**Mental Health Chatbot**

**Submitted for**

**Artificial Intelligence and Machine Learning( CSET301 )**

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**Abstract**

This project introduces an AI-powered **Mental Health Chatbot** designed to provide accessible, anonymous, and responsive emotional support to users experiencing mental stress or psychological discomfort. The chatbot acts as a virtual mental wellness assistant by analysing user inputs through advanced **Natural Language Processing (NLP)** techniques and **machine learning models**. It is capable of performing three major tasks: **emotion classification**, **stress level detection**, and **intent recognition**, which together help the system understand the mental state of a user and respond in a supportive manner.

The chatbot uses pre-processed textual data to accurately interpret users' emotions (such as joy, sadness, anger, or fear), identify signs of stress, and understand the intent behind their messages (e.g., seeking help, expressing thoughts, or asking for advice). The models employed include traditional ML techniques like **Logistic Regression**, **Support Vector Machines (SVM)**, as well as a deep learning model based on **Long Short-Term Memory (LSTM)** networks for sequence-based intent classification.

The system is designed to run in real-time with a **React frontend** and a **JS backend**, ensuring seamless interaction while preserving user privacy. The chatbot aims to break the barriers of stigma associated with mental health by offering an empathetic, always-available virtual companion that encourages individuals to open up about their feelings. By combining statistical learning methods with deep NLP insights, the project demonstrates the potential of AI in enhancing mental healthcare and making psychological assistance more approachable and scalable.

**Introduction**

Mental health has become an increasingly critical aspect of overall well-being in today's fast-paced and digitally connected world. Despite growing awareness, many individuals still hesitate to seek professional help due to social stigma, lack of access, or fear of judgment. In such a context, artificial intelligence (AI) can play a transformative role in bridging the gap between people and mental health support. This project aims to address this issue through the development of an AI-powered **Mental Health Chatbot** that provides an accessible, anonymous, and supportive environment for users to express their feelings and receive emotionally intelligent responses.

The chatbot is designed to simulate empathetic human-like conversations by analysing the user's textual input using **Natural Language Processing (NLP)** and **machine learning algorithms**. It focuses on three core functionalities: detecting emotions, identifying signs of stress, and understanding user intent. These functionalities are powered by trained models that interpret the user's mental state and guide the chatbot to generate appropriate responses. The goal is not to replace human therapists, but to offer a first layer of support that encourages users to talk about their issues and feel heard without fear of judgment.

To build this system, various technologies and models were employed. Emotion classification is handled by traditional ML models like **Logistic Regression** and **Random Forest**, stress detection is implemented using a **Support Vector Machine (SVM)** classifier, and user intent is classified using a **Long Short-Term Memory (LSTM)** deep learning model. Together, these models help the chatbot understand not only what the user is saying but also how they feel and what they need.

The application’s frontend is developed using **React**, offering a user-friendly and responsive chat interface. The backend, built with **Flask**, processes the user’s text, runs it through the models, and returns intelligent, context-aware responses. The chatbot maintains user anonymity and privacy, ensuring that individuals can speak freely without the fear of being identified or judged.

By integrating AI into mental healthcare, this project demonstrates how technology can be leveraged to create emotionally aware systems that foster well-being. It also reflects the potential of statistical and deep learning methods in making psychological support more scalable, accessible, and stigma-free.

**Related Work (If Any)**

Several studies and systems exist using chatbots for healthcare, such as Woebot and Wysa, but most are proprietary. Our approach builds a lightweight open-source system using multi-label classification and intent detection, trained on synthetic and real-world datasets, enabling modularity and expansion for academic research.

**Methodology**

The mental health chatbot uses Natural Language Processing (NLP) and machine learning/deep learning models to interpret and classify user messages. The overall development consists of three key models integrated into a real-time chat system.

**Preprocessing Before model training and inference, input text is pre-processed to ensure quality and consistency**:

Lowercasing

Removal of punctuation, special characters, and stop words

Tokenization using NLTK

Padding sequences to ensure uniform input size

Vectorization via TF-IDF (for classical ML models) or embedding sequences (for LSTM)

* **Model 1** – Emotion Classification A multi-class classification model to detect emotional states such as happiness, sadness, anger, and more.

Algorithms: Logistic Regression and Random Forest

Output: Emotion label based on user input

Evaluation: Achieved ~88% accuracy on the test dataset

* **Model 2** – Stress Detection A binary classification model that determines whether the user is stressed or not.

Algorithm: Support Vector Machine (SVM)

Output: “Stressed” / “Not Stressed”

Evaluation: Reached ~90% F1 score on synthetic and real-world datasets

* **Model 3** – Intent Classification (LSTM-based) This model identifies the intent behind user messages using a deep learning approach.

Model Type: Long Short-Term Memory (LSTM) network

Input: Tokenized and padded text sequences

Output: Intent class (e.g., seeking help, expressing gratitude, asking questions)

Libraries: TensorFlow / Keras.

Evaluation: LSTM achieved ~87% accuracy with minimal overfitting due to dropout

**Hardware/Software Required**

**Hardware Requirements**

* A system with a minimum of **8 GB RAM**
* **Stable internet connection** for accessing datasets, libraries, and GitHub
* **Processor**: Intel i5 or higher (recommended for model training and responsiveness)

**Software Requirements**

* **Python 3.10** (primary programming language)
* **Code Editor/IDE**:  
   – **Jupyter Notebook** for model development and testing  
   – **Visual Studio Code (VSCode)** for building backend and frontend components
* **Libraries and Frameworks**:  
   – scikit-learn (ML models)  
   – pandas and NumPy (data processing and analysis)  
   – nltk (Natural Language Processing – tokenization, stopwords)  
   – Flask (backend server and API integration)  
   – matplotlib (data visualization)  
   – tensorflow or keras (for LSTM model)
* **Frontend Framework**:  
   – **React.js** (for chatbot UI)
* **Version Control and Hosting**:  
   – **Git** and **GitHub** (for code management and collaboration)

**Experimental Results**

* Emotion classifier achieved ~88% accuracy on test data.
* Stress detection showed ~90% F1 score.
* Intent classification reached ~85% using TF-IDF features.
* Real-time chatbot testing showed successful classification and response generation in <2 seconds.

**Conclusions**

The chatbot successfully integrates statistical models to classify emotions, detect stress, and generate contextual responses. It can serve as a preliminary mental health support system, proving that ML-based solutions can contribute significantly to wellness technology.

**Future Scope**

* Integrate deep learning models like BERT for better understanding.
* Add multilingual capabilities.
* Develop a mobile version.
* Include sentiment-aware text generation using transformer-based models.
* Collaborate with psychologists for response refinement.

**GitHub Link of Your Complete Project**

* [**DEVANSH263/Mental-Health-AI**](https://github.com/DEVANSH263/Mental-Health-AI)