Mental Health Tracker System from social media

SHRUTI NEELI[1], SONAL RAINA[2], AYUSH RAZDAN[3], PROF. P. J. JAMBHULKAR[4]
[1, 2, 3, 4] *Department of Computer Technology, Pune Institute of Computer Technology, Pune, India*

Abstract- ***Social media platforms like Facebook, Twitter, and Instagram have brought about significant changes in our lives, connecting people like never before and creating a digital persona for individuals. While social media has several benefits, it also has some drawbacks. Recent studies have linked high usage of social media with increased levels of depression. This study focuses on using machine learning techniques to identify probable depressed Twitter users by analyzing both their network behavior and tweets. The study trains and tests classifiers to determine whether a user is depressed or not, using features extracted from their activities on the network and tweets. The findings indicate that using more features leads to higher accuracy and F-measure scores in detecting depressed users. This data-driven, predictive approach can be useful for the early detection of depression or other mental illnesses. The study's main contribution is in exploring the impact of different features on detecting depression levels. The results also highlight the challenges and limitations that machine learning researchers face in the field of mental health, and provide recommendations for future research and development in this area.***

Indexed Terms- ***Social Media Analytics, Depression, Anxiety, Machine Learning (ML), Support Vector Machine (SVM), Naive Bayes, Decision Tree, Feature Selection, Mental disease, Reddit, bipolar, ADHD.***

I. INTRODUCTION

Depression is a widespread mental illness that affects millions of people worldwide, and can lead to suicide. Diagnosis of depression usually involves face-to-face clinical depression criteria, but early-stage depression often goes undetected as many patients do not seek medical help. Recently, there has been growing interest in using social media data to detect, estimate, and track changes in the occurrence of mental illnesses. Social media's extensive reach provides valuable data for mental health clinicians and researchers, leading to a better understanding of mental health issues. Moreover, negative emotions in social networks can have a contagious effect and contribute to depression and other mental illnesses. Depression is a significant risk factor for suicide, and undiagnosed or untreated depression can lead to dire consequences. Several studies have utilized social media data to detect physical and mental illnesses, including depression.

This study aims to detect depression in individuals by analyzing their social media activity and tweets. The study's primary goal is to develop new mechanisms that help detect and limit depression diffusion in social networks. Several classification techniques, including support vector machine (SVM)-linear, are used to identify the level of depression. A person's mental health is measured by their degree of affective disorder, which can result in various mental illnesses such as anxiety disorder, depressive disorder, mood disorder, and personality disorder.

II. LITERATURE REVIEW

The objective of the study discussed in [8] was to use machine learning techniques to identify potentially depressed users on Twitter based on their network behavior and tweets. The researchers created classifiers that could distinguish between depressed and non-depressed users by analyzing various features derived from their network activities and tweets. Individuals with major depressive disorder were found to frequently post tweets with negative emotional sentiments, providing signals that could indicate their depression. The researchers employed common natural language processing algorithms like SVM, Naive Bayes, and Decision Tree to develop their classifiers. The study referenced in [9] demonstrated that social media data can be leveraged to identify individuals who may be at risk of suicide. Machine learning algorithms were found to be particularly effective in distinguishing individuals who are at risk,

even among non-clinical populations. The research revealed that these algorithms were successful in accurately identifying individuals with high suicidal tendencies in 92% of cases, with a sensitivity of 53%, specificity of 97%, positive predictive value of 75%, and negative predictive value of 93%.

In [10], the authors introduce a co-training technique that involves training two classifiers on different feature sets and leveraging unlabelled data to enhance the performance of both classifiers. They compare the efficacy of their co-training approach with single classifier methods such as Support Vector Machines (SVM) and Decision Trees.

The results indicate that the co-training approach outperformed the single classifier methods, achieving an accuracy rate of 89.27% in classifying posts related to mental health. The authors also conducted a feature analysis to identify the most important features for predicting mental illness.

In summary, the study highlights the potential of co-training algorithms to effectively identify mental illnesses using social media data and emphasizes the importance of leveraging multiple data sources to enhance classification accuracy. However, the research is limited by its reliance on a single dataset, and further investigation is needed to evaluate the generalizability of the findings to other social media platforms and populations.

According to [11], the approach used by the authors surpassed the performance of conventional machine learning algorithms and achieved state-of-the-art results in classifying mental illnesses based on social media texts. Additionally, the authors conducted a feature analysis to determine which features were most significant in predicting mental illness.

Overall, the study showcases the potential of deep learning and transfer learning techniques to accurately classify mental illnesses using social media texts. It emphasizes the importance of leveraging advanced natural language processing methods for mental health research. However, the study's findings are restricted to a single dataset, and further research is required to evaluate their applicability to other social media platforms and populations.

The [12] paper proposes a deep learning model designed to detect mental illness from user-generated content on Twitter. The authors used a vast dataset of tweets related to mental health to train the model and compared its performance with traditional machine learning algorithms and other advanced approaches. The findings demonstrate that the deep learning model outperformed these other methods and achieved state-of-the-art performance in detecting mental illness from social media posts. The study highlights the potential of advanced natural language processing techniques for mental health research and emphasizes the significance of early detection and intervention for mental illnesses.

However, the study is limited by the use of a single dataset, and further research is needed to assess the applicability of the results to other social media platforms and populations.

In [13], the paper examines the application of deep learning techniques in classifying depression in social media text. The authors used a dataset of tweets associated with depression and trained a deep neural network to classify tweets into either depressed or non-depressed categories. They compared their approach's performance with traditional machine learning algorithms and other advanced methods. The results indicate that their deep learning approach outperformed these other methods and achieved high accuracy in detecting depression from social media text. The study highlights the potential of advanced natural language processing techniques for mental health research and the significance of early detection and intervention for depression.

However, the study's limitations include the use of a single dataset, and further research is required to evaluate the findings' generalizability to other social media platforms and populations.

III. PROPOSED METHODOLOGY

A. Dataset

Gathering information on social media is the first step towards improving mental health. We use APIs to collect data from social media platforms such as Twitter. We use keywords, hashtags and other filters to gather information about mental health.

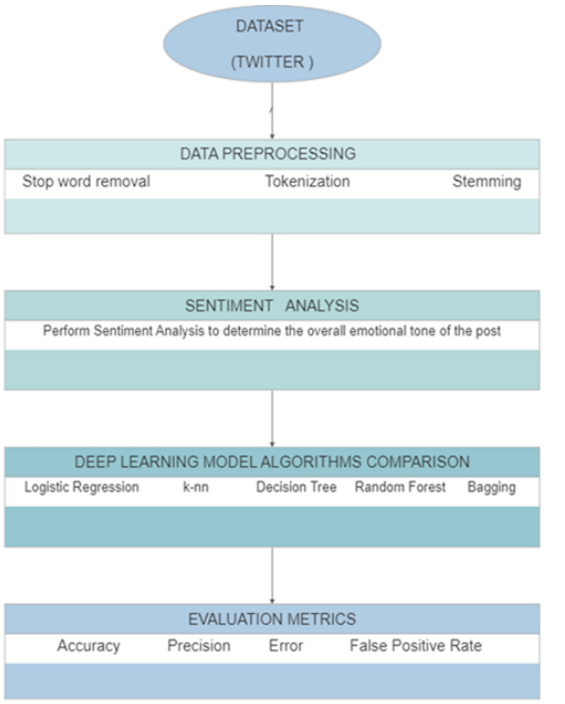


Fig. 1: Proposed Methodology

After collecting the data, we must preprocess it to remove noise, filter out irrelevant data and normalize the format. Data can be cleaned using advanced techniques such as tokenization, body generation, lemmatization, and stop word removal. Sentiment Analysis: Sentiment analysis is the process of determining the emotional state in a text. In this step, you can use the theory of analysis algorithms to identify good, bad or average articles.

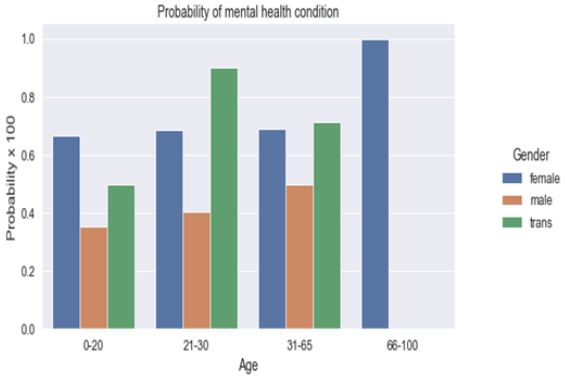
Topic Modeling: Topic modeling is the process of identifying topics or themes that appear in a text. In this step, you can use techniques such as Hidden Dirichlet Allocation from Social Media (LDA) to identify mental health issues.

Clustering: Clustering is the process of grouping similar documents together. In this step, you can use clustering techniques such as k-means clustering to cluster similar groups according to their theory and meaning. Visualization: Visualization is an important step in analyzing and interpreting the results of a mental health assessment. You can visualize categories and themes using tools such as word clouds, heatmaps, and network charts. Evaluation: The final step in developing a mental health evaluation is to evaluate the results. You can use statistical techniques such as regression analysis to identify factors that affect mental health and mental health conditions over time. Overall, developing mental health information from social media is a complex task that requires expertise in machine learning, natural language processing, and data analysis. However, it can provide a better understanding of mental health and help people and organizations make decisions about mental health.

C. Model Building

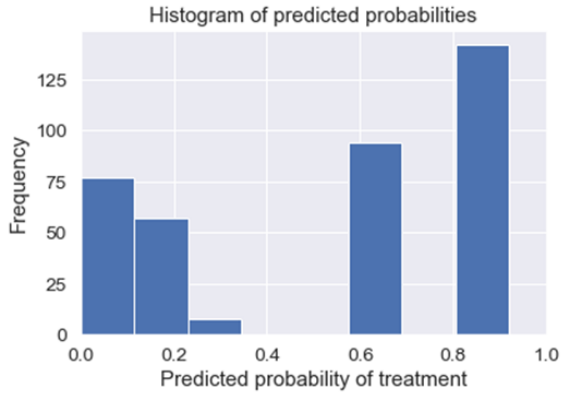
THE METHODOLOGY HERE: SVM classifiers, Naive Bayes (NB), and Decision Trees (DT) are a few of the popular algorithms utilized in jobs involving natural language processing. The SVM-linear classifier has the best performance of them. Since there isn't a single algorithm that can be used for all tasks, researchers often experiment with different algorithms and improve them for the problems that interest them.

1. NB: NB is based on the probability "Bayes' theorem". This theorem's prerequisite, P(X|Y) = P(Y|X)P(X)/P(Y), states that NB can only be used if the features are independent of one another. It is a prediction model that delineates the potential outcomes for each class under various scenarios for each attribute. It is frequently used in machine learning because of its effectiveness in combining the evidence from several features.



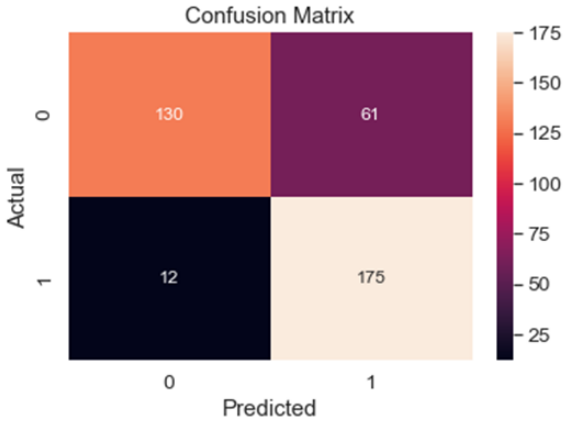
2. Decision Trees: By ordering examples according to the feature values, Decision Trees (DTs) categorise instances. A DT's nodes and divisions each stand for a feature and a potential value, respectively. DTs simply pose a series of carefully

constructed questions to classify a task that makes them straightforward, for which they are extensively employed within the machine learning field.



3. Support Vector Machine (SVM): SVM is a high-dimensional 5-space supervised learning model that highlights two distinct classes. To prevent overfitting, it can modify a number of aspects while maintaining good performance. In particular when working with real-world data, SVM is renowned for its potent capability, which includes a solid theoretical foundation and its insensitivity to high-dimensional data.

For a binary classification problem, SVM is a sort of method with a set of labelled training samples. The potential hyperplane produced by the SVM training algorithm separates the examples into two classes.



Accuracy: 0.8068783068783069
Classification Error: 0.19312169312169314
False Positive Rate: 0.3193717277486911
Precision: 0.7415254237288136

4. Feature engineering is defined as "the process of using domain knowledge of the data to create features that can be used by machine learning algorithms to find patterns" in the context of machine learning. Features are created to extract the data that a machine learning algorithm can understand and may be helpful for prediction.

The Twitter platform has a massive amount of information about the user, various features can be extracted from the activity histories and tweets of Twitter.

5. Logistic Regression: For categorization issues, supervised machine learning techniques such as logistic regression are used. Assisted machine learning algorithms are trained on labelled datasets and accuracy is assessed using an answer key. A mapping function from input variables x1, x2, and xn to output variables (Y) with the formula f(Xi) = Y is what the model aims to learn and approximation. Because the model predictions are continually assessed and adjusted in light of the output values, the process is known as supervised learning.

Sentiment Analysis using Logistic Regression:

We train the model on a sample Twitter dataset as part of developing sentiment classifiers using logistic regression. The supplied dataset comes in the form of tweets, which is not the easiest format for a model to comprehend. Therefore, in order to transform the provided text into a format that the model can easily understand, we will need to perform some data pre-processing and cleaning.

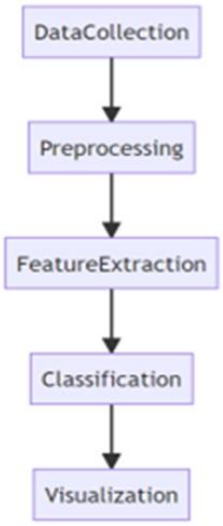
IV. SYSTEM ARCHITECTURE

The typical system architecture of a mental health tracker system that utilizes social media data consists of multiple components, including data collection, preprocessing, feature extraction, classification, and visualization. The following is a high-level overview of each component:

- Data Collection: This component involves collecting social media data from various sources

such as Twitter, Facebook, and Instagram, using web scraping techniques or APIs. The collected data can be in different formats such as text, images, or videos.

- Preprocessing: After data collection, the collected data is preprocessed to eliminate irrelevant information, remove noise and identify mental health-related content. Techniques such as stemming, tokenization, and removing stop words are employed.
- Feature Extraction: Once the data has been preprocessed, the system extracts features from it, such as sentiment analysis, emotion detection, and topic modeling. These features are used to present the social media data in a more structured and meaningful way.
- Classification: The extracted features are then utilized to classify the mental health status of individuals. This can include conditions like depression, anxiety, and stress. Machine learning algorithms such as logistic regression, support vector machines, and deep learning models can be employed for classification.
- Visualization: Finally, the results of the classification are visualized through graphs, charts, and dashboards to provide insights into individuals' mental health status and trends over time. This information can help mental health professionals and policymakers make informed decisions and take appropriate actions.
- Overall, a mental health tracker system's system architecture is complex and requires expertise in natural language processing, machine learning, and data visualization techniques. However, such a system has the potential to provide valuable insights into individuals' and populations' mental health status and can aid in early detection and intervention for mental health problems.



V. RESULTS

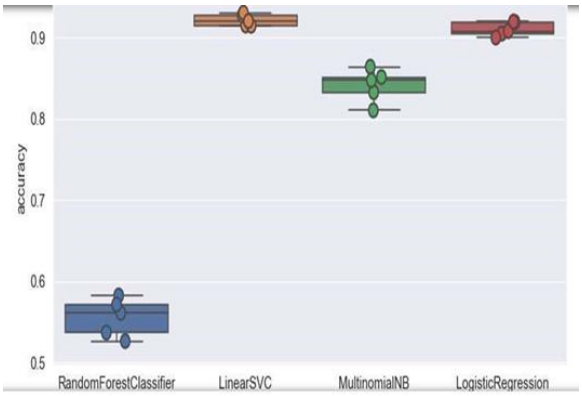
Various classification algorithms have been used to classify tweets by mental health topics. This helps to gain a more comprehensive and nuanced understanding of the psychological discussion that takes place on Twitter.

The figure below shows the accuracy of the machine learning model based on the number on the y-axis and the model name on the y-axis, for example, our model learning on clinical data shows the accuracy. This is shown in the bottom figure in figure 7. It includes the performance index and the coefficient of cross-validation index. According to the figure below, Linear Support Vector Machine (SVC) is the most accurate, i.e.0.9, the lowest accuracy is 0.5, which is a random forest model.

In addition to other patterns we examined on our data, we inferred people's thoughts and feelings on Twitter about depression, anxiety, stress, and other hashtags, as shown in the image below –

Serial No.	Machine Learning Algorithms	Mean Accuracy
1.	Linear Support Vector Classification (SVC)	0.921
2.	Logistic Regression	0.909
3.	Multinomial Naïve	0.840

	Bayes	
4.	Random Forest	0.555



Confusion matrices are used to evaluate the classification model, where we classify Twitter data with a machine learning algorithm, for example (Support Vector Machine) SVM. The results of the analysis are then displayed in a dashboard that provides a real-time overview of psychology and its different topics. Finally, the system continues to check to make sure the dashboard is updated with the latest information, providing real insights into the psychological discussions taking place on Twitter.

The performance of various deep learning models in the Twitter dataset is shown in the table below.

Some guesswork can be found by removing the video while checking the research data and cleaning the data, then inserting some tweets into the code. It shows how they guessed them. With 3 tweets, all three theories can be predicted at runtime as shown below.
"Very frustrating day on Twitter."
- Prediction: 'Positive.
"I'm leaving Instagram because it's causing more stress."
- Prediction: 'Positive'

"I can't get my money out of the country."
- Forecast: 'Neutral'
"Potential for increased exposure due to low pressure."
- Prediction: "Negative".

Word cloud: All the sentiments shown in this cloud, including positive, negative, and neutral.

TABLE II: Performance Evaluation

Serial No.	Sentiments	Precision	Recall	F1 score
1.	Negative	0.96	0.93	0.95
2.	Neutral	0.88	0.93	0.91
3.	Positive	0.89	0.87	0.88

We calculate and analyze attitudes from tweets using machine learning algorithms. We implement the machine learning algorithms, including Naive Bayes, Random Forest, Regression, and support vector machine.

CONCLUSION

In this research paper, we conduct a comprehensive study on the Twitter dataset to evaluate differential feature extraction performance using machine learning models. The main purpose of using different learning models is to evaluate how this video extraction affects the performance of different parts of the exposure. This article describes a binary classification problem based on determining whether a person is depressed based on their tweets and Twitter profile activity. Use different machine learning algorithms and search for different data. Perform several preliminary steps, including data preparation and aggregation, data collection and screening, and selection.

It uses machine learning based models such as Classifiers (Naive Bayes NB, Logistic Regression, Support Vector Machines (SVM) and Random Forests (RF)). The performance of algorithms is measured in

terms of accuracy, f1 score, precision, and recall. The results showed that the support vector machine gave better results than other machine learning models.

Machine learning is widely used in text analysis and sentiment analysis. The main question of this study is to determine the different characteristics of emotions (positive-negative and neutral) that affect emotions and how negative emotions are the result of a research topic (psychology). It has emerged from social networking sites and how people express their opinions on the social networking platform Twitter. The SVM model achieves an optimal combination of accuracy measures; turns a non-uniform problem into a separate problem. Although the DT model is comprehensive and follows straightforward steps, it can fail when exposed to completely new information. This work can be considered as a step towards creating a social-based platform that can detect and predict mental health and mental health problems and see good solutions for users. The main contribution of this study is its rich, diverse and distinctive use of tweets and behaviors of different users.

This research can be continued in the future by considering more machine learning models and finding more reliable ways to measure the impact of features. It is important to remember that mental health professionals should be used as a complement to mental health care, not a substitute. The system can help diagnose mental health problems, but users should consult a psychiatrist for diagnosis and treatment.

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