PHASE 4

BUILD A MODEL IN CHATBOT

Date	**25.10.2023**
Team ID	**Proj_212175_Team-2**
Project Name	**Create a Chatbot in Python**
Maximum Marks	

ABSTRACT :

The primary components of building a chatbot model include data collection, preprocessing, model architecture design, training, and deployment. Natural language understanding and generation techniques play a pivotal role in enabling the chatbot to comprehend and generate human-like responses.

Data is collected from various sources, and preprocessing involves tasks like tokenization, stemming, and removing noise. Model architecture design choices encompass selecting between rule-based, retrieval-based, or generative models, each with its own strengths and weaknesses.

CODE :

```
tf.keras.utils.plot_model(chatbot.decoder,to_file='decoder.png',sho
w _shapes=True,show_layer_activations=True)

for idx,i in enumerate(model.layers):

 print('Encoder layers:' if idx==0 else 'Decoder layers: ')

for j in i.layers:

 print(j)
```

```
print('--------------------')

class ChatBot(tf.keras.models.Model):
 def _init_(self,base_encoder,base_decoder,*args,**kwargs):
```



```
 super()._init_(*args,**kwargs)

self.encoder,self.decoder=self.build_inference_model(base_encoder,
b ase_decoder)

 def build_inference_model(self,base_encoder,base_decoder):
encoder_inputs=tf.keras.Input(shape=(None,))
 x=base_encoder.layers[0](encoder_inputs)
 x=base_encoder.layers[1](x)
 x,encoder_state_h,encoder_state_c=base_encoder.layers[2](x)

encoder=tf.keras.models.Model(inputs=encoder_inputs,outputs=[e
n coder_state_h,encoder_state_c],name='chatbot_encoder')

      decoder_input_state_h=tf.keras.Input(shape=(lstm_cells,))
decoder_input_state_c=tf.keras.Input(shape=(lstm_cells,))
decoder_inputs=tf.keras.Input(shape=(None,))
 x=base_decoder.layers[0](decoder_inputs)
 x=base_encoder.layers[1](x)
```

```
x,decoder_state_h,decoder_state_c=base_decoder.layers[2](x,initial
_ state=[decoder_input_state_h,decoder_input_state_c])
 decoder_outputs=base_decoder.layers[-1](x)
 decoder=tf.keras.models.Model(
```

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```
inputs=[decoder_inputs,[decoder_input_state_h,decoder_input_sta
t e_c]],

outputs=[decoder_outputs,[decoder_state_h,decoder_state_c]],nam
e ='chatbot_decoder'
 )
 return encoder,decoder


 def summary(self):
 self.encoder.summary()
 self.decoder.summary()


 def softmax(self,z):
 return np.exp(z)/sum(np.exp(z))


 def sample(self,conditional_probability,temperature=0.5):
 conditional_probability =
np.asarray(conditional_probability).astype("float64")
 conditional_probability = np.log(conditional_probability) /
temperature
```

```
 reweighted_conditional_probability =
self.softmax(conditional_probability)

 probas = np.random.multinomial(1,
reweighted_conditional_probability, 1)
```



```
 return np.argmax(probas)


 def preprocess(self,text):

 text=clean_text(text)

 seq=np.zeros((1,max_sequence_length),dtype=np.int32)

for i,word in enumerate(text.split()):

 seq[:,i]=sequences2ids(word).numpy()[0]

return seq


 def postprocess(self,text):

 text=re.sub(' - ','-',text.lower())

 text=re.sub(' [.] ','. ',text)

 text=re.sub(' [1] ','1',text)

 text=re.sub(' [2] ','2',text)

 text=re.sub(' [3] ','3',text)

 text=re.sub(' [4] ','4',text)

 text=re.sub(' [5] ','5',text)

 text=re.sub(' [6] ','6',text)

 text=re.sub(' [7] ','7',text)
```

```
 text=re.sub(' [8] ','8',text)
 text=re.sub(' [9] ','9',text)
 text=re.sub(' [0] ','0',text)
 text=re.sub(' [,] ',', ',text)
 text=re.sub(' [?] ','? ',text)
 text=re.sub(' [!] ','! ',text)
 text=re.sub(' [$] ','$ ',text)
 text=re.sub(' [&] ','& ',text)
 text=re.sub(' [/] ','/ ',text)
 text=re.sub(' [:] ',': ',text)
 text=re.sub(' [;] ','; ',text)
 text=re.sub(' [] ',' ',text)
 text=re.sub(' [\'] ','\'',text)
 text=re.sub(' [\"] ','\"',text)
 return text

 def call(self,text,config=None):
 input_seq=self.preprocess(text)
 states=self.encoder(input_seq,training=False)
 target_seq=np.zeros((1,1))
 target_seq[:,:]=sequences2ids(['<start>']).numpy()[0][0]
stop_condition=False
 decoded=[]
```

```
while not stop_condition:

decoder_outputs,new_states=self.decoder([target_seq,states],traini
n g=False)
```

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```
# index=tf.argmax(decoder_outputs[:,-1,:],axis=-
1).numpy().item()
 index=self.sample(decoder_outputs[0,0,:]).item()
word=ids2sequences([index])
 if word=='<end> ' or len(decoded)>=max_sequence_length:
stop_condition=True
 else:
 decoded.append(index)
 target_seq=np.zeros((1,1))
 target_seq[:,:]=index
 states=new_states
 return self.postprocess(ids2sequences(decoded))

chatbot=ChatBot(model.encoder,model.decoder,name='chatbot'
) chatbot.summary()

tf.keras.utils.plot_model(chatbot.encoder,to_file='encoder.png',sho
w _shapes=True,show_layer_activations=True)

tf.keras.utils.plot_model(chatbot.decoder,to_file='decoder.png',sho
```

w _shapes=True,show_layer_activations=True)

EXPLANATION :

- **tf.keras.utils.plot_model(chatbot.decoder, to_file='decoder.png', show_shapes=True, show_layer_activations=True):**

This code generates a visualization of the chatbot.decoder model and saves it as 'decoder.png'. Here's what each argument does:

- **chatbot.decoder: This is presumably a Keras model (a neural network) that you want to visualize.**
- **to_file='decoder.png': It specifies the filename where the visualization of the model will be saved as an image (in this case, 'decoder.png').**
- **show_shapes=True: This flag indicates that you want to display the shapes of the layers in the visualization.**
- **show_layer_activations=True: This flag indicates that you want to show the layer activations in the visualization. • The code then seems to iterate through the layers of the model (which is not defined in the provided code, but I assume it's a reference to the chatbot.decoder model).**

Inside the loop, it prints information about the layers. It differentiates between 'Encoder layers' and 'Decoder layers' based on the idx variable. This suggests that the model might have an encoder-decoder architecture (common in sequence-to-sequence models or chatbots).

It further iterates through the layers within the current i (which is presumably a layer or a model) and prints information about these

sub-layers.

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- **tf.keras.utils.plot_model(chatbot.encoder, to_file='encoder.png', show_shapes=True, show_layer_activations=True)**

It visualizes the architecture of the chatbot.encoder

model. Saves the visualization as 'encoder.png'.

It includes information about the shapes of the layers and shows layer activations in the visualization.

- **tf.keras.utils.plot_model(chatbot.decoder, to_file='decoder.png', show_shapes=True, show_layer_activations=True)**

It visualizes the architecture of the chatbot.decoder

model. Saves the visualization as 'decoder.png'.

It also includes information about the shapes of the layers and shows layer activations in the visualization.

OUTPUT :

Encoder layers:
<keras.layers.core.embedding.Embedding object at 0x782084b9d19 0>
<keras.layers.normalization.layer_normalization.LayerNormalizat i on object at 0x7820e56f1b90>
<keras.layers.rnn.lstm.LSTM object at 0x7820841bd650> ----------

Decoder layers:

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<keras.layers.core.embedding.Embedding object at 0x78207c258590 >
<keras.layers.normalization.layer_normalization.LayerNormalizat i on object at 0x78207c78bd10>
<keras.layers.rnn.lstm.LSTM object at 0x78207c258a10>
<keras.layers.core.dense.Dense object at 0x78207c2636d0> ----------

Model: "chatbot_encoder"

_____
Layer (type) Output Shape Param #
==========
==========
input_1 (InputLayer) [(None, None)] 0

encoder_embedding (Embeddin (None, None, 256) 625408 g)

layer_normalization (LayerN (None, None, 256) 512 ormalization)

encoder_lstm (LSTM) [(None, None, 256), 525312 (None, 256),
(None, 256)]

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==========
Total params: 1,151,232
Trainable params: 1,151,232

Non-trainable params: 0

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Model: "chatbot_decoder"

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Layer (type) Output Shape Param # Connected to

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input_4 (InputLayer) [(None, None)] 0 []

decoder_embedding (Embedding) (None, None, 256) 625408 ['input_4[0][0]']

layer_normalization (LayerNorm (None, None, 256) 512 ['decoder_embedding[0][0]']
alization)

input_2 (InputLayer) [(None, 256)] 0 []

input_3 (InputLayer) [(None, 256)] 0 []

decoder_lstm (LSTM) [(None, None, 256), 525312 ['layer_normalization[1][0]',
(None, 256), 'input_2[0][0]', (None, 256)] 'input_3[0][0]']
decoder_dense (Dense) (None, None, 2443) 627851 ['decoder_lstm[0][0]']

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Total params: 1,779,083
Trainable params: 1,779,083

Non-trainable params: 0

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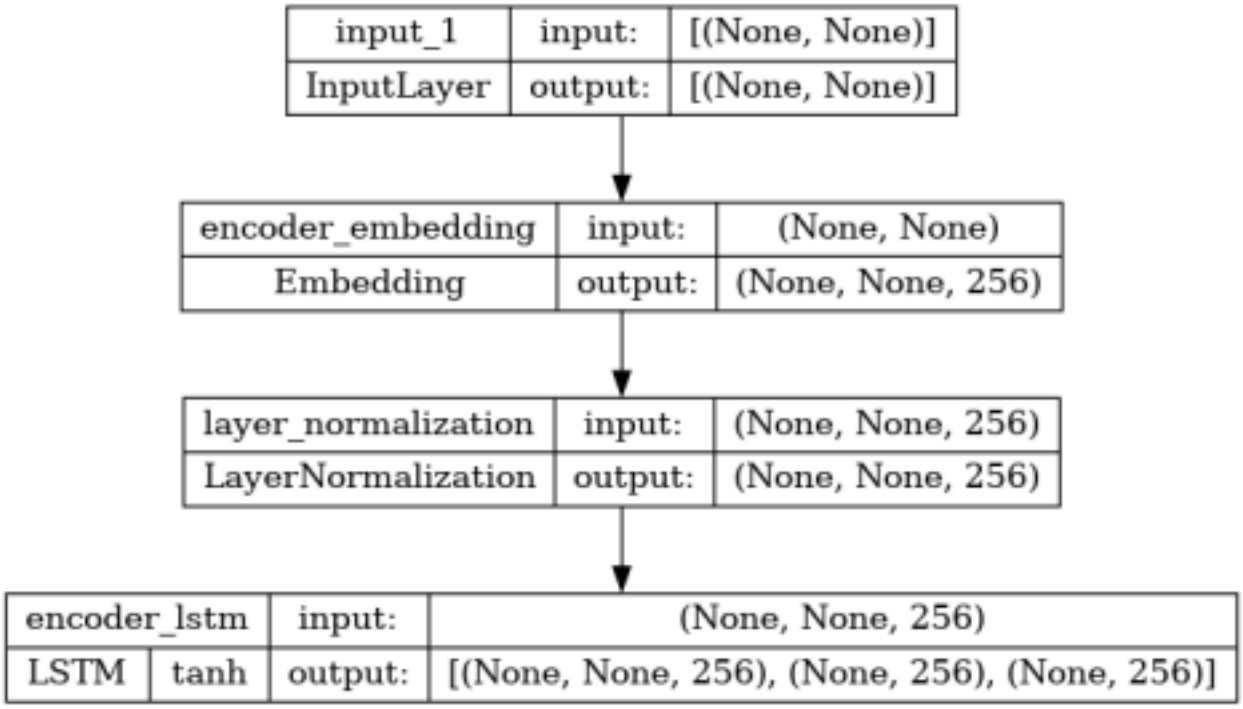


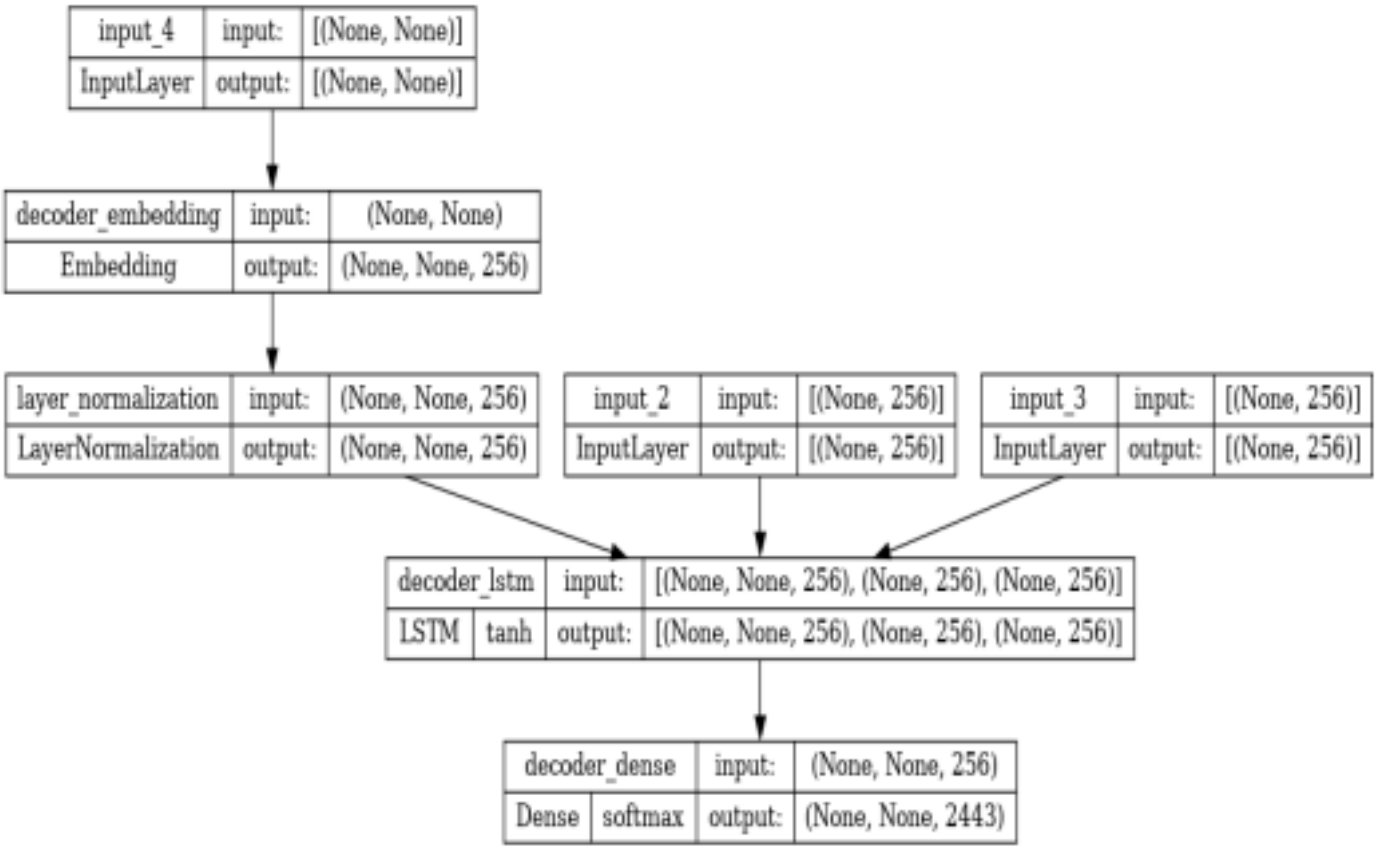
CONCLUSION :

Building a chatbot model involves several key steps:

<u>Data Collection</u>: Gather relevant training data, including conversations, questions, and answers.

<u>Data Preprocessing</u>: Clean and prepare the data, which often includes tokenization, stemming, and removing noise.

<u>Model Selection</u>: Choose an appropriate architecture, such as a sequence-to-sequence model or transformer model.



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<u>Training</u>: Train the model on your preprocessed data using appropriate loss functions and optimizers.

Evaluation: Assess the model's performance using metrics like accuracy, BLEU score, or human evaluation.

Fine-Tuning: Refine the model based on evaluation results, adjusting hyperparameters and data.

Deployment: Deploy the chatbot, whether it's in a web application, messaging platform, or other interfaces.

Monitoring and Maintenance: Continuously monitor and update the chatbot to improve its responses and keep it up to-date.

Building a chatbot model requires a combination of data handling, machine learning expertise, and domain knowledge to create an effective and conversational AI system.