

A Review of Behavioral Analysis-Based Depression Detection Using SVM and KNN Algorithms

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Abstract: Depression, among the widely common psychological ailments across the globe, has a great influence on the psychological well-being of an individual concerning their mood, cognitive functions, and behavioral aspects. Lack of awareness and minimal availability of psychological professionals often create challenges in detecting depression at an earlier stage. From the past few years, the use of Machine Learning and Artificial Intelligence has been identified as a potential way towards detecting depression using behavior pattern identification.

It outlines a number of behavioural analysis-based techniques for diagnosing depression, such as those that use social media messaging, speech patterns, EEG signals, and physiological traits. Numerous models based on machine and deep learning approaches, including ensemble algorithms, SVM, KNN, Artificial Neural Networks, and combination models, are discussed in significant research.

Along with optimisation techniques like GA and particle swarm optimisation, feature optimisation and its significance are also identified. The current work compares the models, limitations, and data sets created by earlier research studies. The importance and future necessity of an integrated data approach and expert feature selection in the successful detection of depression are finally highlighted by the discussion.

This study aims to provide readers with an organized understanding of earlier advancements in intelligent mental health monitoring systems, while also laying the groundwork for future research.

Keywords: Behavioral Analysis, Machine Learning, Depression Detection, Data Sources

I. INTRODUCTION

A common mental ailment that significantly affects people, especially in the early phases of adolescence, is depression, often known as depressive disorder. Mood issues in later adulthood may result from it. It is believed that 5% of people, regardless of cultural background, suffer from depression, while 20% of people have lesser symptoms, such as minor depressive episodes and partial symptoms. A person's emotional emotions, cognitive capacities, and behavioral patterns are all adversely affected by depression, a complicated condition. [8] It can also be quite helpful in recognizing and managing significant stresses, particularly in academic contexts [3]. People may now more readily express their ideas, feelings, and opinions using a variety of media, such as text, images, and videos, thanks to the internet's explosive expansion. Due to its low memory consumption, low bandwidth requirements, and ease of distribution, textual communication in particular has become more popular as a method of assessing depression symptoms. Furthermore, people often change their behavior to fit in with their social environment, which may cause them to conceal their true emotional states. Due to the fact that nationality, ethnic background, and social status can be a major determinant in the development and manifestation of depression, the comprehension of depression should be ideally performed in the context of social background. [17] Due to the above-mentioned challenges, the research on the application of Artificial Intelligence and Machine Learning in the diagnosis and understanding of depression has currently been pursued by scientists. The capacity of machine learning to ideally focus on the examination of massive

information, point out the most important attributes, determine the most important connections, and create ideas on novel information enables such initiatives. [7] The present study adopts a holistic approach to detecting depression using behavioral analysis and machine learning techniques.

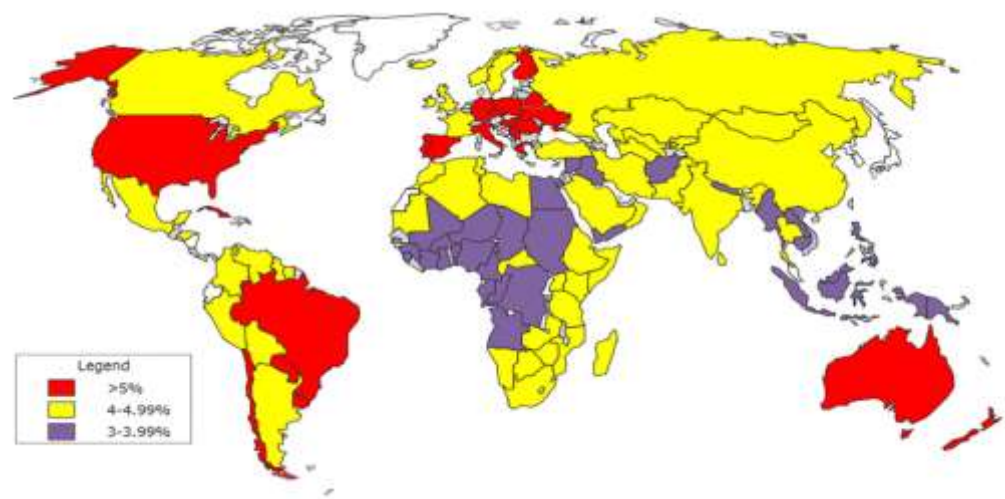


Fig 1.Rate of prevalence of depression in different countries[13].

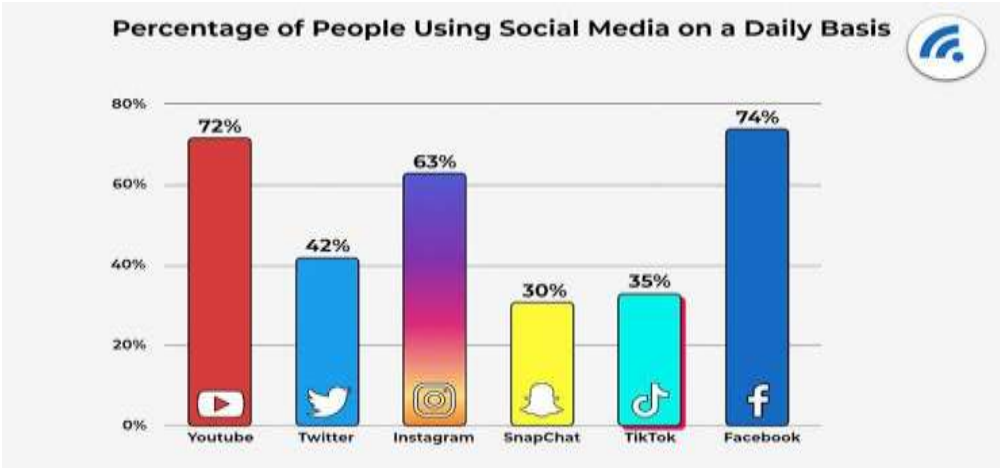


Fig 2. Percentage of People Using Social Media (Datareportal 2024)

Over 4.7 billion people in2024, or 60% of the global population, are already using social media. The sixth source is Data report in 2024.The reason why most people exhibit most of their behaviors in the majority of their time spent in social networks can very easily be explained. One can reveal positive as well as negative opinions expressed in the comments people have posted.

TABLE I:
SAMPLE TABLE FORMAT ON THE EFFECTS OF DEPRESSION

Effect of Depression	Description
Emotional Symptoms	Persistent sadness, feelings of hopelessness, and irritability.
Physical Symptoms	Sleep disturbances, and pain.
Cognitive Effects	Difficulty concentrating, memory problems.
Impact on Daily Activities	Challenges in performing daily tasks, decreased motivation, and loss of interest in hobbies.
Depressed Brain	Impaired decision-making, Affects memory and learning

Depression affects a personal life on a number of dimensions. Emotionally, it usually manifests as persistent sadness, despair, and increased irritability, making daily functioning difficult. Physiological symptoms that may add to the psychological turmoil include fatigue, changes in appetite, sleep disturbances, and unwanted sudden physical discomfort. Depression has especially disastrous effects on cognition; individuals under such symptoms have a difficulty in concentrating, making decisions, or remembering details, which makes it hard for them to carry out everyday tasks. Moreover, social disengagement and strained interpersonal relations have also been linked with depression, thereby further isolating them and deepening their feelings loneliness and abandonment.

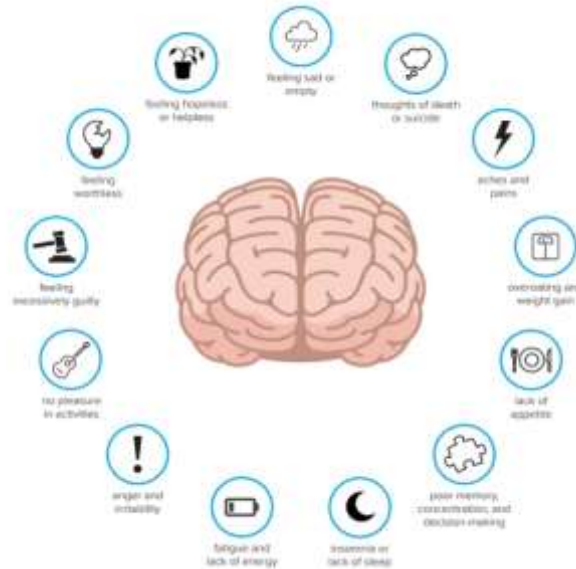


Fig 3. Symptoms of Depression (*medicalnewstoday.com*)

II. METHODS FOR DETECTING DEPRESSION

Determining the best treatment option for a psychiatric ailment requires a critical clinical assessment. The severity of symptoms, the distress people experience from these manifestations, the benefits and risks associated with specific treatments, the disabilities caused by the symptoms, and the possible adverse impact on other conditions are a few factors considered when weighing all aspects. One challenging task that requires the expertise of a highly qualified medical expert is assessing the severity of the condition. This can be achieved through various methods, including clinical assessments, expert recommendations, and text-based descriptions [14].

2.1 Text-Based Analysis of Social Media

The World Wide Web has grown at an exponential rate and has made it possible for people with ideas, feelings, and opinions to be voiced by the public. Social sites such as Facebook and Twitter have also become mediums for people with mental illness as expression and communication tools. Text, pictures, and conversation are ways that convey emotional expression inside. A depressed person will never display who they really are. Such people are less likely to begin a conversation with strangers. Such people feel a strong need to communicate through text messaging. There has been an observation that the use of text messages has increased as a mark of sadness because messages can be transferred, they require less memory, and they require less resource space to transport them. The study employs the use of word analysis within the social network to seek mental health issues. [15].

2.2 Evaluation through Speech

The ability to recognize facial expressions, body gestures, voice, motions, and eye movements are examples of technological advancements in emotional detection that may aid in the creation of an objective technique for diagnosing depression. Verbal

affect is connected to the speakers' general mood and how they convey their feelings. Speech has a major advantage over other emotional detection methods since previous studies have demonstrated the unique features of speech from sad individuals.[16].

Thus, usage of social media could very well be associated with the risk of mental health problems. Not all social media sites are the same when it comes to the influence of mental health concerns. People exhibiting severe symptoms of depression are spending visibly much more time on these social media pages than those who experience lower symptoms of depression, suggesting a clear relationship existing between the usage of these media platforms and the degree of depression, as evident from the information provided in the image below. It also raises the potential for people with severe depression to use these media platforms as an escape or coping tool, potentially worsening feelings of loneliness or inadequacy, among others. (17)

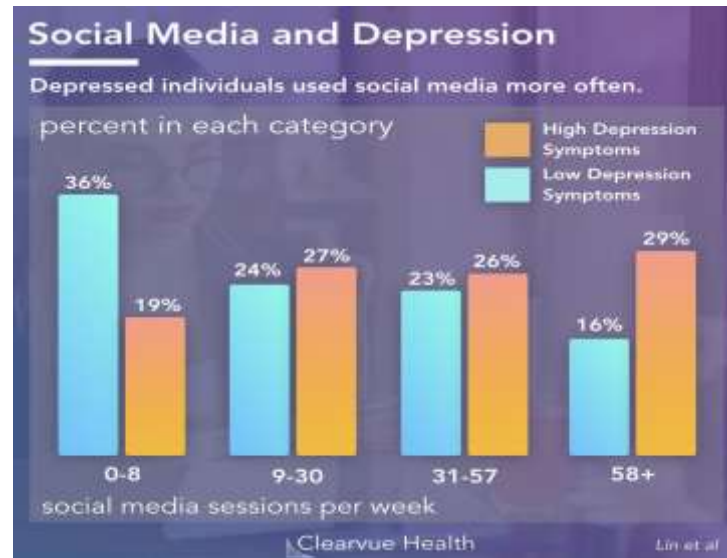


Fig 4. Connection between social media use and depression(<https://www.clearvuehealth.com>)

III. LITERARURE REVIEW

No	Title	Author(s)	Method	Year	Dataset	Result
i.	Depression Detection by Analyzing Social Media Post of User (5)	Rutuja K Bhoge, Snehal A Nagare, Swapanali P Mahajan, Prajakta S Kor	Bidirectional Encoder Representations from Transformers (BERT)	2022	Twitter, Facebook data	85%
ii.	A machine learning approach to immobility detection in mice during the tail suspension test for depressive-type behavior analysis. (13)	Martins, Thiago Matias, Jonathan Paul Brown Driemeyer, Tauana Prestes Schmidt, Antonio Carlos Sobieranski, Rafael Cypriano Dutra, and Tiago Oliveira Weber	TST, SVM, CNN, DT, MLP	2023	The dataset comprised videos of rodent movements recorded during the TST	87.5%

iii.	Enhancing the efficacy of depression detection system using optimal feature selection from EHR. (12)	Sweta Bhadra & Chandan Jyoti Kumar	ANN, SVM, Random Forest	2023	Psychological data	88%
iv.	A Hybrid Deep Learning Model for Predicting Depression Symptoms From Large-Scale Textual Dataset(19)	S. Almutairi, M. Abohashrh, H. H. Razzaq, M. Zulqarnain, A. Namoun, and F. Khan	CNN, LSTM	2024	Twitter, Reddit, or other public forums	90%
v.	Depression Detection from Social Media Text Analysis using Natural Language Processing Techniques and Hybrid Deep Learning Model (7)	Tejaswini, Vankayala, Korra Sathya Babu, and Bibhudatta Sahoo	Hybrid model: Fast text Convolution Neural Network with Long Short-Term Memory (FCL)	2024	Dataset 1: 6,500 records from Reddit (balanced) - Dataset2: Tweets from Twitter (unbalanced)	88%
vi.	Predicting Postpartum Depression with Aid of Social Media Texts Using Optimized Machine Learning Mode (15)	Devasagayam Suganthi, Arumugam Geetha	Osprey Parameter Optimized MLP (OPOMLP)	2024	Social Data	94%

IV. METHODOLOGY

4.1 Literature Collection

Reputable academic sites as IEEE 12 Xplore, Springer, Science Direct, ACM Digital Library, and Google Scholar were used to compile pertinent research papers. The selection mainly concentrated on contemporary research that identifies depression using machine learning, behavioral data, social media analysis, speech processing, EEG signals, and physiological indicators.

4.2 Review the Selection Standards

The selected studies were filtered using the following criteria:

Making use of behavioral data, such as text, voice, EEG, and physiological signals

Applying machine learning or deep learning techniques

There are metrics available for assessing performance.

Relevance to assessing mental health or identifying depression

4.3 Classification of Methods for Identifying Depression

Data modalities, including social media text, speech signals, EEG data, and physiological markers, were used to classify the assessed material. The set of techniques for feature extraction includes statistical analysis measures, signal processing techniques, sentiment analysis, and psycholinguistic features. The techniques of the evolution type, such as Genetic Algorithm (GA) or Particle Swarm Optimization (PSO), are some of the techniques of the mentioned type of machine learning approaches. The K-Nearest Neighbors (KNN), ensembles, Neural Networks, and SVM are some of the types of classification techniques.

4.4 Comparative Study

Every chosen study was examined on terms of:

Sources of data and methods for preprocessing

Strategies for feature extraction and selection

Hybrid or ensemble methods and machine learning models

Evaluation measures such F1-score, recall, accuracy, and precision

4.6 Identifying Research Gaps

The comparison analysis revealed important research constraints, including limited multimodal integration, insufficient feature optimization, a lack of real-time adaptability, and challenges with scalability and cross-cultural validation.

V. CONCLUSION

This review study looked at current methods for detecting depression using machine learning and behavioral analysis. The potential of machine learning models like SVM, KNN, and ensemble techniques for early and non-invasive depression identification is demonstrated by studies using social media content, speech signals, and physiological data. However, issues including data imbalance, limited multimodal integration, and real-time applicability still exist. Future studies should concentrate on creating scalable, moral, and real-time depression detection systems as well as incorporating several behavioral modalities

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