

Artificial Intelligence based Chatbot Therapist to Improve the Mental Health of Trauma Patients

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Abstract—With the use of conversational technology and the best Natural Language Programming (NLP), AI Trauma Chat Assist is a ground-breaking tool that can recognize symptoms of trauma through text and voice messages. This innovative approach protected the privacy of the client while facilitating the smooth connection of people in need with mental health specialists. To assist clients in efficiently coping with trauma and pain, it combined a range of evidence-based practices, including cognitive behavioral therapy and mindfulness, with trauma care procedures. The platform assessed sensitivity index and emotional state using sophisticated language processing techniques, speech recognition, and emotional analysis. Its services are available around-the-clock, offering quick help in times of stress, lowering the possibility that symptoms of trauma will worsen, and facilitating time for mental wellness. intervention. In dire circumstances, it also turned on the emergency response system. User profiles also have the ability to offer a customized service. More significantly, the platform goes above and beyond by concurring with medical professionals regarding the individual's behaviors, which makes it a valuable resource for treating and assisting those who are traumatized.

Index Terms— NLP, Speech Recognition, Emotional Analysis, Trauma. Chat Bot, Artificial Intelligence.

I. INTRODUCTION

One interesting area for healthcare innovation is the nexus between Artificial Intelligence (AI) and mental health services. There is an urgent need for scalable and easily available solutions to offer support and aid to those dealing with mental health issues, given the rising incidence of mental health diseases globally. Within this framework, conversational AI technologies—like chatbots—have surfaced as a possible instrument to support conventional therapy modalities and provide prompt interventions.

A few benefits of using chatbots for mental health support are its scalability, confidentiality, and accessibility. Chatbots that use Natural Language Processing (NLP) techniques can offer psychoeducation, coping mechanisms, meaningful interactions, and even help users get in touch with professionals when they need it. Furthermore, chatbots are the perfect tool for providing individualized support whenever and wherever they are due to the widespread use of mobile devices and messaging services.

However, there are a number of difficulties and moral issues with the creation and use of chatbots for mental health assistance. These include protecting user privacy and guaranteeing the dependability and correctness of

AI-driven assessments and data security, resolving biases in AI models, and developing suitable standards for the moral application of conversational bots in delicate situations [1].

There are a number of drawbacks to the current AI-Advanced Platform for Identification of Trauma Symptoms from Voice and Text Communications with Integrated Direct Doctor Connection features [2]. The system's inadequacies in effectively interpreting voice and text messages may jeopardize the accuracy of trauma symptom detection. It is possible for some symptoms to be misinterpreted or misclassified, which could result in inaccurate diagnosis or recommendations. Privacy and confidentiality issues are brought up by the addition of a direct doctor connection functionality [3]. Users who are concerned about the security of their data or possible breaches can be reluctant to disclose critical information over the site. Because users might not fully report their symptoms or experiences, the system's efficacy may be limited and assessments may become erroneous.

Furthermore, the system's capacity to recognize non-verbal clues, body language, and facial expressions—all of which are critical markers in evaluating trauma symptoms—may be compromised by its exclusive dependence on voice and text exchanges [4]. This can result in a limited comprehension of the user's situation, omitting crucial cues that could be discerned in-person when speaking with a healthcare provider. The current system is primarily concerned with text and speech communication analysis, it might not have contextual awareness. It might not account for outside variables including the user's cultural background, prior trauma history, or social milieu. This may restrict the system's capacity to offer customized advice or actions based on the particular situation of the user.

There is a chance of algorithm biases because of the system's reliance on AI technology. The system may perpetuate current disparities or discriminate against particular groups of people if it is trained on a dataset that lacks diversity or contains ingrained biases [5]. The system's shortcomings in terms of accuracy, privacy issues, incapacity to recognize nonverbal signs, lack of contextual awareness, and possible algorithmic biases all emphasize the need for additional refinements and considerations in its development.

The proposed research is to present a thorough assessment of the state of research on conversational AI for mental health support as it stands right now. The system is designed to examine the datasets and applications in the areas of conversational emotion identification, chatbot-based stress-reduction and cognitive-behavioral therapy, and novel methods for tracking and diagnosing depression using social media data.

II. RELATED WORKS

NLP has enabled the application of Cognitive Recognition in Networking in a variety of industries, including healthcare and education. By demonstrating the relationship between emotion and human-like intelligence, it highlights the importance of Cognitive Recognition in understanding and developing emotion-cognition interactions [1]. Inspired by Clark et al. and Garcia et al. Our project on the study of artificial intelligence in psychology addresses the concerns of Evans et al [6]. On the limitations of chatbots in understanding emotional intelligence. It balances between AI and human attention. AI-driven mental health solutions, leveraging insights and challenges gleaned from established research to shape a more comprehensive approach to supporting mental well-being.

Riddhi Hakani et al., [7] demonstrated the stress detection using multiple sources and different methods for auditing and control. The report emphasizes the sensitive conversations about mental health difficulties and eventually de-stigmatize the topic. The proposed AI Trauma Chat Assistance specializes in the use of NLP and speech technology to diagnose trauma through voice and text messages of mental health issues. The chatbots pioneered curiosity and consensus solving, which are important in solving society's most stressful situations due to high business and social uncertainty [8]. Users can interact with the chatbot for emotional control using images, category selection, and descriptions. This aligns with the AI-driven trauma support approach and relates to our initiative, the AI Trauma Chat Assistant.

Psykh, the chatbot using therapeutic answers, have proliferated as a result of recent technology breakthroughs. The rasa open-source framework, to be your therapist and stress reliever [9] introduces Psykh, a chatbot that uses Rasa open source to reduce stress and acts as a therapist to reduce the mental stress present in our fast-paced life. This is based on the AI-driven psychological support approach found in our AI Trauma Chat Assistance project, although the details vary.

Deepa et al., [10] proposed a method to identify and resolve depression through chatbot therapy, based on the overall goal of the proposed AI trauma chat support research to support the damaged brain. Although our program focuses on the exploration of trauma and direct contact with mental health professionals, The emphasis is on identifying and treating depression, there is still fear of mental illness. The use of technology to solve

mental health issues resonates with both projects and demonstrates the growing role of intelligence-driven solutions in this field.

III. PROPOSED SYSTEM

The goal of the proposed work is to create a sophisticated platform with integrated direct doctor connection feature that can recognize trauma symptoms from voice and text conversations using artificial intelligence technologies. The proposed research platform aims to address the growing demand for prompt and precise diagnosis of trauma symptoms, which can be difficult to identify using traditional methods. Post-Traumatic Stress Disorder (PTSD) and other associated mental health conditions are among these symptoms. This platform will be able to monitor voice and text communications, including phone conversations, texts, and social media posts, by utilizing AI algorithms. This will allow the platform to identify patterns and indicators of symptoms related to trauma. It will be able to precisely identify and flag potential trauma symptoms thanks to the AI system's training, which will involve a combination of machine learning techniques and a large database of past trauma cases. Additionally, this platform will incorporate a direct doctor connection feature that will make it simple for customers to get in touch with mental health specialists for prompt support. Users will have a smooth experience to the integrated connection functionality, which enables them to start a live chat or video conversation with a certified therapist or psychiatrist right from the site. All things considered, the proposed AI platform has enormous potential to transform the recognition and treatment of trauma symptoms, offering a dependable and practical option for those in need of mental health help.

A. Data Preprocessing

As shown in Figure 1, the first phase of creating an AI-powered trauma support system involved collecting data from a variety of sources, including audio recordings as well as transcripts from clinical trials and forums to record the conversation. The data is then carefully pre-processed to remove noise and inconsistencies and model content and speech-to-text conversion. A data collection was also conducted to analyze the text and record concepts, phrases, and emotions related to trauma symptoms. For the purpose of training and evaluating the model, this labeled data is divided into training, validation, and testing sets. Additionally, a lemmatize helps simplify the essence of the word, while TF-IDF vectorization prepares the data for numerical representation. Together, these steps form the basis for subsequent modeling of machine learning and feature extraction.

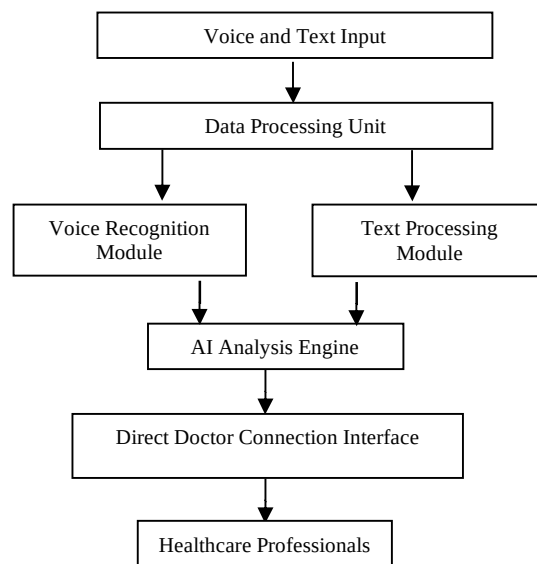


Figure 1. Proposed scheme for mental health chatbot

B. Chat

The chat function displayed by this module loads the questions from chat.json and sends them to the user. These questions are designed to attract users' attention and direct them to comments that show their current feelings. When the user responds in the dialog box, the data is sent to the detector_trauma method in the utils module. This feature uses a sentiment analysis model to analyze the content of the user's text. This technology can

measure behavior to determine whether the text contains negative emotions or anxiety issues, both of which indicate trauma. Analysis results will be returned to the user in a dialog window. If the mod detects that the user has suffered an injury, it can respond by sending them comforting messages, providing links to helpful resources, or requesting that they contact a mental illness therapist. This feedback is designed to respond quickly and appropriately to user feedback. This module is not only about communication, but also an important part of the body's ability to recognize and respond to stress. Because of its central place in the initial assessment of a client's mental health, it often becomes the first point of contact for those in need of support.

C. Voice

The voice module of the AI-powered Trauma Chat Assistance System is an important factor in increasing the platform's reach and user interaction. It uses the `audio_to_text` function available in the `utils` module to write audio data to text. This transformation is important as it transforms the speech into a form that can be processed by NLP algorithms in the system. After the conversion is complete, the `Detect_trauma` function applies emotional analysis to the text. This feature works similar to chat mode, analyzing the user's voice for signs of trauma or stress. The system looks for signs of injury related to speech and behavior, such as word choice, intonation, and context in the user's communication. After completing the emotional assessment, the mod will show the user what it found. If the test reveals an injury, the system will direct the user to helpful options, such as contacting a psychiatrist. Users who need comfort and assistance will benefit from the available response.

D. Doctor and Patient

The utility includes functions such as `get_lat_lng`, `get_nearest` and `create_map` which are used to get the user's location right here, find the nearest doctor or hospital and create a map to display these places, map. `get_lat_lng` uses geocoding to obtain the latitude and longitude of the user's current location. `get_nearest` finds the nearest hospital or doctor based on the user's location. `create_map` uses the Folium library to create a map containing bookmarks. `Doctor.html` HTML template is used to display doctor content retrieved from the backend. This includes the person's name, address, and distance from the user's location. An interactive map that roughly shows the doctor's location is included as part of the interface.

IV. RESULT AND DISCUSSION

The development and implementation of a cognitively focused interactive intervention has yielded positive results. Data preprocessing includes cleaning, tagging, and data classification to ensure physical strength. Using the Hugging Face Transformers emotion analysis technique helps discover emotions in the text that are important for identifying signs of trauma. The integrated chat module benefits users and identifies potential trauma clues, making it beneficial to provide timely support. In addition, voice modes expand the accessibility of the platform, allowing voice interaction for individuals who cannot use text. Below represented equations are used for calculating the accuracy metrics like precision, recall, f1-score and support.

A. Term Frequency- Inverse Document Frequency (TF-IDF)

$$TF-IDF(w_i, D) = TF(w_i, D) \times IDF(w_i) \quad (1)$$

Where:

- $TF(w_i, D)$ is the Term Frequency of word w_i in document D
- $IDF(w_i)$ is the Inverse Document Frequency of word w_i across all documents in the corpus

B. Word Embeddings (Word2Vec)

$$Skip-gram: \max_{t=1} \prod_{-c \leq j \leq c, j \neq 0} P(w_{t+j} | w_t) \quad (2)$$

Where:

- w_t is the target word
- w_{t+j} is a context word within the window of size c around the target word

The above formulae are fundamental to many NLP tasks, including word embeddings, language modeling, and text representation. Doctor and patient modules enhance the user experience by providing location-based services that connect users to nearby mental health professionals. Machine learning models, especially Naive Bayes and Decision Trees, have played an important role in symptom identification and have shown great value for diagnosis. Integration of these models increases the accuracy of diagnosis, reduces detection time and increases accuracy. The use of NLP technology such as emotional analysis provides a better understanding of the user's thoughts, which leads to time intervention and contact with psychologists. Overall, the AI-driven chat

assistant shows good potential in detecting trauma symptoms and providing timely support, highlighting its great impact on mental health.

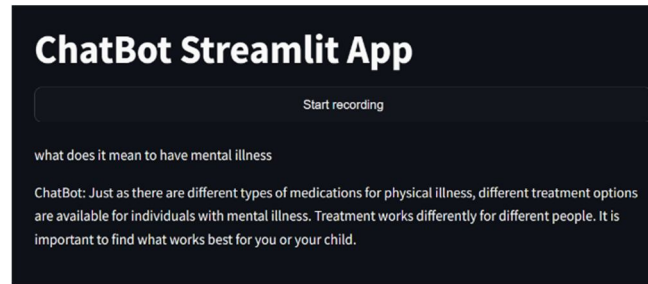


Figure 2. Sample output of the voice module

The above Figure 2 depicts a sample output of the voice module. The phrase when spoken is converted into text and is processed to provide an output. The `audio_to_text` function is used for this purpose. Table 1 given below represents the training and testing classification report using the naïve bayes classification algorithm depicting precision, recall, f1- score and support w.r.t Non- Trauma, Trauma details. The Naive Bayes algorithm for classification relies on the independence of features and is based on the Bayes theorem. Despite its ease of use, its effectiveness and efficiency in handling huge datasets make it a popular choice for jobs like text classification.

TABLE I. TRAINING AND TESTING CLASSIFICATION REPORT USING NAÏVE BAYES CLASSIFICATION DEPICTING PRECISION, RECALL, F1-SCORE AND SUPPORT

	Precision	Recall	F1-score	Support
Non- Trauma	1.00	1.00	1.00	25
Trauma	1.00	1.00	1.00	25
Accuracy	-	-	1.00	50
Macro avg	1.00	1.00	1.00	50
Weighted avg	1.00	1.00	1.00	50

Support indicates how many examples there are of each class in the classification context. Figure 3 is the visualization of the confusion matrix formed using the data from Table 1 using the multinomial Naïve bayes classification algorithm.

Plotting the True Positive Rate (TPR) versus the False Positive Rate (FPR) at different threshold levels is known as the ROC curve. Figure 4 shows the ROC curve generated from the confusion matrix details using the multinomial naïve bayes algorithm. Table 2 gives the training model summary of the dataset. Recurrent Neural Networks (RNNs) with Long Short-Term Memory (LSTM) architecture are able to capture long-term dependencies in sequential data by addressing the vanishing gradient problem.

In contrast to conventional RNNs, LSTM networks include gating mechanisms and memory cells to control the information flow over time, allowing them to store information over longer sequences. Because of this, LSTMs are excellent choices for many applications involving sequential data, including Natural Language Processing. Figure 5 shows the graph between training and validation accuracy/ loss of the generative based model with respect to the accuracy and loss of the model respectively. The blue line represents training accuracy/loss and the orange line represents the validation/ testing accuracy/loss.

TABLE II. TRAINING MODEL SUMMARY

Layer (type)	Output shape	Param #	Connected to
input_1	[(None, None, 86)]	0	[]
input_2	[(None, None, 172)]	0	[]
lstm	[(None, 256), (None, 256), (None, 256)]	351232	['input_1[0][0]']
lstm_1	[(None, None, 256), (None, 256), (None, 256)]	439296	['input_2[0][0]', 'lstm[0][1]', 'lstm[0][2]']
dense	(None, None, 172)	44204	['lstm_1[0][0]']

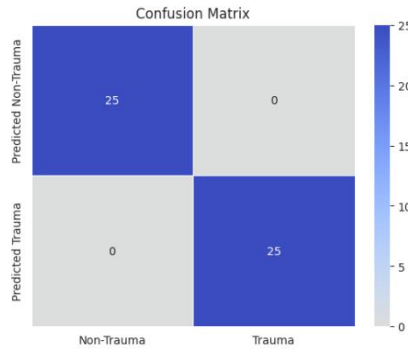


Figure 3. Visualisation of the confusion matrix using multinomial naïve bayes

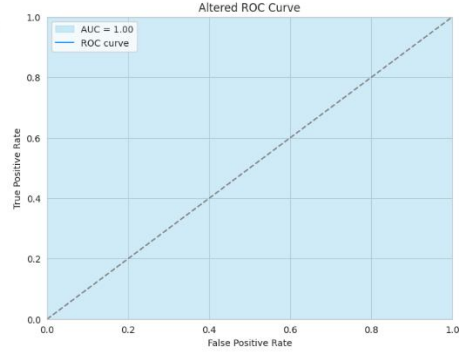


Figure 4. ROC curve generated using multinomial naïve bayes

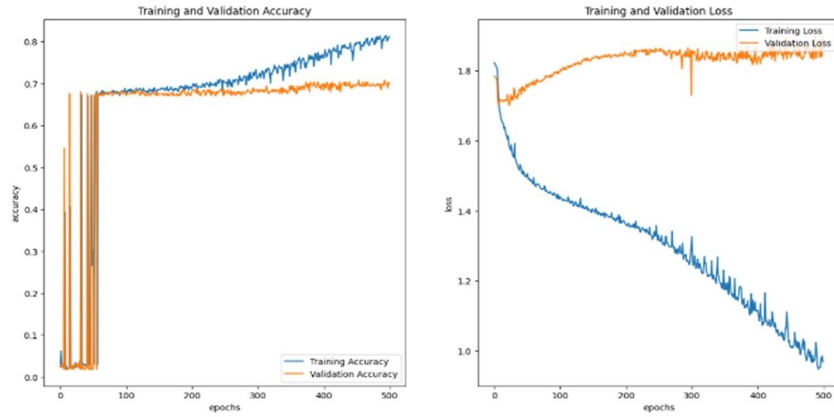


Figure 5. Training and validation accuracy/loss of the generative based model

Table 3 depicts the testing model summary with respect to the layer type and the output shape and parameters.

TABLE III. TESTING MODEL SUMMARY

Layer (type)	Output shape	Param #
embedding	(None, 10, 100)	6600
simple_rnn	(None, 100)	20100
dense	(None, 10)	1010

V. CONCLUSIONS

AI-Powered Trauma Chat Assistance platform combines the analytical skills of AI with the sophisticated knowledge of human healthcare specialists, marking a substantial breakthrough in mental health technology. By accurately analysing both text and voice data for trauma indicators, the platform provides early detection of mental health issues, which is critical for timely intervention. The robust authentication and real-time connection to available doctors demonstrate a strong commitment to user privacy and immediate care, which are essential in sensitive trauma-related cases. Healthcare professionals are equipped with a user-friendly dashboard that presents complex AI-generated data in an accessible format, enabling them to act swiftly and effectively. The underlying scalable infrastructure ensures the platform's reliability and responsiveness, crucial for maintaining user trust and system integrity. This platform not only streamlines the process of identifying and addressing trauma but also sets a new standard for integrating technology into mental health services. By offering safe, efficient and user-friendly solutions, it paves the way for a future where technology and healthcare merge, providing tailored support to those in need. Future development will concentrate on a few crucial areas to improve the AI-Advanced Platform for Identification of Trauma Symptoms from Voice and Text Communications, with Integrated Direct Doctor Connection Functionality. First and foremost, the system's ability to reliably and accurately identify trauma symptoms needs to be improved. This can be accomplished by

enhancing the AI system's prediction power by implementing more sophisticated machine learning algorithms and data analysis methods. To reach a larger user base, the platform can also gain by adding more language support, so that it can speak more than one language. In order to enable direct communication between users and medical providers, it will also be essential to integrate the system with existing healthcare systems and electronic health records. This would facilitate easy communication and prompt assistance to those who have been diagnosed with symptoms of trauma. Finally, in order to evaluate the platform's efficacy and user happiness and to inform next system improvements, comprehensive validation tests and user feedback gathering will be necessary.

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