CREATE A CHATBOT IN PYTHON

TEAM MEMBER

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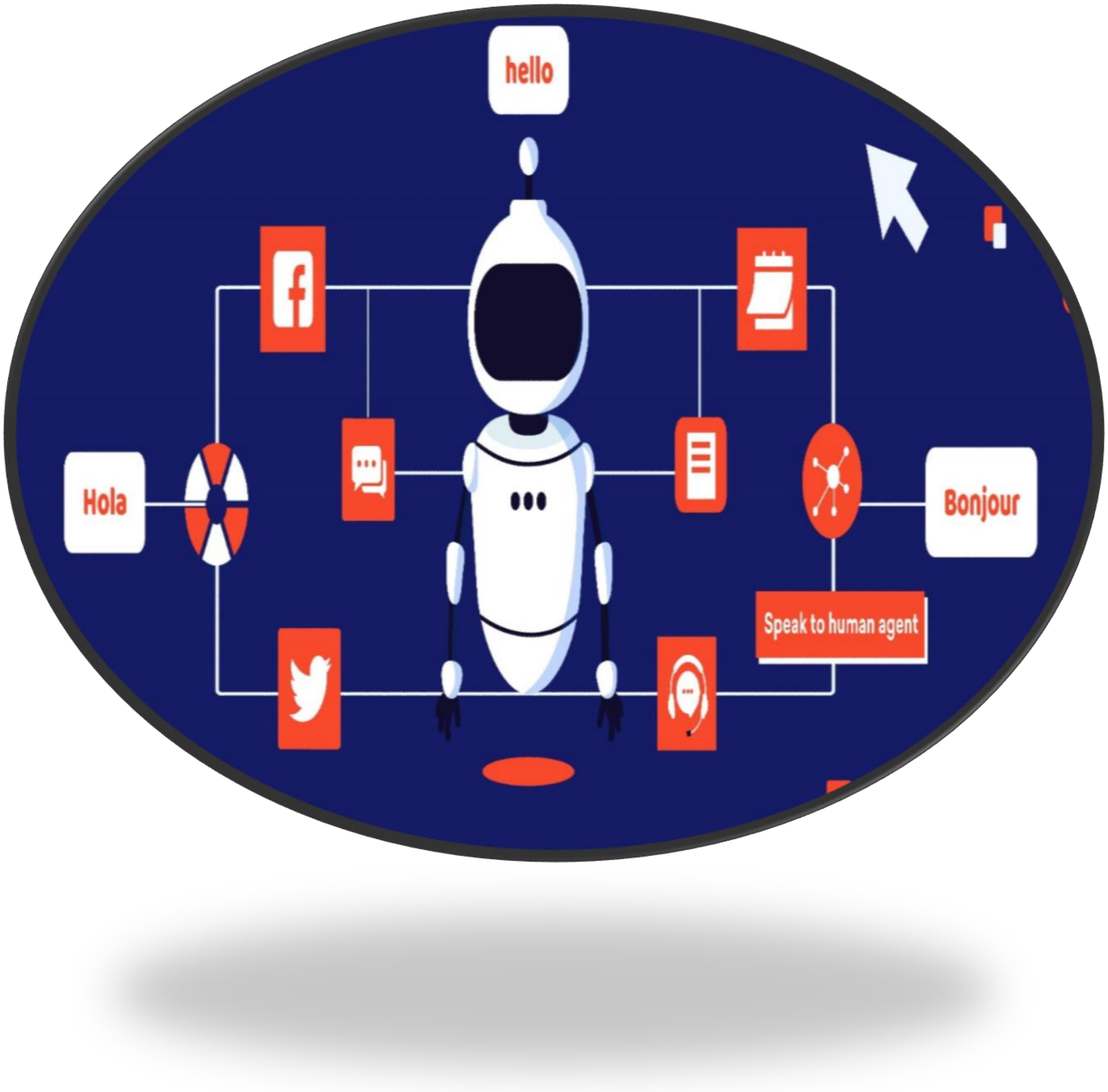
PHASE-2: Innovation

SYNOPSIS:

- Overview
- Innovation techniques
    1. NLTK
    2. Ensemble learning
    3. Deep learning
- Visualizating Accuracy
- Pre-Trained Language Models (Gpt-3)
- Conclusion

OVERVIEW:

Chatbots are developed using innovative techniques like ensemble learning, deep learning, and natural language processing (NLP). Ensemble learning enhances accuracy, deep learning enables complex user queries, and NLP enhances human language understanding, making interactions more engaging.



INNOVATION TECHNIQUES:

Achieving robustness and accuracy in AI systems is a complex and ongoing challenge. There are several innovative techniques exploring to enhance the robustness and accuracy of AI systems. Here are some of them: Deep Learning, Ensemble Learning, Reinforcement Learning, and NLTK (Natural Language Toolkit)

1. NLTK:

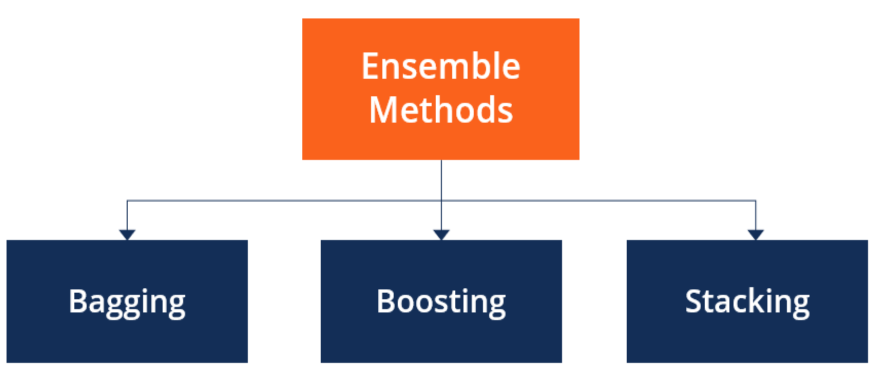
NLTK provides a wide range of tools, resources, and libraries for various NLP tasks, such as text processing, tokenization, stemming, tagging, parsing, and sentiment analysis. NLTK provides a set of tools and resources for text processing and analysis, making it for creating chatbots and improving the accuracy of prediction systems.

IMPLEMENTATION:

```
import nltk
import random
from sklearn.feature_extraction.text import TfidfVectorizer
nltk.download("punkt")
def tokenizer(text):
    text = text.lower()
    tokens = word_tokenize(text)
    tokens = [lemmatizer.lemmatize(token) for token in tokens]
    tokens = [token for token in tokens if token not in stop_words]
    return token
```

2. ENSEMBLE LEARNING:

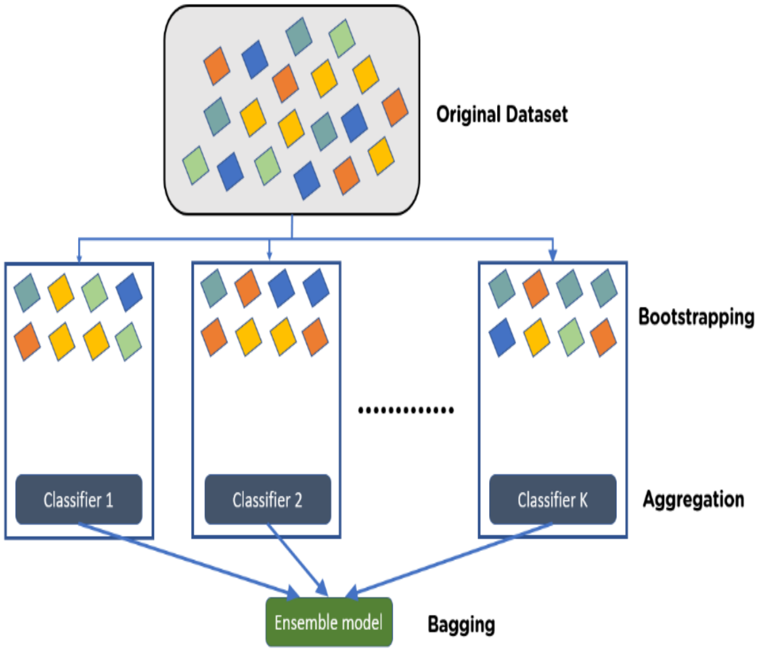
Ensemble learning is a technique in machine learning where multiple models are combined to improve predictive performance.



In this project, I used bagging method to achieve prediction system accuracy and robustness.

BAGGING:

Bagging (Bootstrap Aggregating) is an ensemble machine learning technique designed to improve the performance and robustness of predictive models by creating multiple subsets of training data, training individual models, and combining their predictions.

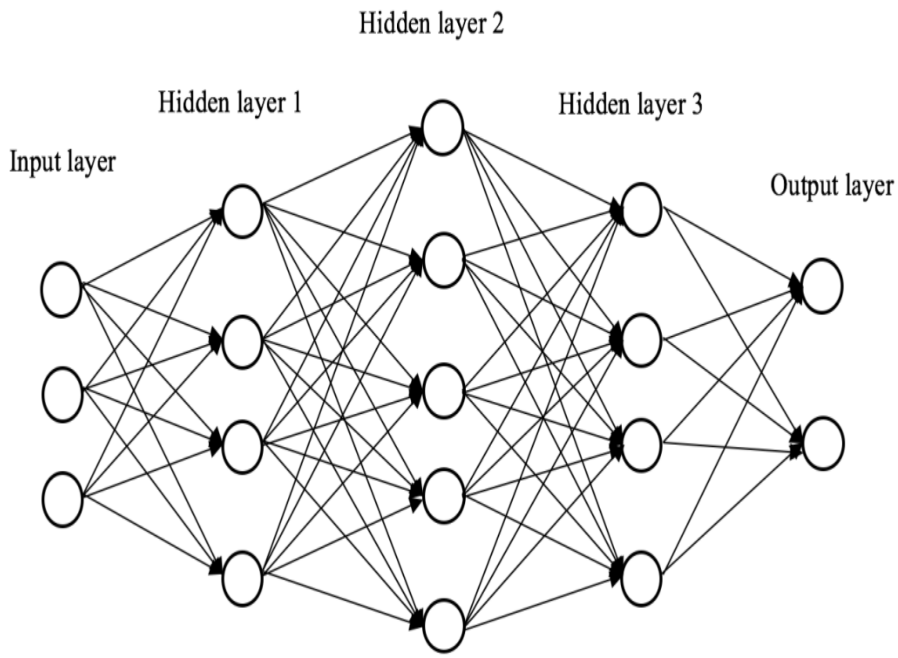


IMPLEMENTATION:

```
def bow(sentence, words, show_details=True):
    sentence_words = clean_up_sentence(sentence)
    bag = [0]*len(words)
    for s in sentence_words:
        for i,w in enumerate(words):
            if w == s:
                bag[i] = 1
            if show_details:
                print ("found in bag: %s" % w)
    return(np.array(bag))
```

3.DEEP LEARNING:

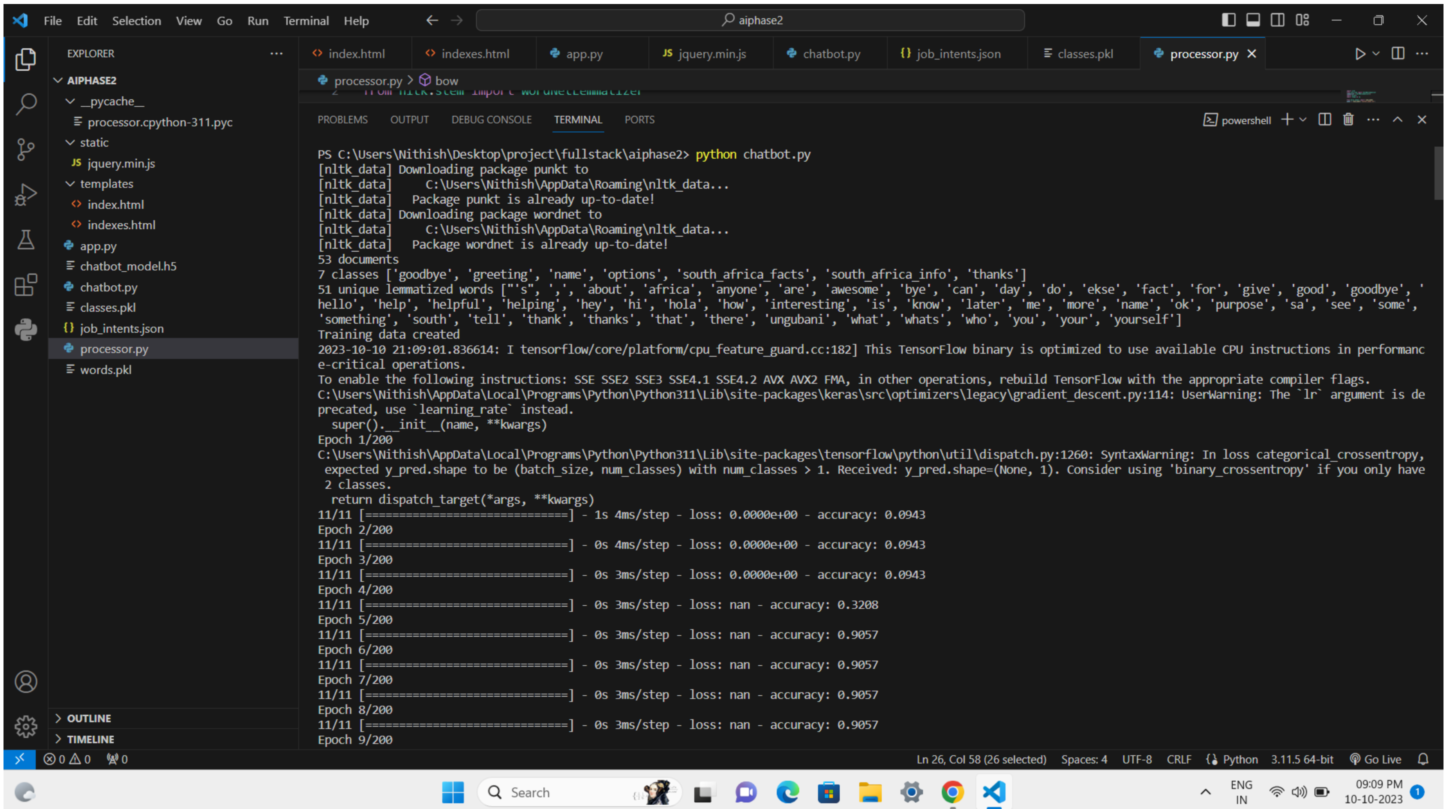
Deep Learning is a subfield of machine learning and artificial intelligence (AI) that focuses on the development of neural networks, particularly deep neural networks, inspired by the structure and function of the human brain.

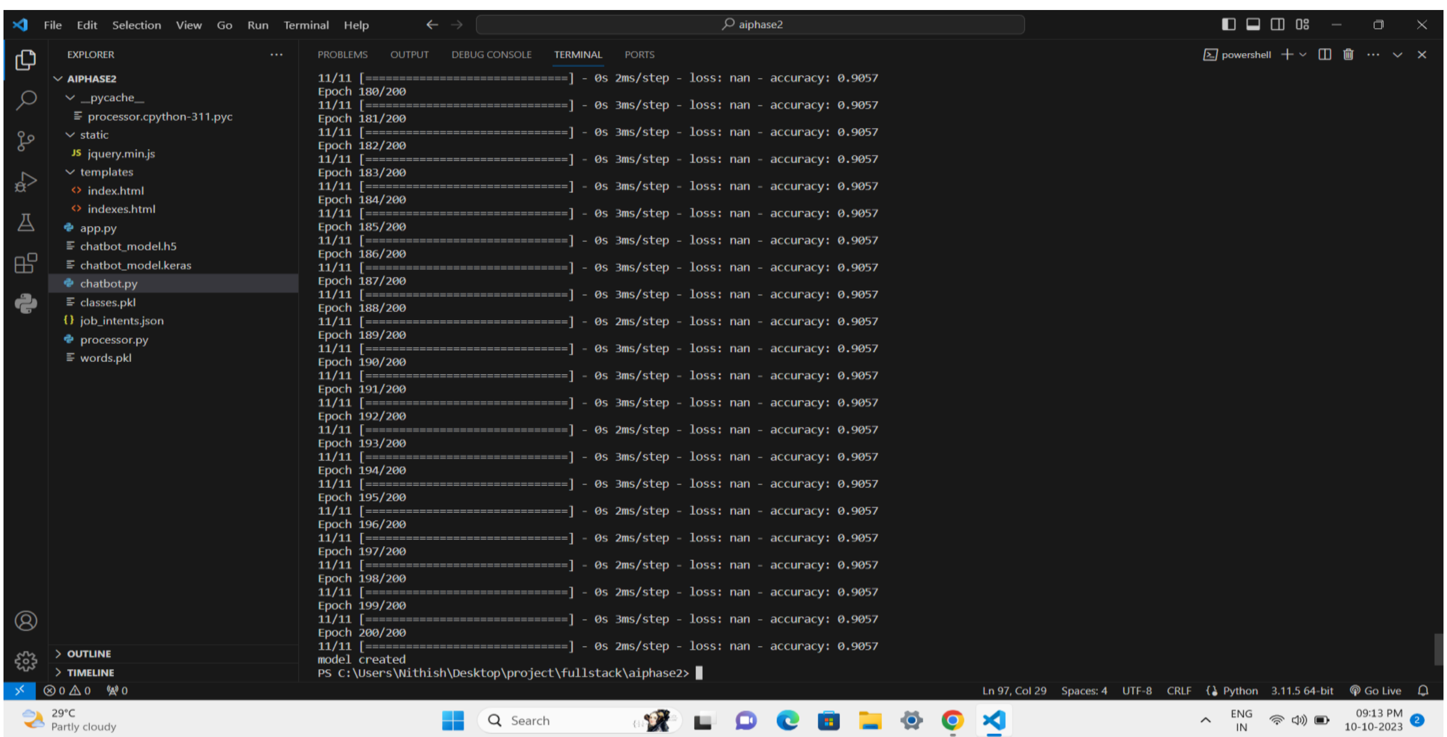


IMPLEMENTATION:

```
 import numpy as np
from keras.models import Sequential
from keras.layers import Dense, Activation, Dropout
from keras.optimizers import SGD
import random
import tensorflow as tf
words=[]
classes = []
documents = []
ignore_words = ['?', '!']
data_file = open('job_intents.json', encoding='utf-8').read()
intents = json.loads(data_file)
for intent in intents['intents']:
    for pattern in intent['patterns']:
        w = nltk.word_tokenize(pattern)
        words.extend(w)
       documents.append((w, intent['tag']))
      if intent['tag'] not in classes:
          classes.append(intent['tag'])
          words = [lemmatizer.lemmatize(w.lower()) for w in words if w not in
ignore_words]
          words = sorted(list(set(words)))
          classes = sorted(list(set(classes)))
          print (len(documents), "documents")
          print (len(classes), "classes", classes)
          print (len(words), "unique lemmatized words", words)
```

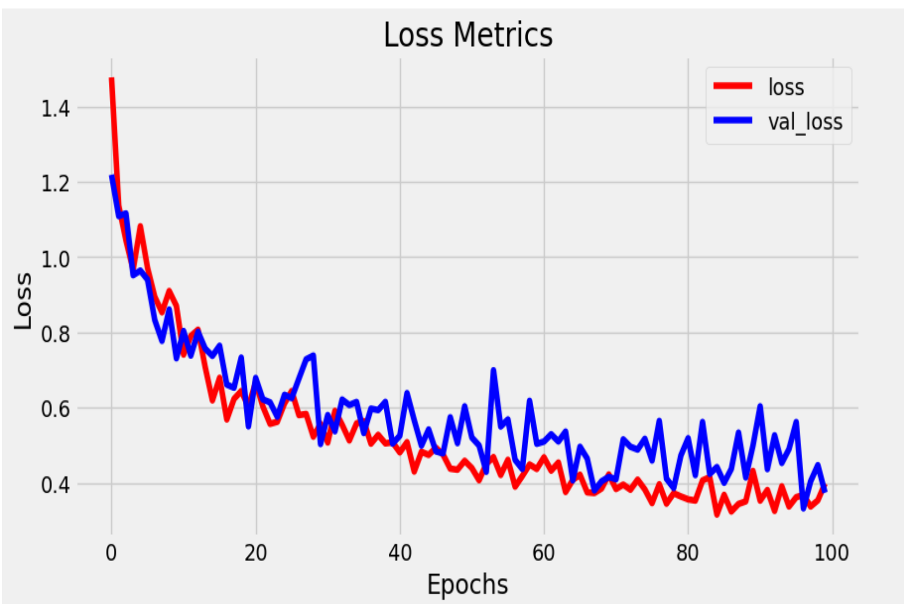
```
pickle.dump(words,open('words.pkl','wb'))
pickle.dump(classes,open('classes.pkl','wb'))
training = []
output_empty = [0] * len(classes)
for doc in documents:
    bag = []
    pattern_words = doc[0]
pattern_words = [lemmatizer.lemmatize(word.lower()) for word in pattern_words]
for w in words:
    bag.append(1) if w in pattern_words else bag.append(0)
    output_row = list(output_empty)
    output_row[classes.index(doc[1])] = 1
    training.append([bag, output_row])
    random.shuffle(training)
    max_length = max(len(item[0]) for item in training)
    training_padded = np.array([item[0] + [0] * (max_length - len(item[0])) +
item[1] for item in training])training = np.array(training_padded)
    train_x = list(training[:, :-1])
    train_y = list(training[:, -1:])
    print("Training data created")
    model = Sequential()
    model.add(Dense(128, input_shape=(len(train_x[0]),), activation='relu'))
    model.add(Dropout(0.5))
    model.add(Dense(64, activation='relu'))
    model.add(Dropout(0.5))
    model.add(Dense(len(train_y[0]), activation='softmax'))
    sgd = tf.keras.optimizers.legacy.SGD(lr=0.01, decay=1e-6, momentum=0.9,
nesterov=True)
    model.compile(loss='categorical_crossentropy', optimizer=sgd,
metrics=['accuracy'])
    hist = model.fit(np.array(train_x), np.array(train_y), epochs=200, batch_size=5,
verbose=1)
    model.save('chatbot_model.h5', hist)
print("model created")
```

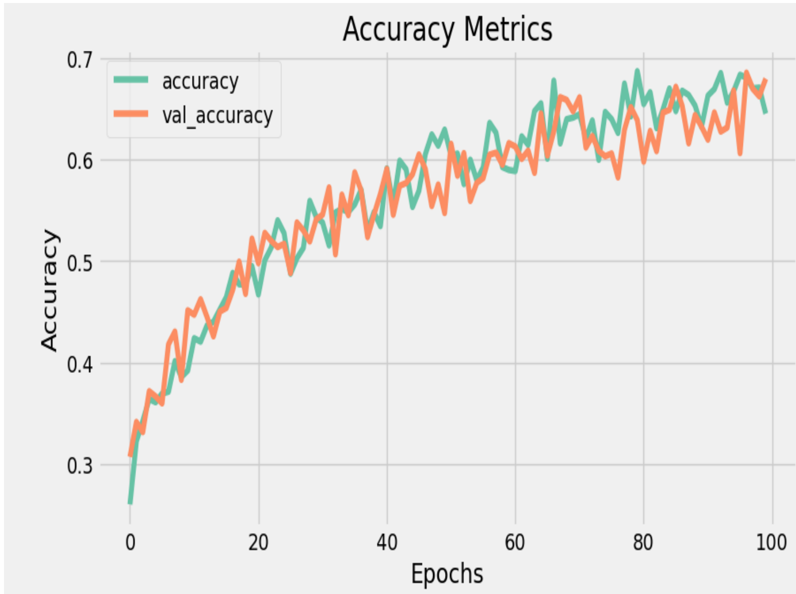

PS C:\Users\Nithish\Desktop\project\fullstack\aiphase2> python chatbot.py
[nltk_data] Downloading package punkt to
[nltk_data]   C:\Users\Nithish\AppData\Roaming\nltk_data...
[nltk_data]   Package punkt is already up-to-date!
[nltk_data] Downloading package wordnet to
[nltk_data]   C:\Users\Nithish\AppData\Roaming\nltk_data...
[nltk_data]   Package wordnet is already up-to-date!
53 documents
7 classes ['goodbye', 'greeting', 'name', 'options', 'south_africa_facts', 'south_africa_info', 'thanks']
51 unique lemmatized words ["'s", ',', 'about', 'africa', 'anyone', 'are', 'awesome', 'bye', 'can', 'day', 'do', 'ekse', 'fact', 'for', 'give', 'good', 'goodbye', 'hello', 'help', 'helpful', 'helping', 'hey', 'hi', 'hola', 'how', 'interesting', 'is', 'know', 'later', 'me', 'more', 'name', 'ok', 'purpose', 'sa', 'see', 'some', 'something', 'south', 'tell', 'thank', 'thanks', 'that', 'there', 'ungubani', 'what', 'whats', 'who', 'you', 'your', 'yourself']
Training data created
2023-10-10 21:09:01.836614: I tensorflow/core/platform/cpu_feature_guard.cc:182] This TensorFlow binary is optimized to use available CPU instructions in performance-critical operations.
To enable the following instructions: SSE SSE2 SSE3 SSE4.1 SSE4.2 AVX AVX2 FMA, in other operations, rebuild TensorFlow with the appropriate compiler flags.
C:\Users\Nithish\AppData\Local\Programs\Python\Python311\Lib\site-packages\keras\src\optimizers\legacy\gradient_descent.py:114: UserWarning: The `lr` argument is deprecated, use `learning_rate` instead.
super().__init__(name, **kwargs)
Epoch 1/200
C:\Users\Nithish\AppData\Local\Programs\Python\Python311\Lib\site-packages\tensorflow\python\util\dispatch.py:1260: SyntaxWarning: In loss categorical_crossentropy, expected y_pred.shape to be (batch_size, num_classes) with num_classes > 1. Received: y_pred.shape=(None, 1). Consider using 'binary_crossentropy' if you only have 2 classes.
return dispatch_target(*args, **kwargs)
11/11 [==============================] - 1s 4ms/step - loss: 0.0000e+00 - accuracy: 0.0943
Epoch 2/200
11/11 [==============================] - 0s 4ms/step - loss: 0.0000e+00 - accuracy: 0.0943
Epoch 3/200
11/11 [==============================] - 0s 3ms/step - loss: 0.0000e+00 - accuracy: 0.0943
Epoch 4/200
11/11 [==============================] - 0s 3ms/step - loss: nan - accuracy: 0.3208
Epoch 5/200
11/11 [==============================] - 0s 3ms/step - loss: nan - accuracy: 0.9057
Epoch 6/200
11/11 [==============================] - 0s 3ms/step - loss: nan - accuracy: 0.9057
Epoch 7/200
11/11 [==============================] - 0s 3ms/step - loss: nan - accuracy: 0.9057
Epoch 8/200
11/11 [==============================] - 0s 3ms/step - loss: nan - accuracy: 0.9057
Epoch 9/200


11/11 [==============================] - 0s 2ms/step - loss: nan - accuracy: 0.9057
Epoch 180/200
11/11 [==============================] - 0s 3ms/step - loss: nan - accuracy: 0.9057
Epoch 181/200
11/11 [==============================] - 0s 3ms/step - loss: nan - accuracy: 0.9057
Epoch 182/200
11/11 [==============================] - 0s 3ms/step - loss: nan - accuracy: 0.9057
Epoch 183/200
11/11 [==============================] - 0s 3ms/step - loss: nan - accuracy: 0.9057
Epoch 184/200
11/11 [==============================] - 0s 3ms/step - loss: nan - accuracy: 0.9057
Epoch 185/200
11/11 [==============================] - 0s 3ms/step - loss: nan - accuracy: 0.9057
Epoch 186/200
11/11 [==============================] - 0s 3ms/step - loss: nan - accuracy: 0.9057
Epoch 187/200
11/11 [==============================] - 0s 3ms/step - loss: nan - accuracy: 0.9057
Epoch 188/200
11/11 [==============================] - 0s 2ms/step - loss: nan - accuracy: 0.9057
Epoch 189/200
11/11 [==============================] - 0s 3ms/step - loss: nan - accuracy: 0.9057
Epoch 190/200
11/11 [==============================] - 0s 3ms/step - loss: nan - accuracy: 0.9057
Epoch 191/200
11/11 [==============================] - 0s 3ms/step - loss: nan - accuracy: 0.9057
Epoch 192/200
11/11 [==============================] - 0s 2ms/step - loss: nan - accuracy: 0.9057
Epoch 193/200
11/11 [==============================] - 0s 3ms/step - loss: nan - accuracy: 0.9057
Epoch 194/200
11/11 [==============================] - 0s 3ms/step - loss: nan - accuracy: 0.9057
Epoch 195/200
11/11 [==============================] - 0s 2ms/step - loss: nan - accuracy: 0.9057
Epoch 196/200
11/11 [==============================] - 0s 2ms/step - loss: nan - accuracy: 0.9057
Epoch 197/200
11/11 [==============================] - 0s 2ms/step - loss: nan - accuracy: 0.9057
Epoch 198/200
11/11 [==============================] - 0s 2ms/step - loss: nan - accuracy: 0.9057
Epoch 199/200
11/11 [==============================] - 0s 3ms/step - loss: nan - accuracy: 0.9057
Epoch 200/200
11/11 [==============================] - 0s 2ms/step - loss: nan - accuracy: 0.9057
model created
PS C:\Users\Nithish\Desktop\project\fullstack\aiphase2>

VISUALIZATING ACCURACY:

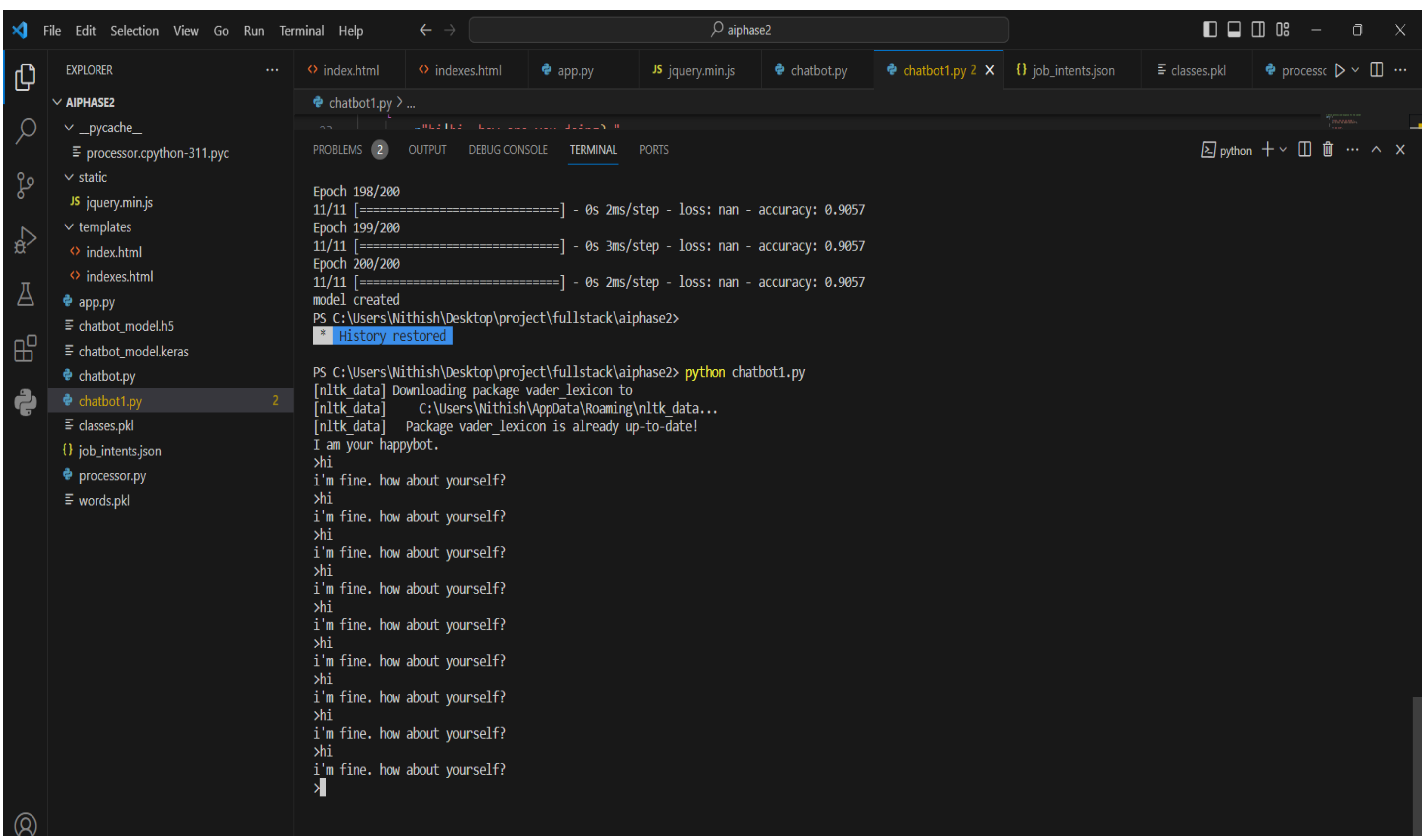
```
fig,ax=plt.subplots(nrows=1,ncols=2,figsize=(20,5))
 ax[0].plot(history.history['loss'],label='loss',c='red')
 ax[0].plot(history.history['val_loss'],label='val_loss',c = 'blue')
 ax[0].set_xlabel('Epochs')
 ax[1].set_xlabel('Epochs')
 ax[0].set_ylabel('Loss')
ax[1].set_ylabel('Accuracy')
ax[0].set_title('Loss Metrics')
ax[1].set_title('Accuracy Metrics')
ax[1].plot(history.history['accuracy'],label='accuracy')
ax[1].plot(history.history['val_accuracy'],label='val_accuracy')
ax[0].legend()
ax[1].legend()
plt.show()
```





PRE-TRAINED LANGUAGE MODELS (GPT-3)

GPT-3 can be effectively utilized to enhance the quality of responses in a chatbot. By integrating GPT-3 into a chatbot system, you can take advantage of its natural language understanding and generation capabilities.



CONCLUSION:

The integration of NLP, Deep Learning, and Ensemble Learning has significantly improved chatbot development, enhancing their comprehension, response accuracy, and performance, leading to potential applications in various fields.