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AI in Detecting Mental Illness

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Abstract

Depression is a prevalent condition worldwide, and its diagnosis is challenging due to its non-physical symptoms. As individuals with depression share their symptoms, significant life events, and relationship dynamics on social media as posts. Researchers are increasingly leveraging digital footprints to raise awareness about the disorder. Psychological research is increasingly using natural language processing (NLP) messages on social media to explore the link between depression and language. Mental illness can affect a person's mood and often result in chronic sadness, hopelessness, anxiety and low self-esteem. Social media platforms have become important sources of mental health information, providing insights as users join conversations, share experiences, seek advice, and connect with others. Accurate diagnosis is critical in the treatment of mental illness, especially major depression, and early diagnosis and intervention are critical. The rate of recovery from depression is closely related to the scale of relapse; this research aims to expand our understanding of depression by identifying social factors, helps in improving early diagnosis.

Keywords : Mental illness, Psychological, Major depression diagnosis, Social media, Natural language processing.

1. Introduction

Depression is the leading cause of mental illness and disability worldwide. Untreated mental condition can lead to sadness,hopelessness and in some cases, suicide. Because mental illness is not physically visible, it can often be diagnosed by symptoms that manifest in behavior or behavior. The evaluation will be based on the patient's self-report, observation of relatives or friends, and psychological evaluation. Many psychological studies use social media data. Researchers used natural language processing techniques to examine the relationship between depression and language. Mental illness affects a person's mind, and when depression is severe, these disorders can persist for a long time. People with mental illness every so often experience chronic sadness, hopelessness, anxiety and low self-esteem.

Social media has become an increasingly important source of data on mental health conditions, serving as a prominent platform for individuals to engage in daily discussions, share information, seek advice, and communicate with peers who have similar interests. In general, symptom diagnosis is a fundamental step in the treatment process of mental illness. Specifically for Major Depressive Disorder (MDD), timely identification and prevention are crucial, as the recovery rate from depression is directly related to the duration of the depressive period.

2. Literature Survey

Gkotsis et al. [1] Using deep learning to analyze Reddit posts about mental health issues, they successfully identified and categorized

content related to conditions such as depression and anxiety. They highlighted the potential of social media to provide insight into patients' experiences and inform mental health interventions.

PrasadithBuddhithaet al.[2] Regular online dating can lead to loneliness and mental health problems. This study warns young people about the negative consequences of social relationships and the impact of facts often presented on the Internet.

Betul Keles, et al.[3] examined the impact of social media on the mental health of young people. They noted that while social media provides social support, it also creates risks such as feeling inadequate and being exposed to negative content.

Zhang Wenli, Ph.D.[4] developed the Deep Knowledge Aware Depression Detection (DKDD) framework, which uses social media information and machine learning to improve depression detection. This approach holds promise for serious mental health evaluations and fully normal diagnoses.

Rohizah Abd Rahman et al. [5] explores the use of AI in the early detection of mental depression and highlights the machine's ability to identify relationships and electronic medical records to identify patterns in mental health.

Deepali Joshi et al. [6] used unsupervised techniques to analyze Twitter data to identify early signs of mental health issues through pattern language. The algorithms are useful in identifying dynamic changes, highlighting their potential for early detection and timely intervention based on social media.

Jina Kim etal, [7] reviewed studies analyzed a combination of psychometric tests, ext er-

nal health models and user data to understand t he future direction of the app.

Professor Dhanashri B. Wagh etal. [8] examined the use of Twitter data to address greater stress caused by COVID-19. This study used short-term temporal lattice (LSTM) networks to predict depression levels based on various features. This demonstrates the potential of social media and machine learning in early detection of depression.

Manuel J. Rivera [9] explores the use of electroencephalography (EEG) and deep learning (DL) to diagnose dementia. While EEG is useful but complex, deep learning (especially neural networks) can process large EEG data. The analysis includes the use of publicly available data, standard deviation, and repeatability. Combining the detailed information of EEG with the influence of DL can improve early and accurate diagnosis of mental disorders.

Ngumimi Karen Iyortsuunet al. [10] reviewed the implementation of machine learning and deep learning in the diagnosis of mental illness such as depression and anxiety. This study analyzed 33 papers using the PRISMA method. It demonstrates the potential of machine learning and deep learning to predict and treat mental illnesses.

The literature on mental illness detection is explored and gaps identified are described in Table 2.1

Study	**Mental health types**	**design**	**Sample size**	**Accuracy and Quality**
1	Anxiety, PTSD,	Deep Learning	234 Reddit users	Accuracy 91.08%
2	Suicide, PTSD	NLP	Number of users 572	Accuracy88.88 %
3	Psychological distress	12 cross-sectional Study	21,231 participants	Accuracy 89.81%
4	Depression, Mental	PRISMA guide-	22 articles	not specified in systemat-

	Disorders	lines		ic review
5	Depres-sion	De-pres-sion Detec-tion Frame work	N/A	F1-score: 84.8%
6	PTSD, anxiety	using cluster-ing al-gorithm s	80,000 tweets	Achieved 76.12%
7	suicide, social support, stress detection	key-word co-occur-rence net-work.	565 pa-pers	N/A
8	Anxiety, Eating Disorders	Self-super-vised learn-ing	527 fea-tures extract-ed	2% accu-racy over state-of-the-art binary classifica-tion ap-proach
9	Epilepsy, Schizo-phrenia, Sleep disorders.	sys-tematic map-ping study	system-atic mapping method-ology	compari-son due to lack of reference dataset
10	Schizo-phrenia, PTSD	Sys-tematic review and meta-analy-sis	Varied Small to Large	Accuracy 92.58

Table 2.1 comparison table of existing works

3. Proposed Methodology

To develop a deep learning model for precisely detecting mental illnesses such as Major Depressive Disorder (MDD) using social media posts, a comprehensive methodology that combines natural language processing (NLP). This involves collecting and preprocessing self-reports, observations, and social media content, which provides real-time insights into mental health. By analyzing linguistic features indicative of issues like chronic sadness, hopelessness, anxiety, and low self-esteem, this model aims to accomplish high accurateness while minimalizing incorrect diagnoses. Through iterative training and validation.

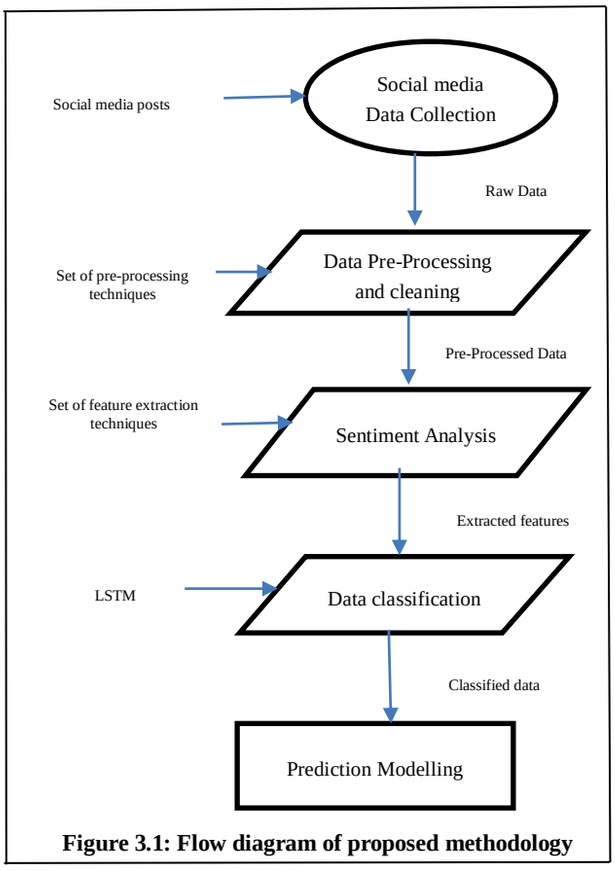

Figure 3.1: Flow diagram of proposed methodology

The above fig 3.1 shows the flow diagram of proposed methodology

a. Data Collection

The data collection process involved utilizing web scraping techniques to gather data from

numerous social media platforms such as Twitter and Facebook. Manual data set collected are tabulated in the table 3.1.

Emotion	Train	Test	Total
Anxiety	150	126	276
Depressed	130	120	250
joy	50	48	98
Fear	90	86	176

Table 3.1 Types of data collected

b. Data Preprocessing

Following the data collection phase from social media platforms through web scraping, the next step involved data preprocessing to prepare the raw data for analysis. Initially, the dataset underwent cleaning processes to remove noise such as HTML tags, special characters, and irrelevant metadata. Steps involved in data preprocessing are as followed in the fig 3.2.

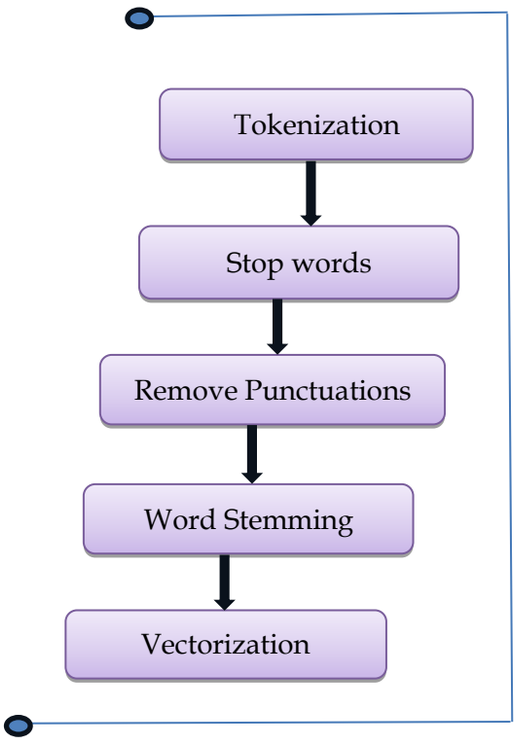

Fig3.2 Steps involved in Pre-processing phase

Tokenization : Splitting text into meaningful units (tokens) such as words, phrases, symbols.	
Code import nltk from nltk.tokenize import word_tokenize text = Feeling sad today. tokens = word_tokenize(text)	
Input: Feeling sad today.	Output: ['Feeling', 'sad', 'today', '.']

Stop Words Removal: Removing common words (e.g., the, is, are) that do not contribute much to the meaning of the text.	
from nltk.corpus import stopwords stop_words = set(stopwords.words('english')) filtered_tokens = [word for word in tokens if word.lower() not in stop_words]	
Input: ['Feeling', 'sad', 'today']	Output:['Feeling', 'sad', 'today']

Punctuation Removal: Removing punctuation marks from text.	
import stringtext =Feeling sad today.table = str.maketrans (string.punctuation) clean_text = text.translate(table)	
Input: Feeling sad today.	Output:'Feeling sad today'

Word Stemming: Reducing words to their root or base form.	
from nltk.stem import Porter-Stemmer stemmer = Por-terStemmer() stemmed_tokens = [stem-mer.stem(word) for-word in filtered_tokens]	
Input: ['Feeling', 'sad', 'today'	Output: ['feel', 'sad', 'today']

Vectorization: Converting text into numerical vectors (arrays) for machine learning algorithms.	
from sklearn.feature_extraction.text import CountVectorizer vectorizer = CountVectorizer() X = vectorizer.fit_transform (stemmed_tokens)	
Input: ['feel', 'sad', 'today']	Output:['feel' 'sad' 'today'] [[1 1 1]]

Table 3.2 Steps in pre-processing

4. Results and Discussion

This research explores the link between depression and language use through natural language processing (NLP) to improve early diagnosis and treatment for mental illness. Depression, the leading cause of mental illness and disability worldwide, often leads to severe mental health issues or suicide if untreated. Diagnosing depression is challenging due to its non-physical symptoms, typically assessed through self-reporting and psychological evaluations. Thefindings show that individuals with depression use specific language patterns on social media, such as increased expressions of sadness, despair, anxiety, and low self-esteem. Social media provides valuable mental health insights as users share experiences and seek advice. By analyzing language and social interactions through NLP, this study aims to enhance early diagnosis, prevent relapse, and develop effective treatment strategies for depression. The values of the performance of the model are followed in below table 4.1.

Accuracy	Precision	F1-score
$\frac{\text{TPos} + \text{TNeg}}{\text{TPos} + \text{TNeg} + \text{FPos} +}$	$\frac{TPos}{TPos + FP}$	$\frac{2 \times \text{precision} \times re}{\text{precision} + reca}$
98.98%	98.99%	99%

Table 4.1 A comprehensive evaluation of different methods

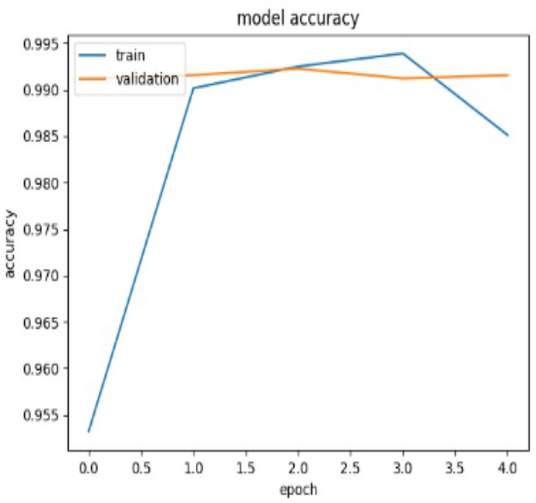

Fig 4.1 screenshot of model accuracy

In the fig 4.1 shows the training and validation accuracy of a model over five epochs, indicating high accuracy for both. However, a slight overfitting might be suggested as the training accuracy surpasses the validation accuracy, especially noticeable after the second epoch.The x-axis denotes the number of epochs, indicating how many times the model has been trained on the entire dataset. The y-axis shows the accuracy, reflecting the proportion of correct predictions by the model. Higher values on this axis represent better model performance.

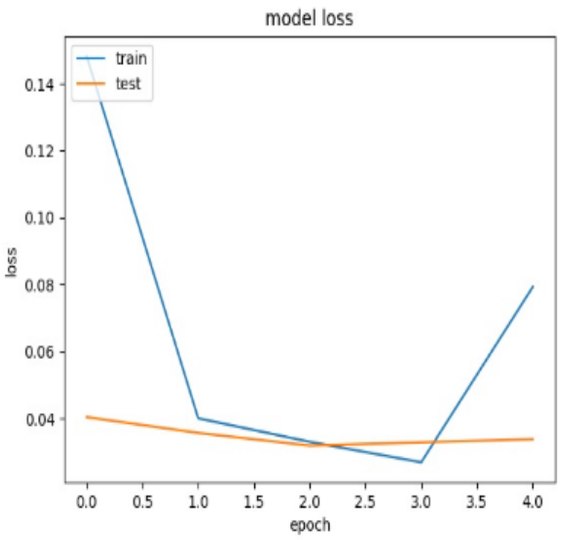

Fig 4.2 Screenshot of model loss

In the fig 4.2 shows the training and test loss over five epochs. The training loss initially drops significantly, indicating rapid learning, but rises slightly after the second epoch, suggesting overfitting. The test loss remains stable and low, indicating good generalization to unseen data.The x-axis represents the number of epochs, which is the number of times the learning algorithm has processed the entire training dataset.The y-axis represents the loss, which measures how well the model's predictions match the actual outcomes. Lower loss values indicate better model performance.

5. Conclusion

A deep learning technique has been proposed to measure the severity of depression using social media data. The campaign uses social media to instantly assess the severity of depression to help provide appropriate treatment based on the severity of depression. This study shows that deep learning can predict one disease while detecting another. In summary, while deep learning models for psychiatric diagnosis are important in the field, their real-world impact will depend on careful, practical, honest, and continuous improvement. By solving these problems, we can use the full potential of AI to improve mental health and support people's needs.

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