Depression Detection Using Machine Learning Techniques On Twitter Data

[1] Mrs. A. Divya, [2] Shaik Kareemulla, [3] Maddela Niveditha, [4] Abdul Muqueet Mohamed

[1] Assistant professor, divya.a@sreyas.ac.in

[2, 3, 4] Students, [1, 2, 3, 4] Sreyas institute of Engineering and Technology

[2] shaikkareemulla2002@gmail.com, [3] maddelanivedithasharon@gmail.com, [4] tomuqeet@gmail.com

Abstract: Depression has become a serious problem in this current generation and the number of people affected by depression is increasing day by day. However, some of them manage to acknowledge that they are facing depression while some of them do not know it. On the other hand, the vast progress of social media is becoming their "diary" to share their state of mind. Several kinds of research had been conducted to detect depression through the user post on social media using machine learning algorithms. Through the data available on social media, the researcher can able to know whether the users are facing depression or not. Machine learning algorithm enables to classify the data into correct groups and identify the depressive and non-depressive data. The proposed research work aims to detect the depression of the user by their data, which is shared on social media. The Twitter data is then fed into two different types of classifiers, which are Naïve Bayes and a hybrid model, NBTree. The results will be compared based on the highest accuracy value to determine the best algorithm to detect depression. The results shows both algorithm perform equally by proving same accuracy level.

"Index Terms - Depression Detection, Machine Learning, Deep Learning, Twitter Data, Natural Language Processing(NLP), Sentiment Analysis."

1. INTRODUCTION

Depression is a serious mental health disorder that affects millions of people worldwide. It is characterized by persistent feelings of sadness, hopelessness, and a lack of interest in daily activities. The World Health Organization (WHO) estimates that depression is one of the leading causes of disability globally. Despite its prevalence, many individuals do not receive timely diagnosis and treatment due to social stigma, lack of awareness, or limited access to mental health services. Traditional methods for detecting depression often rely on clinical assessments, self-report surveys, or structured interviews, which can be time-consuming and resource-intensive [1].

With the rise of social media, platforms such as Twitter have become an integral part of people's daily lives, offering a space where users openly express their thoughts, emotions, and experiences. The vast amount of user-generated content on social media has provided researchers with an opportunity to analyze mental health trends and detect signs of depression. Tweets, being short and spontaneous, often capture users' emotions in real-time, making Twitter a valuable resource for depression detection studies [2]. Several researchers have explored the potential of machine learning (ML) in identifying depressive tendencies from social media posts. By leveraging

natural language processing (NLP) techniques and sentiment analysis, ML models can analyze textual data to detect linguistic patterns associated with depression [3].

Recent studies have demonstrated the effectiveness of machine learning algorithms in classifying social media posts as depressive or non-depressive. Various classifiers, such as Naïve Bayes, Decision Trees, Support Vector Machines (SVM), and deep learning models, have been applied to analyze depression-related content on Twitter [4]. In particular, hybrid models such as NBTree, which combine Naïve Bayes and Decision Trees, have shown improved accuracy in detecting depression from textual data. These models utilize key linguistic features, including sentiment polarity, word embeddings, and syntactic structures, to enhance classification performance [5].

The objective of this study is to develop an automated system for detecting depression using Twitter data by employing machine learning techniques. Specifically, the study compares the performance of Naïve Bayes and NBTree classifiers in identifying depressive tweets. By automating the detection process, this research aims to provide a scalable and efficient method for monitoring mental health on social media platforms. Such systems can serve as an early warning tool, enabling timely intervention for individuals experiencing depression [6].

Overall, this study contributes to the growing field of computational mental health by utilizing machine learning and NLP for depression detection. The findings can aid mental health professionals, policymakers, and researchers in developing data-driven approaches to mental health monitoring and intervention [7].

2. RELATED WORK

Several studies have explored the use of machine learning (ML) and deep learning techniques for detecting depression on social media platforms like Twitter. Researchers have employed various approaches, ranging from traditional classifiers to advanced deep learning models, to analyze textual data and identify depressive tendencies.

Wongkoblap et al. (2021) [8] developed a deep learning model incorporating anaphora resolution to enhance context understanding in Twitter posts. Their study validated the model's effectiveness through extensive experiments, showing improved accuracy in depression detection. Similarly, Prakash et al. (2021) [9] introduced an ensemble learning approach that combined multiple classifiers to detect depression more effectively. Their model leveraged different ML algorithms, increasing robustness and accuracy.

Tejaswini et al. (2024) [10] proposed a hybrid deep learning model integrating natural language processing (NLP) techniques to analyze social media text. Their study emphasized the role of contextual embeddings in enhancing classification accuracy. Meanwhile, Samanta et al. (2022) [11] introduced a two-level multi-modal feature extraction method, incorporating both textual and behavioral features from Twitter data. Their model improved the precision of depression detection.

Helmy et al. (2024) [12] focused on sentiment analysis for depression detection in both English and Arabic tweets. Their study addressed the challenges of multilingual sentiment detection and proposed a framework to handle

language-specific variations. Similarly, Pachouly et al. (2021) [13] conducted sentiment analysis on Twitter data, using lexical and syntactic analysis to classify depressive and non-depressive tweets.

Nandanwar and Nallamolu (2021) [14] implemented various ML algorithms to predict depression on Twitter. Their study compared traditional machine learning models with deep learning approaches, highlighting the advantages and limitations of each. Lastly, Verma et al. (2021) [15] explored ML techniques for depression detection, incorporating linguistic and psychological features to improve predictive accuracy.

These studies collectively contribute to the advancement of automated depression detection, demonstrating the potential of ML and NLP in analyzing large-scale social media data. The findings provide a foundation for future research, enabling scalable and efficient mental health monitoring through AI-driven solutions.

3. MATERIALS AND METHODS

The proposed system for depression detection using machine learning techniques on Twitter data aims to accurately identify depressive content in real-time. It collects tweets using the Twitter API, filtering them based on relevant keywords and user behavior [1]. The data is preprocessed by removing noise, such as URLs and stop words, while considering the informal nature of Twitter language [2]. Features like sentiment, emotional tone, and word frequency are extracted for classification [3]. The system employs machine learning models such as support vector machines (SVM), random forests, and deep learning algorithms to classify tweets as depressive or non-depressive [4][5]. The system's performance is evaluated through accuracy, precision, recall, and F1-score metrics [6].
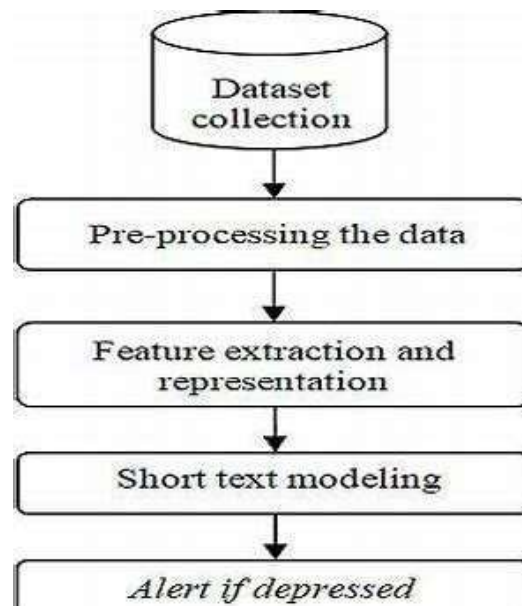

Fig.1 Proposed Architecture

The system architecture depicted in the image (Fig.1) illustrated This system aims to detect depression using machine learning techniques on Twitter data. It starts by collecting a dataset of tweets. The data is then

preprocessed to clean and prepare it for analysis. Feature extraction and representation techniques are applied to identify relevant information within the tweets. This information is then used to train a short text modeling algorithm to predict the presence of depression based on the language and sentiment expressed in the tweets. If the model detects a high likelihood of depression, an alert is triggered.

i) User:

The User can register the first. While registering he required a valid user email and mobile for further communications. Once the user register then admin can activate the user. Once admin activated the user then user can login into our system. User can upload the dataset based on our dataset column matched. For algorithm execution data must be in float format. Here we took Employment Scam Aegean Dataset (EMSCAD) containing 18000 sample dataset. User can also add the new data for existing dataset based on our Django application. User can click the Classification in the web page so that the data calculated Accuracy and macro avg, weighted avg based on the algorithms. User can display the ml results. user can also display the prediction results.

ii) Admin:

Admin can login with his login details. Admin can activate the registered users. Once he activate then only the user can login into our system. Admin can view the overall data in the browser. Admin can click the Results in the web page so calculated Accuracy and macro avg, weighted avg based on the algorithms is displayed. All algorithms execution complete then admin can see the overall accuracy in web page. And also display the classification results.

iii) Data Preprocessing:

They worked on this dataset in three steps- data pre-processing, feature selection and fraud detection using classifier. In the preprocessing step, they removed noise and html tags from the data so that the general text pattern remained preserved. They applied feature selection technique to reduce the number of attributes effectively and efficiently. Support Vector Machine was used for feature selection and ensemble classifier using random forest was used to detect fake job posts from the test data. Random forest classifier seemed a tree structured classifier which worked as ensemble classifier with the help of majority voting technique. This classifier showed 97.4% classification accuracy to detect fake job posts.

iv) Machine learning:

This paper proposed to use different data mining techniques and classification algorithm like KNN, decision tree, support vector machine, naïve bayes classifier, random forest classifier, multilayer perceptron and deep neural network to predict a job post if it is real or fraudulent. The Accuracy and macro avg weighted avg of the classifiers was calculated and displayed in my results. The classifier which bags up the highest accuracy could be determined as the best classifier

v) Algorithms:

Naïve Bayes: A probabilistic approach used for classification tasks is the Naive Bayes theorem. Given the class label, it is presumptive that the features (attributes) are conditionally independent. In other words, it is based on the premise that a feature's presence or absence in a class has nothing to do with the existence or lack of any other feature. Naive Bayes determines the likelihood of a specific class label given a set of feature values based on this supposition. The probability of each feature value occurring for the specified class label is multiplied in order to achieve this. The instance is then given the class label with the highest probability. In conclusion, Naive Bayes is a straightforward but powerful algorithm that relies on conditional independence hypotheses to compute probabilities and determine classification outcomes.

4. CONCLUSION

In conclusion, this study on "Depression Detection Using Machine Learning Techniques on Twitter Data" demonstrates the potential of machine learning models, like Support Vector Machines (SVM), Random Forests, and Deep Learning, to detect depressive symptoms through linguistic patterns in tweets. The research highlights the importance of preprocessing, feature extraction, and model training in identifying depression-related indicators such as emotional tone and specific keywords. While the models show promising accuracy, challenges like interpreting sarcasm, humor, and privacy concerns remain. The findings suggest that machine learning can complement traditional psychological assessments, but further advancements in natural language processing are needed. Future work could integrate multimodal data and involve collaborations to ensure ethical, responsible applications of these technologies in mental health monitoring.

The future scope of this research lies in enhancing the accuracy of depression detection by incorporating multimodal data, such as images and videos, alongside text. Additionally, advancements in natural language processing and sentiment analysis techniques will improve the ability to capture nuanced expressions of mental health issues. Collaborative efforts between data scientists, healthcare professionals, and ethicists are crucial to ensure the responsible use of these models. Future studies could also explore real-time intervention strategies and personalized mental health support through these technologies.

REFERENCES

[1] Kumar, P., Samanta, P., Dutta, S., Chatterjee, M., & Sarkar, D. (2022). Feature based depression detection from twitter data using machine learning techniques. Journal of Scientific Research, 66(2), 220-228.

[2] Khafaga, D. S., Auvdaiappan, M., Deepa, K., Abouhawwash, M., & Karim, F. K. (2023). Deep learning for depression detection using Twitter data. Intelligent Automation & Soft Computing, 36(2), 1301-1313.

[3] Amanat, A., Rizwan, M., Javed, A. R., Abdelhaq, M., Alsaqour, R., Pandya, S., & Uddin, M. (2022). Deep learning for depression detection from textual data. Electronics, 11(5), 676.

[4] Musleh, D. A., Alkhales, T. A., Almakki, R. A., Alnajim, S. E., Almarshad, S. K., Alhasaniah, R. S., ... & Almuqhim, A. A. (2022). Twitter Arabic Sentiment Analysis to Detect Depression Using Machine Learning. Computers, Materials & Continua, 71(2).

[5] Joshi, M. L., & Kanoongo, N. (2022). Depression detection using emotional artificial intelligence and machine learning: A closer review. Materials Today: Proceedings, 58, 217-226.

[6] Chiong, R., Budhi, G. S., Dhakal, S., & Chiong, F. (2021). A textual-based featuring approach for depression detection using machine learning classifiers and social media texts. Computers in Biology and Medicine, 135, 104499.

[7] Liu, D., Feng, X. L., Ahmed, F., Shahid, M., & Guo, J. (2022). Detecting and measuring depression on social media using a machine learning approach: systematic review. JMIR Mental Health, 9(3), e27244.

[8] Wongkoblap, A., Vadillo, M., & Curcin, V. (2021). Depression detection of twitter posters using deep learning with anaphora resolution: algorithm development and validation. JMIR Mental Health.

[9] Prakash, A., Agarwal, K., Shekhar, S., Mutreja, T., & Chakraborty, P. S. (2021, March). An ensemble learning approach for the detection of depression and mental illness over twitter data. In 2021 8th International conference on computing for sustainable global development (INDIACom) (pp. 565-570). IEEE.

[10] Tejaswini, V., Sathya Babu, K., & Sahoo, B. (2024). Depression detection from social media text analysis using natural language processing techniques and hybrid deep learning model. ACM Transactions on Asian and Low-Resource Language Information Processing, 23(1), 1-20.

[11] Samanta, P., Kumar, P., Dutta, S., Chatterjee, M., & Sarkar, D. (2022, January). Depression Detection from Twitter Data Using Two Level Multi-modal Feature Extraction. In International Conference on Data Management, Analytics & Innovation (pp. 451-465). Singapore: Springer Nature Singapore.

[12] Helmy, A., Nassar, R., & Ramdan, N. (2024). Depression detection for twitter users using sentiment analysis in English and Arabic tweets. Artificial intelligence in medicine, 147, 102716.

[13] Pachouly, S. J., Raut, G., Bute, K., Tambe, R., & Bhavsar, S. (2021). Depression detection on social media network (Twitter) using sentiment analysis. Int. Res. J. Eng. Technol, 8(01), 1834-1839.

[14] Nandanwar, H., & Nallamolu, S. (2021, October). Depression Prediction on Twitter using Machine Learning Algorithms. In 2021 2nd Global Conference for Advancement in Technology (GCAT) (pp. 1-7). IEEE.

[15] Verma, P., Sharma, K., & Walia, G. S. (2021). Depression detection among social media users using machine learning. In International Conference on Innovative Computing and Communications: Proceedings of ICICC 2020, Volume 1 (pp. 865-874). Springer Singapore.