

Mental Health Chatbot Project



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Introduction

We are developing a mental health chatbot that uses a neural network, trained on the CounselChat dataset.

This dataset contains real-world counseling dialogues, and the chatbot will assist in providing mental health support through text-based conversations.





Problem Statement

A chatbot trained to provide basic mental health responses can bridge the gap, offering an accessible, always-available resource for people in need of guidance and support.



Goals

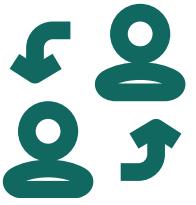
01



Objective 01

Develop a mental health chatbot capable of generating empathetic and helpful responses based on user input.

02



Objective 02

Train a neural network on the Dataset to improve its understanding of therapy-related dialogues

03



Objective 03

Achieve a model that can handle sensitive conversations appropriately while maintaining coherence and relevance.

Previous Work

- Chatbots like Woebot and Wysa have successfully integrated AI to provide mental health support. These systems use conversational AI to offer users emotional support and cognitive behavioral therapy techniques.
- Neural networks have been successfully used in various natural language processing tasks, including intent classification and dialogue generation. Neural networks with dense layers, such as the one used in this project, are easier to train and can still achieve competitive performance, particularly when working with structured datasets like the one used for this chatbot.

Output

```
1 chatbot()
Start Talking with the bot(type quit to stop!
You: hi
1/1 _____ 0s 68ms/step
Bot: Hi there. How are you feeling today?
You: i feel sad
1/1 _____ 0s 34ms/step
Bot: I'm sorry to hear that. I'm here for you. Talking about it might help. So, tell me why do you think you're feeling this way?
You: I have been experiencing a sudden increase in panic attacks. What could be the underlying cause, and how can I address it effectively?
1/1 _____ 0s 25ms/step
Bot: While I'm not a mental health professional, I can offer some general suggestions and possible reasons for the sudden increase in panic attacks.

1. Stress and Anxiety High levels of stress and anxiety can trigger panic attacks. Examine your current stressors, such as work, relationships, or other life events, and consider seeking support to manage them.
2. Trauma Past traumatic experiences can resurface and lead to panic attacks. If there is any unresolved trauma, it may be beneficial to seek therapy to process and heal from it.
3. Substance Use The use of certain substances, including caffeine, alcohol, or recreational drugs, can contribute to anxiety and panic attacks. Reducing or eliminating their consumption may help.

To address the increase in panic attacks effectively, I strongly encourage you to consider the following steps

1. Reach Out for Support Talk to someone you trust about what you're going through, such as a close friend, family member, or counselor. Sometimes, sharing your feelings can bring relief and understanding.
2. Consult a Mental Health Professional A licensed therapist or counselor can help you explore the underlying causes of your panic attacks and provide personalized coping strategies and treatment.
3. Practice Relaxation Techniques Incorporate relaxation techniques like deep breathing exercises, meditation, or yoga into your daily routine. These can help you manage stress and anxiety more effectively.

Remember, seeking help is a sign of strength, and there's no shame in reaching out for support when you need it.
You: quit
```

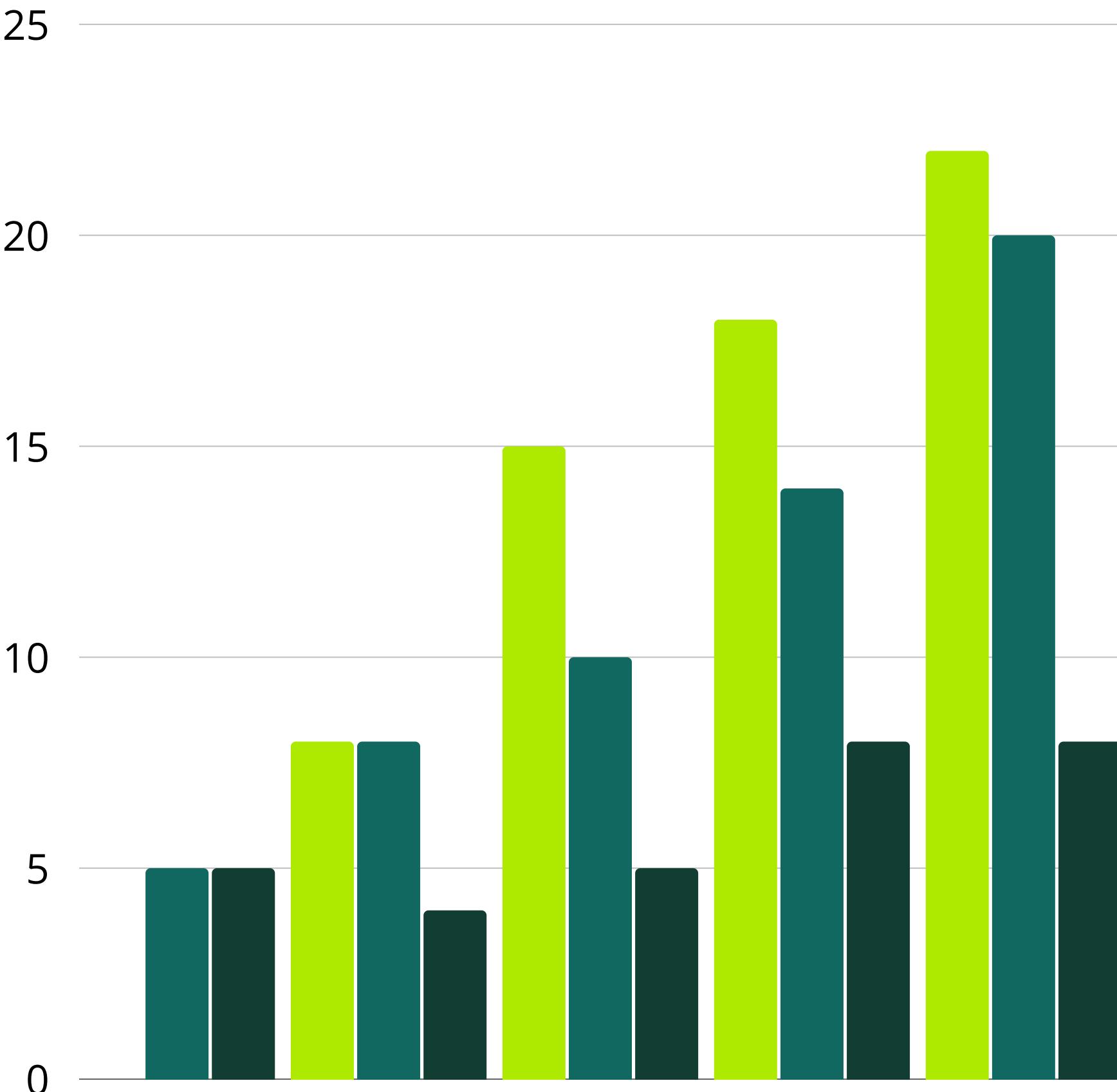
Data Description

The dataset consists of user input patterns (labeled as patterns.) and corresponding chatbot responses (labeled as responses.). Each row in the dataset represents a particular mental health scenario and contains multiple variations of user inputs and responses, allowing the chatbot to learn from a variety of conversational examples.

Data Links : https://huggingface.co/datasets/heliosbrahma/mental_health_chatbot_dataset
<https://www.kaggle.com/datasets/elvis23/mental-health-conversational-data>

Key-Features

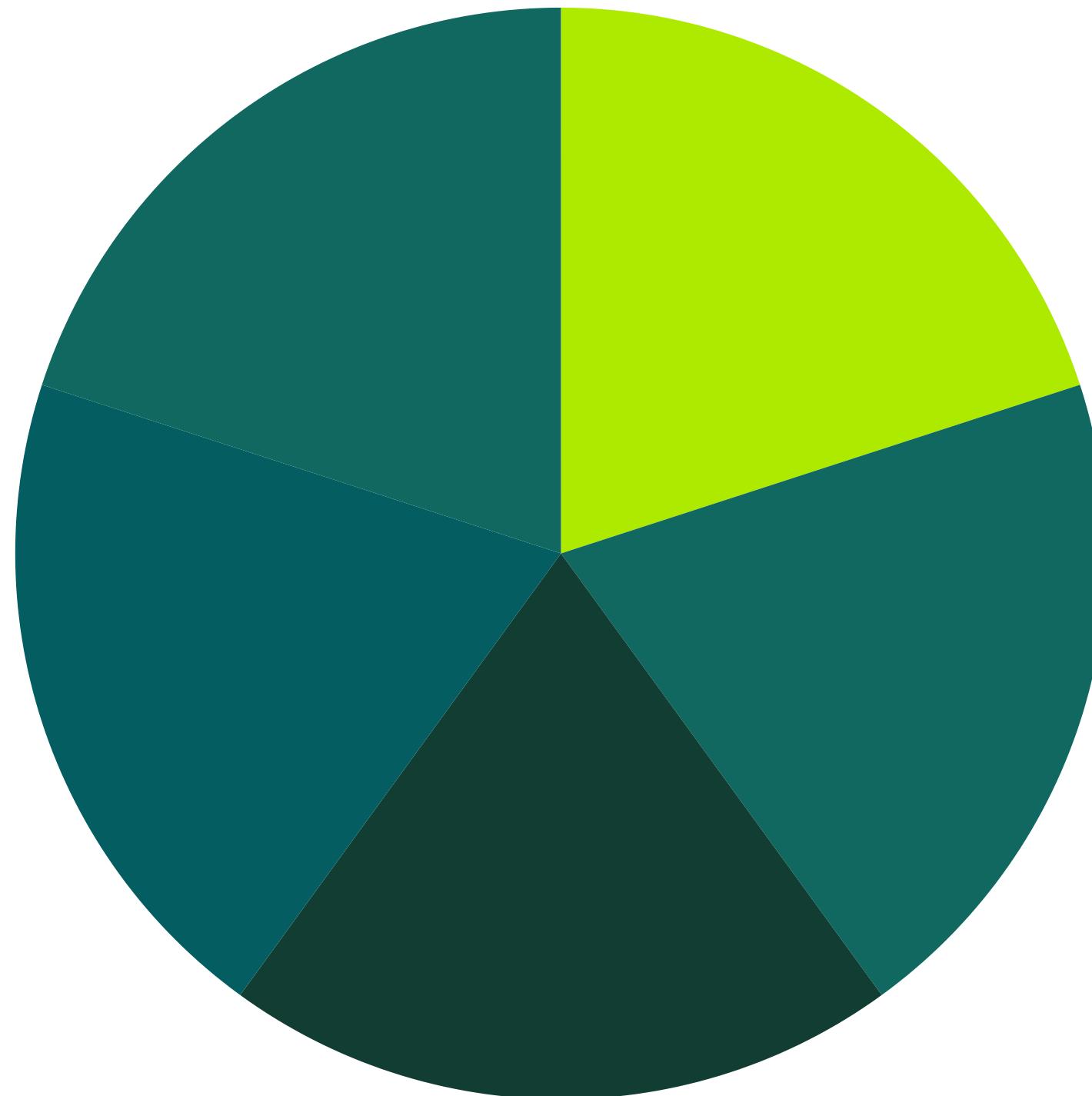
- List of directories , each directory consists of tag , pattern and response
- Covers a variety of mental health topics such as anxiety, stress, and depression.
- Provides multiple conversational variations for each mental health issue, enabling robust training.



Data Exploration

During data exploration, we analyzed the structure and content of the dataset:

Exploratory data analysis revealed that each directory of the dataset includes user input patterns and responses. By combining the patterns and responses, we can generate numerous question-response pairs, increasing the variety of conversational data available for training. This approach improves the chatbot's ability to generalize across different types of mental health-related conversations.



Methodology

Model Choice:

A custom neural network model was chosen due to its simplicity and computational efficiency. The model was designed to handle multi-class classification tasks, where each class corresponds to a chatbot response.

Approach:

- A neural network, consisting of multiple layers (Embedding Layer, Global Average Pooling, Dense Hidden Layers, Output Layer) processes the textual data to capture complex patterns in mental health dialogues. The network is trained to generate responses based on input questions, learning to understand therapy-related contexts and emotions.
- **Preprocessing:** Tokenizing text, padding sequences, and preparing input-output pairs (question to response) for supervised learning.

```
1 # Tokenization process (Vectorising the Data)
2
3 vocab_size = 1000 # the size of the vocabulary in the text data
4 embedding_dim = 16
5 max_len = 20
6 oov_token = "<OOV>" # Out Of Vocabulary are words not present in the vocabulary and will be mapped as UNK token
7
8 tokenizer = Tokenizer(num_words=vocab_size, oov_token=oov_token)
9 tokenizer.fit_on_texts(training_sentences)
10 word_index = tokenizer.word_index
11 sequences = tokenizer.texts_to_sequences(training_sentences)
12 padded_sequences = pad_sequences(sequences, truncating='post', maxlen=20)
```

```
1 # Training the Neural Network of our Chatbot with 3 Hidden layers
2 model = Sequential()
3 model.add(Embedding(vocab_size, embedding_dim, input_length=max_len))
4 model.add(GlobalAveragePooling1D())
5 model.add(Dense(16, activation='relu')) # Activation function Relu 1
6 model.add(Dense(16, activation='relu')) # Activation function Relu 2
7 model.add(Dense(num_classes, activation='softmax')) # Activation function Softmax
8
9 model.compile(loss='sparse_categorical_crossentropy', optimizer='adam', metrics=['accuracy'])
10 print(model.summary())
11 epochs = 550
12 history = model.fit(padded_sequences, np.array(training_labels), epochs=epochs)
```

Experimental Setup

Data Splitting:

The dataset was split into training and evaluation sets (80% training, 20% evaluation). No test set was used as the primary goal is dialogue generation, which will be evaluated through human feedback.

Tools Used:

The neural network was implemented using TensorFlow and Keras. The training process involved padding the input sequences to a uniform length, tokenizing the data, and training the model using a CPU due to the simplicity of the model

```
1 def generate_response(user_input):
2     # convert user input to a padded sequence of integers using the tokenizer
3     sequence = tokenizer.texts_to_sequences([user_input])
4     padded_sequence = pad_sequences(sequence, truncating='post', maxlen=20)
5
6     # predict the class probabilities for the input sequence using the trained model
7     predictions = model.predict(padded_sequence)
8
9     # find the index of the class with the highest probability
10    class_index = np.argmax(predictions)
11
12    # convert the class index back to the corresponding tag using the label encoder
13    tag = lbl_encoder.inverse_transform([class_index])[0]
14
15    # choose a random response from the list of responses for the predicted tag
16    responses = data['intents']
17    for intent in responses:
18        if intent['tag'] == tag:
19            result = np.random.choice(intent['responses'])
20            break
21
22    return result
```

Results

Model Performance: The chatbot demonstrated strong performance in generating appropriate responses based on user inputs. The use of multiple hidden layers and ReLU activation functions allowed the model to learn complex relationships between inputs and responses. The softmax output layer ensured accurate multi-class classification, allowing the chatbot to respond coherently to a variety of mental health-related queries.

Accuracy: The model achieved high accuracy (0.88) after training for 550 epochs, with the validation accuracy remaining stable throughout the training process.

Conclusion

- The trained neural network demonstrates a strong ability to understand and respond to user inputs across various mental health topics. While there is room for improving emotional nuance, the network maintains a coherent conversational flow and offers support based on learned dialogue patterns.
- **Significance:** This project highlights the role of AI in supporting mental health services by offering scalable, low-cost assistance. However, more work is required to ensure the chatbot can handle critical cases appropriately, including the integration of escalation protocols for users in distress.



Thank You