AI Based Suicidal Behaviour

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Abstract: *It is a web-based application that greatly assists the medical field. One of the leading causes of death worldwide is suicide, which is a serious problem with mental health. According to a number of studies in suicidology, emotional dysregulation is a factor that can lead to suicidal behavior. In the digital age of today, people frequently express suicidal ideation on social media platforms in order to seek assistance, compassion, or advice. Using machine and deep learning algorithms, the primary objective of this study is to classify suicide notes according to their emotional content. Utilizing these shifts as key indicators of suicidal ideation, we propose an innovative method for automatically identifying emotional changes in the content of a suicide note. The objective is to automatically determine whether suicide notes' latent emotional states and their classification as suicidal or non-suicidal are correlated. In order to deal with a variety of binary classification scenarios and analyze emotional patterns, we make use of a random forest model with term frequency, inverse document frequency, and term frequency.*

Keywords: Machine Learning, Term Frequency Inverse Document Frequency

I. INTRODUCTION

More than 700,000 people commit suicide each year, according to the World Health Organization1. As the leading cause of death among people of all ages, suicide continues to be a global health crisis. 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. Early detection of suicidal ideation and intervention to protect people at risk are essential steps in reducing suicide rates and providing appropriate mental health support. It is challenging to integrate numerous factors, including psychological, social, and environmental variables, for the early detection of suicidal ideation. Suicide is one of the leading causes of death worldwide, particularly among young people. Consequently, identifying individuals at risk is a crucial public health priority. The foundation of most traditional approaches to assessing the risk of suicide is typically the identification of factors like mental illness, agitation, or previous suicidal behavior. However, they are only marginally better than chance at predicting suicidal thoughts or actions. Due to this limitation, there is a growing interest in utilizing artificial intelligence (AI) to enhance suicide risk prediction. 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. Text-based AI systems for suicide risk detection have shown promising results, but they still face challenges like inconsistent data quality, lack of standardization, and inadequate validation against clinical benchmarks that make it difficult to integrate them into clinical practice. In order to close these gaps, a benchmark dataset that includes standardized and structured vocal and textual samples must be created. Such a dataset, which would capture explicit and implicit linguistic and acoustic features linked to outcomes related to suicide, would serve as a foundation for training robust ML and DL models. However, there is no such standardized dataset at this time. A method for creating vocal and textual datasets from individuals who have had suicidal ideation and attempted suicide is proposed in this paper. This makes it possible to identify characteristics that distinguish ideation from attempts. It also looks at existing text-based suicide detection systems and relevant suicide theories that could be used as a foundation for AI-driven

research in the future that aims to understand and anticipate the transition from suicidal thoughts to actions. This framework makes it possible to create reliable, data-driven tools to support efforts to promote early detection and prevention in mental health care.

II. LITERATURE SURVEY

A system that is able to simultaneously predict mental disorders based on facial emotional cues and generate a comprehensive dataset of mental disorders is the contribution of this research, as stated by Joseph Aina et al. [1]. The cutting-edge YOLOv8 object detection algorithm is used to identify and classify visual cues associated with particular mental disorders in the author's hybrid architecture for the detection of 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]. Using a long-short-term memory (LSTM) neural network, the author examined emotional patterns and dealt with a variety of binary classification scenarios. Results demonstrated an F-measure exceeding 80% in all suicide note classification scenarios.

Hamideh Ghanadian [3], benchmarked against state-of-the-art NLP classification models, specifically, those centered around 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. Social factors inform our synthetic data-driven approach, which yields 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 text data from college Sina Weibo users into input data that can be used in machine learning. Feature extraction is carried out using deep neural networks. 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]. With an F1 score of 0.8 (0.42), the text analysis model performed the best for non-depressed (depressed) individuals, while the voice quality model scored 0.76 (0.38). 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). The verdict is depressed when the percentage is above borderline (above 55 percent). The collected tweets and the facebook posts are analyzed by the model and labeled the user as depressed or non-depressed.

The proposed study, according to Kuhaneswaran A/L Govindasamy [8,] aims to identify users who are depressed based on the data they share on social media. The Twitter data are then fed into Naive Bayes and a hybrid model called NB Tree, two different types of classifiers. In order to determine which algorithm is the most effective for detecting

depression, the results will be compared using the highest accuracy value. 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 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, of which 81 met the inclusion requirements and were used in the qualitative synthesis. 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. Many people who are contemplating suicide communicate their feelings, hopelessness, or intent via text on social media platforms, chat messages, or personal blogs before taking any action. However, timely identification of such high-risk individuals remains a major challenge due to the subtle nature of the language used to convey distress and the enormous volume of textual data generated each day. Two common suicide detection methods, manual content monitoring and keyword-based filtering, frequently fail to comprehend the meaning, emotion, and context of textual expressions. These methods have limited practical application due to their high rate of false positives and false negatives. As a result, we urgently require an automated, intelligent system that can more accurately and reliably detect suicidal intent in text. Using Natural Language Processing (NLP) and Machine Learning (ML) techniques, the proposed system aims to automatically analyze text data, identify suicidal intent, and provide preventive support. Utilizing TF-IDF (Term Frequency–Inverse Document Frequency) for feature extraction and a Random Forest classifier for intent detection, the system is able to effectively learn linguistic patterns associated with suicidal tendencies. In addition, it will identify individuals at risk and provide resources for mental health and preventative measures, ensuring that distressed individuals receive assistance promptly.
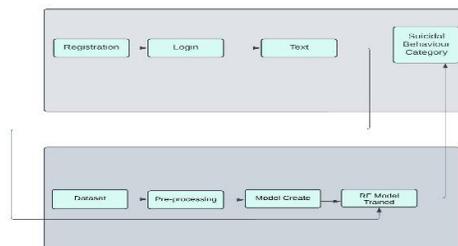

Fig1. Proposed Architecture

Algorithms

An irregular timberland is an AI procedure that is utilized to take care of relapse and order issues. It uses group realizing, which is a procedure that joins numerous classifiers to give answers for complex issues. An irregular

woodland calculation comprises of numerous choice trees. The 'backwoods' created by the irregular timberland calculation is prepared through packing or bootstrap totaling. Packing is a group meta-calculation that works on the exactness of AI calculations. The (arbitrary backwoods) calculation lays out the result in light of the expectations of the choice trees. It predicts by taking the normal or mean of the result from different trees. Expanding the quantity of trees builds the accuracy of the result.
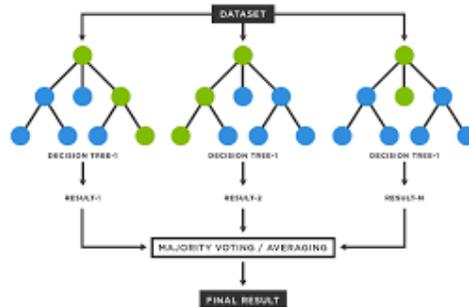

Fig.2. Random forest Architecture

IV. CONCLUSION

In conclusion, the Suicidal Behaviour Detection System provides an intelligent and automated machine learning-based method for determining suicidal intent from textual data. The system ensures smooth interaction, accurate analysis, and meaningful classification of suicidal behavior categories by integrating the user interface and the machine learning backend. Combining the Random Forest algorithm with TF-IDF feature extraction improves the model's ability to identify subtle linguistic cues associated with suicidal ideation. Utilizing efficient preprocessing techniques like tokenization, stopword removal, and lemmatization also ensures model dependability and data quality. In general, this system is a useful tool for detecting people who are at risk early on, offering opportunities for prompt intervention, and responsibly utilizing artificial intelligence to aid in suicide prevention.

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406

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407

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