Exploring Sentiment Detection of Social Media Posts with Motion Aware AI

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Abstract: *In today's world, early detection of depression is a critical issue within the field of psychology. Mental health problems have become a significant global challenge, affecting more than 300 million people suffering from depression alone. With the wealth of user-generated content on social media platforms, researchers are increasingly turning to machine learning to explore whether this data can be leveraged to identify mental health issues in individuals. Depression, in particular, remains a major concern in society, and researchers worldwide continue to investigate this topic. Despite extensive research into understanding individual moods, including depression, anxiety, and stress, using data from devices like smartphones, predicting depressive moods remains an open question. Social network analysis is a key approach to address this challenge. In this paper, we propose a system for analyzing depression and detecting suicidal ideation by predicting potential suicidal acts based on the level of depression. Our study utilizes machine learning techniques to identify depressed social media users through their posts. We trained and tested classifiers to determine whether a user is experiencing depression by analyzing features extracted from their posts. We employed machine learning classification algorithms to predict different stages of depression on a scale from 0 to 100%. Data was collected in the form of posts and classified to determine whether the user was experiencing depression using machine learning algorithms. This approach aims to enable early detection of depression and other mental illnesses. A significant contribution of this study is the exploration of various features and their impact on depression detection. Furthermore, we aim to develop a deep learning model for classifying users with depression using multiple-instance learning. This model learns from user-level labels to identify post-level labels. By considering all possible post-label categories, it generates temporal posting profiles that help classify users with depression. The research demonstrates clear differences in posting patterns between users with depression and those without, which is indicated by the combined likelihood of post-label categories. In this study, machine learning is applied to process data scraped from social media users' posts, using Natural Language Processing (NLP) and the BERT algorithm to detect depression potentially more efficiently and conveniently.*

Keywords: Machine Learning, NLP, BERT Algorithm, Depression, Classification, Social Media Post

I. INTRODUCTION

In today's world, the issue of early detection of depression is of utmost importance in the field of psychology. Depression is a common mental disorder that can be exacerbated by life events, and it affects over 350 million people globally, which is approximately 5% of the world's population. Tragically, nearly 800,000 people lose their lives to suicide each year, making it the second leading cause of death among individuals aged 15-29, with depression being a major factor in many of these cases. Recent studies also reveal that depression is a leading cause of disability and contributes to various physical health problems. The rise of the internet and digital communication technologies, especially social networking platforms like Facebook, Twitter, and Instagram, has transformed how people connect and communicate electronically. These platforms not only host text and multimedia content but also allow users to express their emotions and thoughts about various topics online. While this enables open and free expression, it also provides an opportunity for healthcare professionals to gain insights into the mental state of individuals based on their online interactions. Machine learning techniques have the potential to uncover unique patterns within online communication and use them to identify the

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emotional state, including feelings like happiness, sadness, anger, anxiety, and depression among social media users. Furthermore, a growing body of research focuses on the impact of social networks on various aspects of social relationships, including breakups, mental health conditions (such as depression, anxiety, and bipolar disorder), relapses into smoking and drinking, experiences of sexual harassment, and even suicidal thoughts. Young adults, racial/ethnic minorities, essential workers, and unpaid caregivers have reported experiencing worse health outcomes, increased substance use, and higher levels of negative thinking. The transition from adolescence to young adulthood is marked by significant changes in physical, psychological, and social dimensions. During this developmental stage, individuals can exhibit various behaviors that may either contribute to normal development or lead to mental health issues. Depression can have a profound impact on a person's life, affecting their performance at work, in school, and social interactions. Regardless of your recent digital activities, it's likely that social media played a role. Whether you connected with friends on Facebook, shared cat photos, or posted your child's first steps on Instagram, social media is a significant part of modern life. People often use these platforms to express their emotions, opinions, and daily experiences through posts, photos, and videos. In this study, our objective is to analyze social media posts to identify potential indicators of depression among relevant social media users. We employ various machine-learning techniques for this purpose. The primary research goal is to leverage machine learning algorithms for detecting signs of depression in users' social media posts.

1.1 NLP (Natural Language Processing):

The research discussed in this paper falls within the domain of Natural Language Processing (NLP), specifically focusing on text classification. The history of text classification tasks traces back to early efforts in the 1960s, where researchers aimed to automatically categorize documents based on statistical analysis of specific keywords. Subsequently, similar research endeavors led to the development of rule-based text classification systems such as CONSTRUE in 1990. As time progressed, the field gradually shifted towards employing machine learning algorithms, which became more prominent around the year 2000. Apart from text categorization, machine learning has also played a pivotal role in other text-related tasks, like sentiment analysis, which concentrates on extracting opinions and sentiments from textual content. Initially, sentiment analysis was applied in conjunction with machine learning to identify positive or negative sentiments in movie reviews and was subsequently extended to various other review domains. This analysis approach also found application in diverse areas like monitoring social media content and conducting general assessments of consumer attitudes. More recently, deep learning techniques have been adopted for text classification, alongside their more prevalent usage in image classification. Notably, state-of-the-art results in multiple text-based tasks have been achieved through transfer learning methods, including Universal Language Model Fine-tuning (ULMFit) and the Google research project known as Bidirectional Encoder Representations from Transformers (BERT) for training language representations. These approaches have demonstrated significant advancements in text analysis. The BERT code and several pre-trained models have contributed to these developments.

1.2 Problem Statement

Depression has been verified to have an impact on the language of individuals. To expand a software to investigate and come across despair of social media posts of clients via tool studying techniques. This challenge aims to use natural language processing, tool studying techniques, and neural network architectures to build, tune, and have a look at models that classify social media Post of Users as "depressed" or "non-depressed.

II. LITERATURE REVIEW

Instrumental opportunities of studying the conduct of customers in social networks are actively developing. In particular, strategies of computational linguistics are efficiently utilized in studying the posts from social media.

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Sr. No.	Paper Title	Journal Author	Journal Year	Remark
1.	Depression Detection by Analyzing Social Media Posts of User	N. A. Asad, M. A. Mahmud Pranto, S. Afreen and M. M. Islam	2019	A data-analytic based model to detect depression of any human being is proposed in the paper
2.	Facebook social media for Depression Detection in the Thai Community	K. Katchapakirin, K. Wongpatikaseree, P. Yomaboot and Y. Kaewpitakkun	2018	The research, employs Natural Language Processing (NLP) techniques to develop a depression detection algorithm for the Thai language on Facebook where people use it as a tool for sharing opinions, feelings, and life events.
3.	Mining Twitter Data for Depression Detection	P. Arora and P. Arora	2019	The health tweets are analyzed for Depression, Anxiety from the mixed tweets by using Multinomial Naive Bayes and Support Vector Regression (SVR) Algorithm as a classifier in paper
4.	Sentiment analysis of social networking sites (SNS) data using machine learning approach for the measurement of depression	A. U. Hassan, J. Hussain, M. Hussain, M. Sadiq and S. Lee	2017	In the paper, researchers present how to find the depression level of a person by observing and extracting emotions from the text, using emotion theories, machine learning techniques, and natural language processing techniques on different social media platforms.
5.	Depression detection using emotion artificial intelligence	M. Deshpande and V. Rao	2017	The paper, aims to apply natural language processing on Twitter feeds for conducting emotion analysis focusing on depression.
6.	A Machine Learning based Depression Analysis and Suicidal Ideation Detection System using Questionnaires and Twitter	S. Jain, S. P. Narayan, R. K. Dewang, U. Bhartiya, N. Meena and V. Kumar	2019	The paper, proposes depression analysis and suicidal ideation detection system, for predicting the suicidal acts based on the level of depression.
7.	Depression and self-harm risk assessment in online forums.	Yates, A., Cohan, A., and Goharian, N.	2017	Yates et al. used neural network model to reveal the risks of self-harm and depression based on posts from Reddit and Twitter and showed the high accuracy of this diagnostic method.

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8.	Predicting depression from language-based emotion dynamics: longitudinal analysis of Facebook and Twitter status updates. Journal of Medical Internet Research	Seabrook, E.M., Kern, M.L., Fulcher, B.D., and Rickard, N.S	2018	O'Dea et al.examined that Twitter is progressively researched as methods for recognizing psychological well-being status, including depression and suicidality in the population.

The field of detecting the level of depression from social media posts is rapidly evolving and offers a wide range of techniques and methods. In our research, we present a detailed description of the methods we employed for identifying depression using Natural Language Processing, specifically by utilizing the BERT algorithm. Our approach consists of several key components, including data preprocessing, feature extraction, the use of machine learning classifiers, feature analysis, and the presentation of experimental results.

2.1 Objective

The targets are as follows:

- The system will continuously monitor the posts and conversations of users, and if it identifies negative or harmful behavior, it will automatically display positive content on the individual's profile, taking into account their level of depression.
- Assist the person in overcoming depression.

III. METHODOLOGY

Machine Learning Classification Techniques used for the mode

BERT Algorithm:

BERT, short for Bidirectional Encoder Representations from Transformers, is created to generate in-depth bidirectional understandings of unlabeled text by considering both the context on the left and right. Consequently, the pre-trained BERT model can be adapted by merely adding an extra output layer to create state-of-the-art models for a wide array of Natural Language Processing (NLP) tasks. We developed a new language model based on Bidirectional Encoder Representations from Transformers (BERT), adhering to the same principles. This model is designed to produce deep bidirectional representations that can be customized with an additional output layer. In our project, we utilized this output layer, referred to as a "pooled output," for binary comment classification. Out of the available pre-trained models, we selected the English-language uncased version of BERT, opting for an all-lowercase format before tokenization because case sensitivity was not particularly crucial for our social media comment classification task..
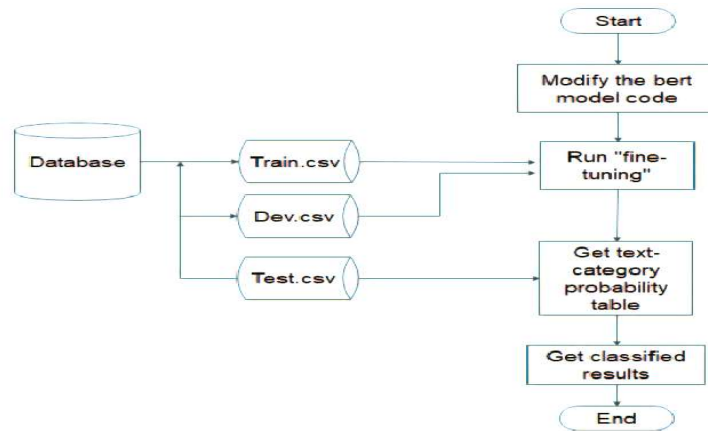

Fig.1 BERT Algorithm

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Relevant Mathematics Associated with The Project:
System Description:
S= I, O, F, DD, NDD, Failure, Success
Where,
S=System
I= Input
O=Output
F=Failure
S=Success

I is Input of system
Input I = set of Inputs
Where,
I= {Users Social media posts}

F is Function of system
F = set of Function
Where,
F1= {Input Dataset}
F2= {Json to CSV Conversion}
F3={Pre-processing}
F4={Cleaning}
F5= {Train test split}
F6= {Sentiment Dictionary}
F7= {Classifier (BERT Algorithm)}
F8={Tokenization}
O is Output of system
Output O1= {Depression detection}
Success Conditions: Product working Smoothly. depression detection successfully.
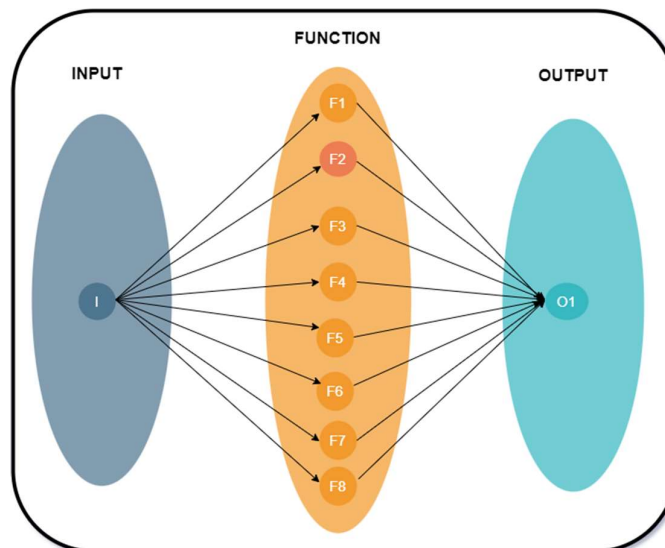**Failure Conditions:** if internet connection Unavailable.

Fig.2 Venn Diagram

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Where,
I = {Users Social media posts}
F1= {Input Dataset}
F2= {Json to CSV Conversion}
F3={Pre-processing}
F4={Cleaning}
F5= {Train test split}
F6= {Sentiment Dictionary}
F7= {Classifier (BERT Algorithm)}
F8={Tokenization}
Output O1 = {Depression detection}

IV. SYSTEM ARCHITECTURE

Depression poses a significant challenge to both personal and public health. A crucial approach to addressing this issue involves a thorough examination of an individual's behavioral traits. These traits are observable on various social networking platforms like Facebook, Twitter, Instagram, and others. Social media offers valuable insights into a person's behavior, thought patterns, mood, social networks, and opinions. The use of social networking sites, particularly among the younger generation, is on the rise. People on these platforms freely share their emotions, daily activities, and opinions on various topics. As a result, social networking sites can serve as a screening tool to assess depression levels. These platforms provide a window into a person's experiences, opinions, social interactions, and personality. Traditional methods of diagnosing patients are becoming less relevant, while user-generated content on social media posts offers a potential means to predict mental health and depression in individuals. Our project's goal is to extract information from social media posts and gain a comprehensive understanding of an individual's behavioral attributes and their responses to specific questionnaires. This information is then used to predict the user's level of depression. We conducted a quantitative study to train and test various machine learning classifiers, aiming to determine whether a social media post indicates depression based on the content initiated by the user or their activities on social media. The diagram below illustrates our depression detection model, which incorporates activity and content features. We begin by collecting all tweets from both depressed and non-depressed accounts, along with user account information and activities like the number of followers, following, post timing, mentions, and reposts. Subsequently, all posts from an account are combined into a single document, and text pre-processing is applied to these documents. This involves creating a corpus and tokenizing the posts. In this process, we can utilize the BERT Classification Algorithm.
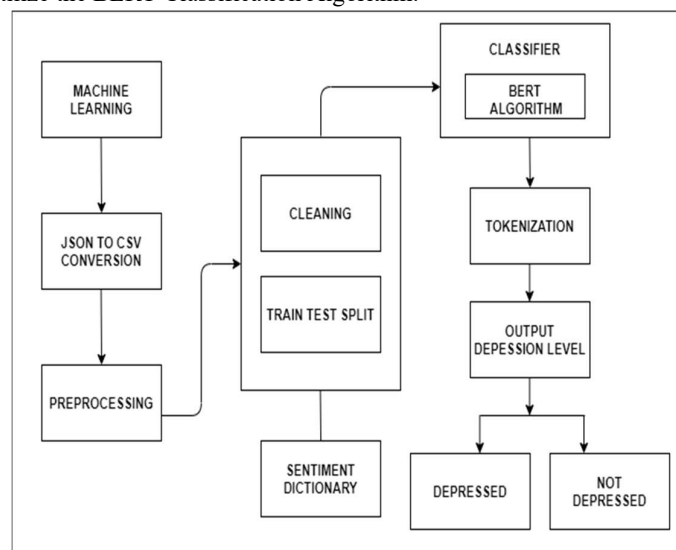

Fig.3 System Architecture

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4.1 Exiting System

The current system offers an efficient approach to assess a user's level of depression using the Naïve Bayes algorithm. The process begins with the extraction of textual data from Facebook, facilitated by the extraction class and the Facebook Graph API. Once the data is obtained, it undergoes preprocessing, which involves addressing missing or redundant attributes. Techniques such as tokenization, converting text to lowercase, word stemming, and the removal of certain words are employed during this preprocessing phase.In our proposed system, the user's Facebook posts are examined to determine whether they may be experiencing depression. However, solely analyzing posts may not yield highly accurate results. Therefore, we also analyze the user's comments, as well as their interactions with friends through chats. It's reasonable to assume that someone experiencing depression may confide in a friend, which is why we consider these interactions. Based on these analyses, users are classified as either stressed or non-stressed.
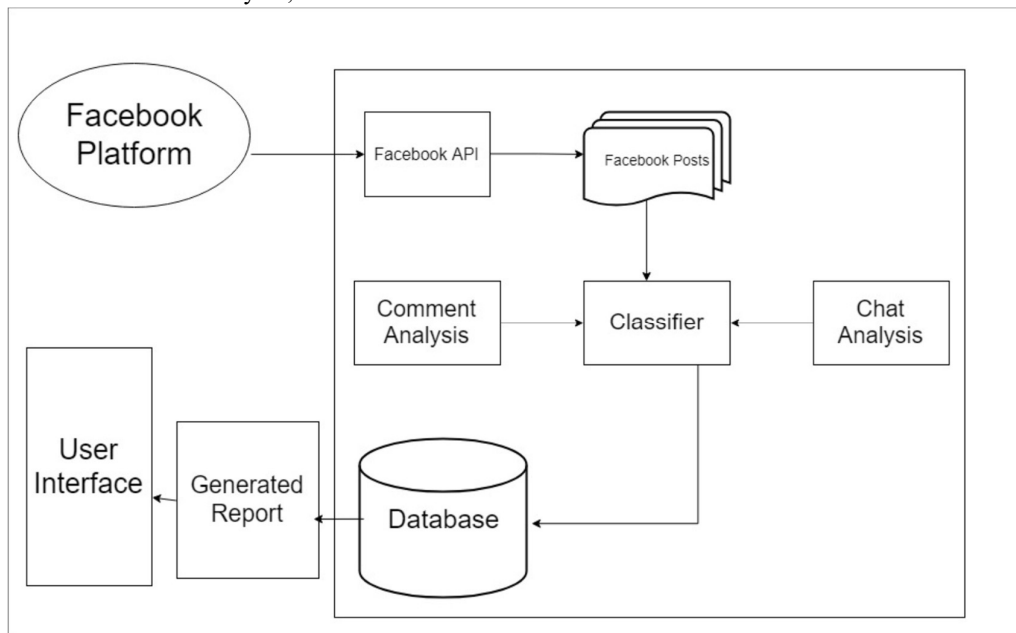

Fig.4 Existing System Architecture

V. CONCLUSION

The proposed device can also moreover help the suspected patron to keep his/her life, thru manner of the approach of know-how in advance whether or not or now no longer or now not or now not the customer is depressed or possibly the device will deliver some motivational posts to the customer based mostly on the quantity of his depression. We give up the device is probably very useful in today's world wherein most humans don't have time to satisfy our friends, percent their thoughts and feelings as we achieved in older days due to busy schedules. So, our device plays a critical feature proper right here to avoid any unwanted human loss. The device will inform their very non-public circle of relatives' members or spouses and youngsters regarding the state of affairs of a depressed man or woman. So that each own circle of relatives or pal circle will help the man or woman to come out of depression.

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