IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 6, May 2026
Impact Factor: 8.2

AI ased Suicidal Behaviour

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Abstract: *It is web-based application which is very much helpful in the medical sector. Suicide is a critical mental health issue and one of the leading causes of death worldwide. Several studies in suicidology claim that emotional dysregulation is a factor triggering suicidal behaviour. In today's digital age, individuals often express suicidal ideation on social media platforms to seek help, empathy, or advice. The primary objective of this study is to classify suicide notes based on their emotional content using machine and deep learning algorithms. We proposed an innovative approach to automatically identify emotional changes in a suicide note's content, leveraging these shifts as key indicators of suicidal ideation. The goal is to automatically identify the correlation between latent emotional states in suicide notes and their classification as either suicidal or non-suicidal. We employed a term frequency and inverse document frequency and random forest model to analyze emotional patterns and address various binary classification scenarios. In this project we have achieved the 91.25% accuracy using random forest. Also we have used knn model for hospital recommendation.*

Keywords: Machine Learning, Term Frequency Inverse Document Frequency

I. INTRODUCTION

The World Health Organization estimates that each year, more than 700,000 people take their own lives1. Suicide remains a global health crisis as the leading cause of death among people of all ages. The presence of persistent thoughts, contemplations, or plans related to self-harm or death is known as suicidal ideation and is frequently a precursor to actual suicide attempts. In order to reduce suicide rates and provide appropriate mental health support, early detection of suicidal ideation and intervention to protect those at risk are essential steps. For the early detection of suicidal ideation, it is difficult to integrate numerous psychological, social, and environmental factors. Especially among young people, suicide is one of the leading causes of death worldwide. As a result, determining who is at risk is an essential public health priority. The identification of factors like mental illness, agitation, or previous suicidal behavior is typically the foundation of the majority of traditional approaches to assessing the risk of suicide. However, when it comes to predicting suicidal thoughts or actions, they are only marginally better than chance. A growing interest in using artificial intelligence (AI) to improve suicide risk prediction stems from this limitation. To detect suicidal ideation among social media users and individuals with mental illnesses like schizophrenia or depression, a number of AI-based systems have already been developed. These systems typically employ machine learning (ML) and deep learning (DL) techniques that are trained on linguistic and acoustic patterns derived from speech or text data. Although text-based AI systems for suicide risk detection have demonstrated promising results, their integration into clinical practice is hindered by issues such as inconsistent data quality, lack of standardization, and inadequate validation against clinical benchmarks. A benchmark dataset containing standardized and structured vocal and textual samples is necessary to close these gaps. Strong ML and DL models could be trained on such a dataset, which would include explicit and implicit linguistic and acoustic features linked to suicide outcomes. However, there is currently no such standardized dataset. This paper proposes a method for creating textual and vocal datasets from people who have thought about or attempted suicide. This makes it possible to identify characteristics that distinguish ideation from attempts. Additionally, it examines relevant suicide theories and text-based suicide detection systems that may serve as a foundation for AI-driven research in the future with the goal of comprehending and anticipating the transition from

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suicidal thoughts to actions. Using this framework, it is possible to develop trustworthy, data-driven tools to aid in the promotion of mental health care prevention and early detection.

II. LITERATURE SURVEY

According to Joseph Aina et al., the contribution of this research is a system that can simultaneously generate a comprehensive dataset of mental disorders and predict mental disorders based on facial emotional cues. [1]. In the author's hybrid architecture for the detection of mental disorders, the cutting-edge YOLOv8 object detection algorithm is used to identify and classify visual cues associated with particular mental disorders. To achieve accurate predictions, an integrated learning architecture based on the fusion of Convolution Neural Networks (CNNs) and Visual Transformer (ViT) models is developed to for man ensemble classifier that predicts the presence of mental illness (e.g. depression, anxiety, and other mental disorder).

According to Engel Hernández-Castaeda et al., find a correlation between the latent emotional states in suicide notes and the individuals' classification as either suicidal or non-suicidal. [2]. The author dealt with a variety of binary classification scenarios and examined emotional patterns by employing a long-short-term memory (LSTM) neural network. Results demonstrated an F-measure exceeding 80% in all suicide note classification scenarios.

Hamideh Ghanadian's [3] results were compared to cutting-edge NLP classification models, particularly those based on the BERT family structures. When trained on the real-world dataset, UMD, these conventional models tend to yield F1-scores ranging from 0.75 to 0.87. Our synthetic data-driven strategy is guided by social factors, which results in consistent F1 scores of 0.82 for both models. This indicates that the richness of topics in synthetic data can close the performance gap between various model complexities. Yan ding [4] says that this study uses text-level mining of college students' Sina Weibo data to find depression among them. First, convert college Sina Weibo text data into machine learning-compatible input data. Deep neural networks are used for feature extraction. In order to classify the input data and, ultimately, make depression recognition possible, a deep integrated support vector machine (DISVM) algorithm is used. The recognition model becomes more stable as a result of DISVM, and the diagnosis of depression becomes somewhat more accurate. Through the use of Sina Weibo data, simulation experiments demonstrate that the proposed depression recognition scheme is capable of identifying potential depression patients among college students. A Natural Language Processing (NLP) model for word-level text analysis and a voice quality analysis model for the tense to breathy dimension were developed by Hanadi Solieman [5]. The voice quality model scored 0.76, while the text analysis model performed the best for non-depressed (depressed) individuals with an F1 score of 0.8 (0.42). As a result, we had two models that would be implemented in a system for the diagnosis of depression.

Zhiyong wang [6] presents a method for recognizing audio depression that is based on the convolution neural network and generative antagonism network models. First of all, preprocess the data set, remove the long-term mute segments in the data set, and splice the rest into a new audio file. Then, the features of speech signal, such as Mel-scale Frequency Cepstral Coefficients (MFCCs), short-term energy and spectral entropy, are extracted based on audio difference normalization algorithm.

Nafiz Al Asad [7] this paper proposed a model that takes a username and analyzes the social media posts of the user to determine the levels of vulnerability to depression. The machine learning model is trained to classify the depression criteria in six ranges (Considered Normal, Mild, Moderate, Borderline, Severe, Extreme). When the percentage is above the borderline (more than 55%), the verdict is lower. The collected tweets and the facebook posts are analyzed by the model and labeled the user as depressed or non-depressed.

According to Kuhaneswaran A/L Govindasamy [8,] the proposed study aims to identify depressed social media users based on their data. The Twitter data are then fed into Naive Bayes and a hybrid model called NB Tree, two different types of classifiers. Using the highest accuracy value, the results will be compared to determine which algorithm is best for detecting depression. The results shows both algorithm perform equally by proving same accuracy level.

Alessandro Pigoni [9] Author conducted a systematic review of ML studies evaluating suicidal behaviors exclusively in psychiatric clinical populations. Following the PRISMA guidelines, a systematic literature search was conducted

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on PubMed, EMBASE, and Scopus from the beginning until November 17, 2022. Original research using ML techniques to assess the risk of suicide or predict suicide attempts in the psychiatric population were included. The transparent reporting of a multivariable prediction model for individual prognosis or diagnosis (TRIPOD) guidelines was used to conduct a risk assessment for bias. Approximately 1032 studies were retrieved, and 81 of them were used in the qualitative synthesis because they met the inclusion criteria. Clinical and demographic features were the most frequently employed and random forest, support vector machine, and convolutional neural network performed better in terms of accuracy than other algorithms when directly compared.

Priya Metri [10] this review aims to conduct a comprehensive examination of the etiological factors contributing to the development of suicidal thoughts in students, with the goal of enabling early detection through the application of AI and machine learning techniques. This paper aims to review the state of the art, highlight its shortcomings, and emphasize the necessity of moving toward hybrid and ensemble deep learning models, which have shown early promise but have not been thoroughly examined in the literature.

III. PROPOSED METHOD AND ALGORITHM

Proposed Methodology

Suicide is one of the leading causes of death all over the world, especially among young adults and those in mental distress. Before taking any action, a lot of people who are thinking about suicide express their feelings, hopelessness, or intention via text on social media platforms, chat messages, or personal blogs. However, due to the subtle nature of the language used to convey distress and the enormous volume of textual data generated each day, timely identification of such high-risk individuals remains a major challenge. Manual content monitoring and keyword-based filtering, two common suicide detection methods, frequently fail to comprehend the meaning, emotion, and context of textual expressions. Due to their high rate of false positives and false negatives, these techniques have limited practical application. As a result, we urgently require a machine-learning system that is capable of more accurately and reliably detecting textual suicidal intent. The proposed system aims to automatically analyze text data, identify suicidal intent, and provide preventive support by utilizing Natural Language Processing (NLP) and Machine Learning (ML) techniques. The system is capable of effectively learning linguistic patterns associated with suicidal tendencies by utilizing a Random Forest classifier for intent detection and TF-IDF (Term Frequency–Inverse Document Frequency) for feature extraction. In addition, it will identify individuals at risk and provide resources for mental health and preventative measures, ensuring that distressed individuals receive assistance promptly.

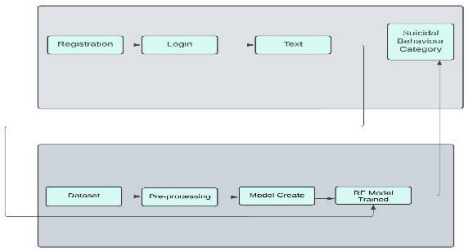

Fig1. Proposed Architecture

Algorithms

Random Forest

An artificial intelligence technique called an irregular timberland is used to deal with issues with order and relapse. It uses group realizing, which is a procedure that joins numerous classifiers to give answers for complex issues. Numerous choice trees make up an irregular woodland calculation. Through packing or bootstrap totaling, the "backwoods" created by the irregular timberland calculation is prepared. Packing is a group meta-calculation that works on the exactness of AI calculations. The (arbitrary) backwoods calculation shows the result in light of what the choice trees expected. It predicts by taking the normal or mean of the result from different trees. The result's

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accuracy improves as the number of trees increases.

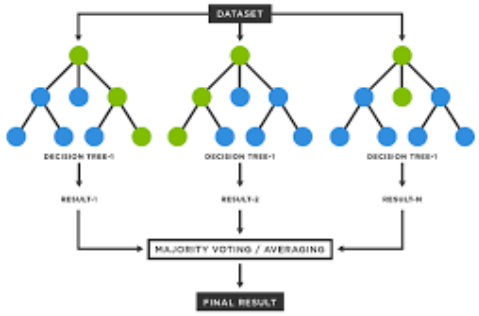

Fig.2. Random forest Architecture

KNN

The k-NN portrayal estimation can be improved by checking the responsibility of all k neighbors according to their distance from the request point, giving closer neighbors a clearer burden. The KNN classifier recommends industries to farmers for crop sales based on distance.

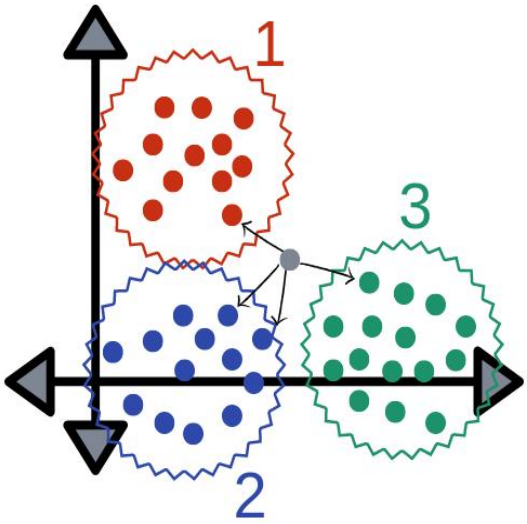

Fig3. KNN Architecture

IV. RESULTS AND DISCUSSION

Learning model is partially implemented in that we are recommending the movies, youtube videos to user once the user in depression mode based on the query or QA. In this paper we are trained total 2 classifiers are trained and used for recommendation. The total 1800 entries are present in the dataset Out of them we have split the dataset into two categories training and testing. For training we have used 1620 entries and 180 entries for testing. We have achieved the 97.25% accuracy as shown in the fig4 by using random forest model. Also we are recommending the hospital by KNN model.

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Accuracy: 0.9761904761904762

Classification Report:
              precision    recall  f1-score   support

           0       0.97      0.98      0.98       147
           1       0.98      0.97      0.98       147
```

Fig4. Performance Metric

V. CONCLUSION

In conclusion, the Suicidal Behaviour Detection System presents an intelligent and automated approach to identifying suicidal intent from textual data using machine learning. By integrating both the user interface and the machine learning backend, the system ensures smooth interaction, accurate analysis, and meaningful classification of suicidal behaviour categories. The combination of TF-IDF feature extraction and the Random Forest algorithm enhances the model's ability to detect subtle linguistic cues associated with suicidal ideation. Furthermore, the use of effective preprocessing techniques such as tokenization, stop word removal, and lemmatization ensures data quality and model reliability. Overall, this system serves as a valuable tool for early identification of at-risk individuals, offering timely intervention opportunities and contributing to suicide prevention efforts through the responsible use of artificial intelligence.

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