99.27% and precision of 99.98% for the train data and an accuracy of 98.18% and precision of 99.06% for the test data. Regarding accuracy and precision, the Naive Bayes performed the worst, scoring 95.06% and 91.54% in train data and 92.20% and 87.20% in test data, respectively.

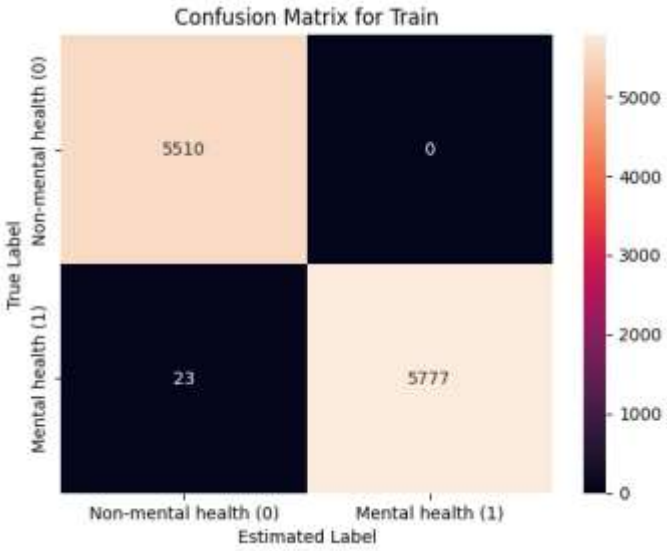

Figure 4.2 Best confusion matrix in Train Data

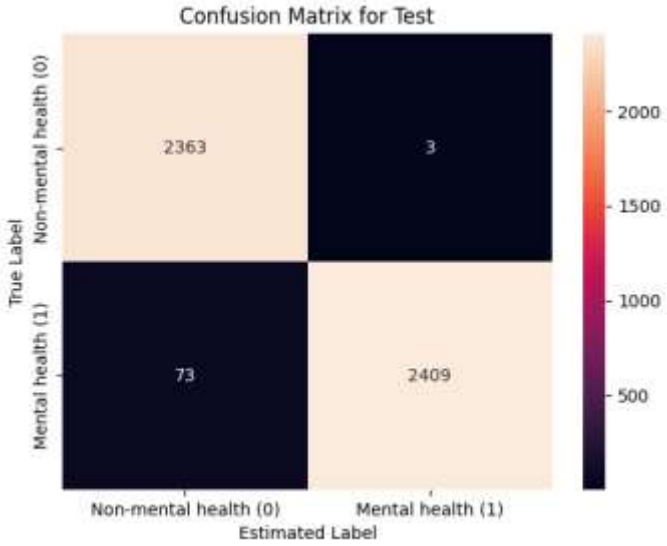

Figure 4.3 Best confusion matrix in Test Data

Figure 4.2 and Figure 4.3 show the best confusion matrix for predicting mental health disorders on the train and test data: Support Vector Machine (SVM).

A confusion Matrix is used to assess classification models. It demonstrates that we categorize Twitter data using SVM machine learning, which has the greatest training and test data accuracy. Python's Scikit module was used to construct this confusion matrix. One may notice that a person is tweeting either positive or bad things here. The diagnostic displays genuinely positive outcomes. The number of positive tweets with mental health disorders is 5777 for train data and 2409 for test data. This demonstrates that the opinions of 5510 for train data and 2363 for test data in their tweets are unfavourable; data indicates that phrases relating to mental health disorders are present in the data, which is negative.

4.3 DISCUSSION

This study used machine learning to make the computer behave like the human brain because the computer cannot understand input provided directly by a human or in text form. GitHub was used to get the Twitter dataset. The dataset is used to identify mental health disorders using the Support Vector Algorithm (SVM), Decision Tree, and Nave Bayes algorithm. The model's development yielded the desired outcome. Using a tokenizer, the data set's sentiment values are transformed into numbers. The tokenizer gives each phrase its unique word index, which turns tokens into sequences of these extracted tokens that are then converted into numbers. For instance, "I am depressed" and "I have a wonderful day today" have different word indexes and sequence lengths. Padding is used to ensure that the sentences in the sequence are of the same size. If the rows have different lengths, '0' is added to make them all the same length. SVM has the most excellent performance out of all the classifiers since it has better accuracy, even if decision trees have the maximum precision for training and test data. Since we prioritize finding mental health illnesses, we will select the classifier with the highest accuracy, SVM machine learning.

CHAPTER 5

CONCLUSION

5.1 INTRODUCTION

In this research study, we have conducted a thorough survey of the Twitter dataset to assess the performance of machine learning techniques. The primary purpose of using different machine learning techniques is to predict the users' mental health disorders based on their tweets. The data was cleaned and pre-processed as per the steps mentioned in chapter 3, and the machine learning models were implemented. To evaluate different classifiers, SVM, decision tree and naïve Bayes are applied to measure performance in terms of accuracy, precision, recall and f1 score. Results have shown that Support Vector Machine presents better results than other machine learning models. Machine learning is widely used for text analysis and sentiment analysis. This study's main issue is classifying positive and negative tweets as mental health disorders. It is caused by social networking sites and how people give their opinion on the social networking platform Twitter. Machine learning techniques affect the performance of different classifiers for sentiment analysis data. This study has shown that machine learning, widely used in other fields such as text classification or sentiment analysis of data, is also a good choice for sentiment analysis.

5.2 Constraints and Limitations

The constraints of this study do not apply to all machine-learning techniques. Based on the type of learning or the data utilised, machine learning algorithms are divided into two categories: supervised and unsupervised. In supervised learning, we use labelled data, which implies that we know both the input and the outcome. In contrast, unsupervised learning uses unlabelled data, where we are given the independent variables' values but not the dependent variables' importance. Different types of algorithms, including the KNN method, logistic regression, and linear regression, are contained in each class. Finding the most accurate and reliable algorithm for this investigation thus becomes a restriction.

The limitation of this research is the machine learning technique inaccurate when the dataset is less. The dataset's amount and quality will affect the machine learning model that we train and test out. When we did the prototype, the prediction of the prototype may be inaccurate as we predict because of the dataset.

5.3 Future Work

Further advancement of a prediction model with advanced algorithm for analysis of mental health disorders by determining more significant predictors that lead to the disease. The dataset used in the research is minimal; in the future, a large dataset can be used, and the study can be applied to the same for more accuracy. Future work for this project can be connecting the mental health prediction with the cloud model and optimizing the work to implement in an Artificial Intelligence environment.

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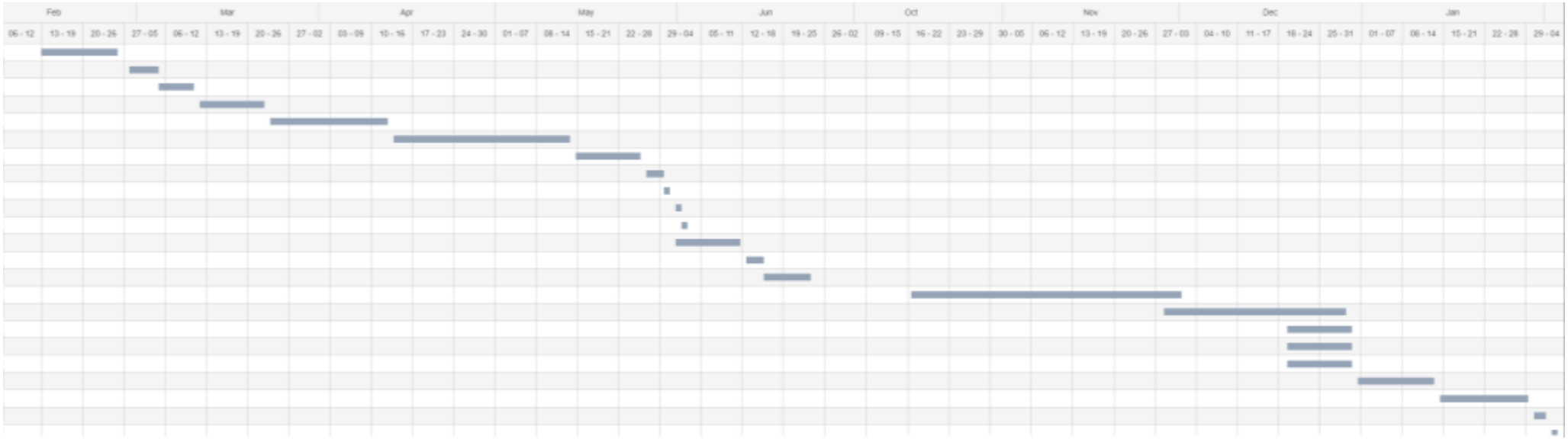
APPENDIX

Gantt Chart

ID	Title	Start Time	End Time
1	Idea Proposing	02/13/2022	02/26/2022
2	Problem Statements	02/28/2022	03/05/2022
3	Objectives and Scope	03/05/2022	03/11/2022
4	Literature Review	03/12/2022	03/23/2022
5	Prior Research Work	03/24/2022	04/13/2022
6	Research Framework	04/14/2022	05/14/2022
7	Project Requirement	05/15/2022	05/26/2022
8	Proposed Design	05/27/2022	05/30/2022
9	Data Design	05/30/2022	05/31/2022
10	Proof of Initial Concept	06/01/2022	06/02/2022
11	Potential Use of Proposed ...	06/02/2022	06/03/2022
12	Complete Thesis Report	06/01/2022	06/12/2022
13	Presentation for PSM 1	06/13/2022	06/16/2022
14	Revise and Finalize	06/16/2022	06/24/2022
15	Construction	10/17/2022	12/02/2022
16	Result	11/29/2022	12/30/2022
17	Discussion	12/20/2022	12/31/2022
18	Limitation	12/20/2022	12/31/2022
19	Future Work	12/20/2022	12/31/2022
20	Revise and Finalize	01/01/2023	01/14/2023
21	Poster	01/15/2023	01/30/2023
22	Presentation for PSM 2	01/31/2023	02/02/2023
23	Finazlization and Submission	02/03/2023	02/04/2023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