



Using Artificial Intelligence for Early Detection of Suicidal Ideation

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(Received: 12 November 2024; Revised: 21 December 2024; Accepted: 03 January 2025; Published online: 12 February 2025)

(Published by Research Trend)

DOI: <https://doi.org/10.65041/BiologicalForum.2025.17.2.7>

ABSTRACT: Suicide continues to be a major global public health concern, taking the lives of more than 700,000 people each year. For prompt intervention and prevention, suicidal ideation must be identified early. This article examines how machine learning, natural language processing (NLP) and predictive analytics are used in artificial intelligence (AI) to detect early indicators of suicide thoughts. AI models have shown the ability to detect high-risk regarding suicidal ideation. This article examines how machine learning, natural language processing (NLP) and predictive analytics are used in artificial intelligence (AI) to detect early indicators of suicidal thoughts. By analysing social media posts, electronic health records, and wearable device data, AI models have demonstrated the potential to identify high-risk individuals with remarkable accuracy. This paper discusses the methodologies, datasets, challenges, and ethical considerations surrounding AI-based approaches to suicide prevention.

Keywords: Suicidal Ideation, Artificial Intelligence, Natural Language Processing, Machine Learning, Data Privacy and ethics, CLPsych 2019 Dataset.

INTRODUCTION

"Traumatic experiences, especially those occurring in childhood, are strongly associated with increased suicide risk. The impact of unresolved trauma often manifests as feelings of hopelessness and self-destructive behaviours" (Felitti *et al.*, 1998). Suicide rates are increasing worldwide, particularly among young adults. Many methods like clinical interviews and self-reported questionnaires have been used traditionally to identify suicide ideation. But these methods do not suffice the current situations, mainly due to increasing stress, lack of necessary family support etc. Moreover, visiting a psychiatric clinic is still considered a stigma even in urban towns and this leads to underreported cases. The advent of Artificial Intelligence offers innovative solutions for addressing these gaps. Advances in predictive modeling enable the early detection of suicide risk by analyzing digital traces of individuals' mental health struggles (Chancellor & De Choudhury (2020)). AI systems can process large datasets, identify elusive behavioural patterns and generate predictive models that go way beyond human capabilities in detecting early signs of suicidal ideation.

AI Approaches to Detect Suicidal Ideation:

Machine Learning Models. Support vector machines (S.VMs) and random forests are two examples of supervised machine learning models that have been used to analyse structured data, including clinical and demographic data. Through the processing of unstructured data sources including text and images,

recent developments in deep learning, especially neural networks, have improved the prediction of suicide risk. Convolutional neural networks (CNNs), for example, were used in one study to analyse face expressions in images posted on social media. The AI model recognized depressive traits linked to suicidal thoughts, such as decreased smiling and lack of eye contact. Over 85% of predictions were made using this technique and they were found to be accurate (Shatte *et al.*, 2019).

Natural Language Processing (NLP). Textual data from online forums and social media platforms (like Reddit and Twitter) is examined using natural language processing (NLP) techniques. Content that shows signs of distress or suicidal thoughts are flagged using sentiment analysis, topic modelling and keyword identification. Algorithms trained on repositories of posts on suicide, for example, can attain sensitivity rates of over 80%.

Wearable and IoT Devices. AI-enabled wearable devices monitor physiological signals such as heart rate variability, sleep patterns and physical activity. Sudden deviations from baseline behaviour are correlated with mental health states, enabling real-time detection of suicidal tendencies.

Datasets Used in AI Research

Examples of Successful Detection Using CLPsych 2019 Dataset". The Computational Linguistics and Clinical Psychology (CLPsych) 2019 dataset has advanced mental health to unfathomable heights. Researchers in this field have used this dataset to train machine learning models that classify individuals based on their mental health status, including suicide risk.

These models are trained to identify linguistic and emotional tone markers like frequency of negative words, and personal pronouns associated with suicidal ideation. Coppersmith *et al.* (2018) in their research have successfully proved that these algorithms achieved high sensitivity, accurately detecting users at risk and aiding in early intervention efforts.

Social Media Platforms: "Social media offers both risks and opportunities in the context of suicide prevention, serving as a platform for crisis intervention and support (Luxton *et al.*, 2012). Datasets derived from social media platforms like Reddit, Twitter, and Facebook form a great source and platform for research in various fields, including mental health, sentiment analysis, and social behaviour. There is a plethora of user-generated content on these networks that may be examined for trends and patterns. To say for instance, the CLPsych 2019 dataset was specifically designed for the Computational Linguistics and Clinical Psychology shared task, focusing on mental health classification. It encompasses Reddit postings that use natural language processing techniques to diagnose mental health conditions like depression, PTSD and self-harm. It has been found that "Individuals with post-traumatic stress disorder (PTSD) frequently exhibit suicidal ideation, particularly when their trauma-related symptoms are compounded by depression or substance abuse" (Kessler *et al.*, 2005).

These datasets are often used to develop predictive models so as to facilitate the early detection of mental health concerns or to gain insights into how people express mental health issues online. The only limiting factor in this, is the ethical concerns and data privacy and the risk of strengthening stereotypes, when working with such data.

Electronic Health Records (EHRs): De-identified patient records provide valuable insights into clinical histories and psychiatric diagnoses.

Custom Surveys: In order to collect certain indicators of suicidal thoughts or behaviours that are specific to their study's environment, researchers frequently create custom surveys while studying suicidal ideation. These questionnaires may concentrate on behavioural, psychological, or emotional markers that aren't necessarily apparent in publicly available social media information. Custom surveys are helpful because they allow for the collection of more precise, qualitative, and quantitative information from respondents, guaranteeing that the information is pertinent to certain therapeutic requirements or research concerns. The questionnaires evaluate the presence of suicide ideation through markers that detect the prevalence of hopelessness, mood swings, withdrawal behaviour and expressions of despair. The Columbia-Suicide Severity Rating Scale (C-SSRS), widely used in both clinical and research settings to detect signs of suicidal ideation (Posner *et al.*, 2011). The Suicidal Ideation Questionnaire (SIQ) that examines how adolescents' mental health correlates with external factors such as social media interactions, family dynamics, and peer relationships (Reynolds, 1988) are best among such tools. For instance, a study by Harris *et al.* (2015) examined the effects of peer support and online

interactions on teenagers' suicidal thoughts by combining data from the SIQ, survey responses, and social media activity.

Challenges in AI for Suicide Prevention

Data Privacy and Ethics. Data privacy, informed consent, and regulatory compliance are the main ethical issues facing AI-based suicide prevention systems that use social media data analysis or tailored surveys to identify suicidal intent. Since sensitive personal data is frequently used by AI models, it is imperative to make sure that the data is handled appropriately to prevent harm or privacy violations.

Informed Consent, anonymization and compliance with regulations such as GDPR are crucial in any such study involving human subtexts especially in social media or any such platform. It is important to inform users that their data may be analysed for mental health objectives and that the results may be utilised to help them make changes in their life. The difficulty of obtaining informed consent when examining social media data for mental health research was brought to light by De Choudhury *et al.* (2013). Although the authors emphasised the significance of gaining consent for research that could have major ramifications for an individual's privacy and well-being, they employed publicly available tweets, they stressed the significance of obtaining the consent of the individuals concerned and maintaining data privacy. When handling sensitive data, anonymisation and data de-identification are crucial procedures, particularly when working with social media content or survey replies.

Privacy laws and regulations that regulate the use of sensitive data must be followed by AI systems that handle mental health data. The European Union's General Data Protection Regulation (GDPR), which establishes stringent criteria for the protection of personal data, is one such regulation. The usage of health-related data is governed by the Health Insurance Portability and Accountability Act (HIPAA). According to these rules, people must have control over how their data is used, have their consent before it is used and have their data securely stored. They emphasized that, particularly when it comes to sensitive health-related data, researchers must make sure that any data utilized for analysis complies with data privacy rules.

Model Bias. AI models may inherit biases from training data, leading to disparities in predictions for minority groups. Prediction discrepancies for minority groups may result from AI algorithms unintentionally reinforcing or even magnifying pre-existing biases in the training data. For instance, the model might not detect suicide ideation in minority populations, if the training data mostly reflects certain demographic groupings. This could result in unequal access to assistance and interventions, leading to inequitable access to interventions and support.

Interpretability. Ensuring that AI predictions are interpretable and actionable is vital for clinical adoption. Winning the trust of stakeholders and physicians requires interpretability since they must comprehend the logic underlying AI forecasts in order to make wise judgements. Clinicians might be reluctant to use AI systems for delicate jobs like suicide

prevention, if they are not given clear explanations of how predictions are formed.

Successful implementations of AI in Social Media Platforms:

Facebook's Suicide Prevention Tools: AI algorithms scan user posts for warning signs and notify intervention teams. AI systems alert intervention teams when they find warning indicators in user posts. In order to assist users intervene before a crisis worsens, the system also urges people to seek support and offers resources like mental health helplines.

The IBM Watson for Suicide Risk Prediction: Watson's machine learning models use EHR analysis to accurately predict suicide behaviour. Watson helps physicians identify high-risk patients by analysing enormous volumes of patient data, such as past behaviour and treatment logs. This enables early intervention and individualized care regimens.

Crisis Text Line: NLP models assess the severity of distress in real-time conversations to prioritize help-seeking individuals. In order to provide priority to those who want assistance, NLP models evaluate the level of distress in real-time chats. By classifying SMS messages according to urgency and connecting people with the right support resources, these models assist crisis counsellors in responding more quickly and efficiently by categorizing text-based messages based on urgency and directing individuals to the appropriate support resources.

YouTube's Suicide Prevention Initiative: YouTube employs artificial intelligence (AI) to identify and eliminate offensive material on suicide and self-harm. It attempts to stop the spread of upsetting films and motivate people to get treatment. By combining automated detection with human review, it aims to reduce the spread of distressing videos and encourage users to seek help.

CONCLUSIONS

"Suicide is a serious public health issue that is preventable with timely, evidence-based interventions." (World Health Organization, 2021). AI holds immense promise for revolutionizing suicide prevention by enabling early detection of suicidal ideation. However, ethical concerns, data biases and the need for interpretability must be addressed to maximize its potential. Collaborative efforts across technology, healthcare, and policy domains are essential for leveraging AI responsibly in this critical area. Furthermore, building trust between users and clinicians will need making sure that AI models' decision-making processes are transparent. Continuous research and cooperation should also concentrate on enhancing AI tools' accuracy while reducing biases that can produce unfair results. Ultimately, utilizing AI to effectively prevent suicides and provide significant support to people in crisis, should be the ultimate

purpose of the society, clinicians and researchers in the field.

FUTURE SCOPE

- Integration of multimodal data sources (e.g., combining text, audio and physiological signals).
- Developing culturally sensitive AI models for diverse populations.
- Enhancing collaboration between AI researchers and mental health professionals can be helpful in employing AI for suicide prevention.

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How to cite this article: Jeyalakshmi Poornalingam (2025). Using Artificial Intelligence for Early Detection of Suicidal Ideation. *Biological Forum*, 17(2): 39-41.