In [5]:

```
!gdown --id 1OurDQUtbWQacvT32HMqFL7vIUrSMllOp
```

```
Downloading...
From: https://drive.google.com/uc?id=1OurDQUtbWQacvT32HMqFL7vIUrSMllOp
To: /content/preprocessed_data.csv
100% 300k/300k [00:00<00:00, 92.3MB/s]
```

In [6]:

```
#Importing the necessary packages
import pandas as pd
import numpy as np
import tensorflow as tf
from tensorflow.keras.preprocessing.text import Tokenizer
from tensorflow.keras.preprocessing.sequence import pad_sequences
```

In [7]:

```
df=pd.read_csv('preprocessed_data.csv')#reading the file preprocessed_data.csv
```

In [8]:

```
df.head(4)#visulazing the DataFrame
```

Out[8]:

	Unnamed: 0	source	target
0	0	U wan me to "chop" seat 4 u nt?\n	Do you want me to reserve seat for you or not?\n
1	1	Yup. U reaching. We order some durian pastry a...	Yeap. You reaching? We ordered some Durian pas...
2	2	They become more ex oredi... Mine is like 25.....	They become more expensive already. Mine is li...
3	3	I'm thai. what do u do?\n	I'm Thai. What do you do?\n

In [9]:

```
def preprocess(x):#for removing the last character
  x=x[:-1]
  return x
```

In [10]:

```
df['source']=df['source'].apply(preprocess)
df['target']=df['target'].apply(preprocess)
```

In [11]:

```
df=df[['source','target']]
df.head()
```

Out[11]:

	source	target
0	U wan me to "chop" seat 4 u nt?	Do you want me to reserve seat for you or not?
1	Yup. U reaching. We order some durian pastry a...	Yeap. You reaching? We ordered some Durian pas...
2	They become more ex oredi... Mine is like 25.....	They become more expensive already. Mine is li...
3	I'm thai. what do u do?	I'm Thai. What do you do?
4	Hi! How did your week go? Haven heard from you...	Hi! How did your week go? Haven't heard from y...

In [12]:

```
df.shape
```

Out[12]:

```
(2000, 2)
```

In [13]:

```
df=df[df['source'].apply(len)<170]#removing sentences where source sentence is greater than 170
df=df[df['target'].apply(len)<200]#removing snetences where target sentence is greater than 200
```

In [14]:

```
df.shape#printing the shape
```

Out[14]:

```
(1990, 2)
```

In [15]:

```
from sklearn.model_selection import train_test_split
X=df['source']
y=df['target']
X_train,X_test,y_train,y_test=train_test_split(X,y,test_size=0.01)#splitting in the data in the ratio of
print(X_train.shape)
```

```
print(X_test.shape)
print(y_train.shape)
print(y_test.shape)
```

```
(1970,)
(20,)
(1970,)
(20,)
```

Target:

In [16]:

```
target_tokenizer= Tokenizer(filters=None,char_level=True,lower=False)#tokenzing the target in character l
target_tokenizer.fit_on_texts(y_train)#fitting on the target train
target_vocab_size= len(target_tokenizer.word_index) + 1
print(len(target_tokenizer.word_index))#printing the vocabulary size
```

```
90
```

In [17]:

```
target_encoded_docs_train = target_tokenizer.texts_to_sequences(y_train)#converting target train into seq
target_encoded_docs_test = target_tokenizer.texts_to_sequences(y_test)#converting target test into sequen

target_padded_docs_train = pad_sequences(target_encoded_docs_train,padding='post')#padding target train
target_padded_docs_test = pad_sequences(target_encoded_docs_test,maxlen=target_padded_docs_train.shape[1]
```

Source:

In [18]:

```
source_tokenizer= Tokenizer(char_level=True,lower=False)#tokenzing the source in character level
source_tokenizer.fit_on_texts(X_train)#fitting on the source train
source_vocab_size= len(source_tokenizer.word_index) + 1
print(len(source_tokenizer.word_index))#printing the vocabulary size
```

```
103
```

In [19]:

```
source_encoded_docs_train = source_tokenizer.texts_to_sequences(X_train)#converting source train into seq
source_encoded_docs_test = source_tokenizer.texts_to_sequences(X_test)#converting source train into seque

source_padded_docs_train = pad_sequences(source_encoded_docs_train,maxlen=target_padded_docs_train.shape[
source_padded_docs_test = pad_sequences(source_encoded_docs_test,maxlen=target_padded_docs_train.shape[1]
```

In [20]:

```
#we are reshaping because sparse_categorical_entropy expects 3dimensions
target_padded_docs_train=target_padded_docs_train.reshape((*target_padded_docs_train.shape,1))
target_padded_docs_test=target_padded_docs_test.reshape((*target_padded_docs_test.shape,1))
```

In [21]:

```
print(target_padded_docs_train.shape)
print(target_padded_docs_test.shape)
```

```
(1970, 199, 1)
(20, 199, 1)
```

In [22]:

```
#we are reshaping because sparse_categorical_entropy expects 3dimensions
source_padded_docs_train=source_padded_docs_train.reshape((*source_padded_docs_train.shape,1))
source_padded_docs_test=source_padded_docs_test.reshape((*source_padded_docs_test.shape,1))
```

In [23]:

```
print(source_padded_docs_train.shape)
print(source_padded_docs_test.shape)
```

```
(1970, 199, 1)
(20, 199, 1)
```

In [49]:

```
X_train.to_csv('X_train2.csv')
y_train.to_csv('y_train2.csv')
X_test.to_csv('X_test2.csv')
y_test.to_csv('y_test2.csv')
```

In [50]:

```
import pandas as pd
pd.DataFrame(source_encoded_docs_train).to_csv("source_encoded_docs_train2.csv")
pd.DataFrame(source_encoded_docs_test).to_csv("source_encoded_docs_test2.csv")
pd.DataFrame(target_encoded_docs_train).to_csv("target_encoded_docs_train2.csv")
pd.DataFrame(target_encoded_docs_test).to_csv("target_encoded_docs_test2.csv")
```

Model1:

In [24]:

```
input=tf.keras.layers.Input(shape=(199,))
embed=tf.keras.layers.Embedding(source_vocab_size,256, input_length=source_padded_docs_train.shape[1])(in
```

```
lstm1=tf.keras.layers.LSTM(128, return_sequences=True)(embed)
dense=tf.keras.layers.TimeDistributed(tf.keras.layers.Dense(512, activation='relu'))(lstm1)
drop=tf.keras.layers.Dropout(0.5)(dense)
output=tf.keras.layers.TimeDistributed(tf.keras.layers.Dense(target_vocab_size, activation='softmax'))(dr
model=tf.keras.models.Model(inputs=input,outputs=output)
model.summary()
```

```
Model: "model"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
input_1 (InputLayer)         [(None, 199)]             0
_________________________________________________________________
embedding (Embedding)        (None, 199, 256)          26624
_________________________________________________________________
lstm (LSTM)                  (None, 199, 128)          197120
_________________________________________________________________
time_distributed (TimeDistri (None, 199, 512)          66048
_________________________________________________________________
dropout (Dropout)            (None, 199, 512)          0
_________________________________________________________________
time_distributed_1 (TimeDist (None, 199, 91)           46683
=================================================================
Total params: 336,475
Trainable params: 336,475
Non-trainable params: 0
_________________________________________________________________
```

In [25]:

```
# Compile model
model.compile(optimizer=tf.keras.optimizers.Adam(0.01),
              loss='sparse_categorical_crossentropy',metrics=['accuracy'])
```

In [26]:

```
model.fit(source_padded_docs_train,target_padded_docs_train,batch_size=1024,epochs=100,
          validation_data=(source_padded_docs_test,target_padded_docs_test))
```

```
Epoch 1/100
2/2 [==============================] - 9s 648ms/step - loss: 4.0295 - accuracy: 0.3307 - val_loss:
3.0509 - val_accuracy: 0.6756
Epoch 2/100
2/2 [==============================] - 0s 252ms/step - loss: 2.5630 - accuracy: 0.6698 - val_loss:
1.3701 - val_accuracy: 0.7176
Epoch 3/100
2/2 [==============================] - 0s 250ms/step - loss: 1.5293 - accuracy: 0.6910 - val_loss:
1.2024 - val_accuracy: 0.6879
Epoch 4/100
2/2 [==============================] - 0s 246ms/step - loss: 1.3614 - accuracy: 0.6641 - val_loss:
1.0989 - val_accuracy: 0.7291
Epoch 5/100
2/2 [==============================] - 0s 245ms/step - loss: 1.3344 - accuracy: 0.6993 - val_loss:
1.0950 - val_accuracy: 0.7302
Epoch 6/100
2/2 [==============================] - 0s 244ms/step - loss: 1.3359 - accuracy: 0.6934 - val_loss:
1.0957 - val_accuracy: 0.7302
Epoch 7/100
2/2 [==============================] - 0s 243ms/step - loss: 1.3253 - accuracy: 0.6955 - val_loss:
1.0986 - val_accuracy: 0.7302
Epoch 8/100
2/2 [==============================] - 0s 245ms/step - loss: 1.3172 - accuracy: 0.6998 - val_loss:
1.0917 - val_accuracy: 0.7302
Epoch 9/100
2/2 [==============================] - 0s 244ms/step - loss: 1.3089 - accuracy: 0.6998 - val_loss:
1.0867 - val_accuracy: 0.7302
Epoch 10/100
2/2 [==============================] - 0s 245ms/step - loss: 1.2991 - accuracy: 0.6996 - val_loss:
1.0887 - val_accuracy: 0.7302
Epoch 11/100
2/2 [==============================] - 0s 254ms/step - loss: 1.2875 - accuracy: 0.6998 - val_loss:
1.0894 - val_accuracy: 0.7302
Epoch 12/100
2/2 [==============================] - 0s 244ms/step - loss: 1.2725 - accuracy: 0.6998 - val_loss:
1.0809 - val_accuracy: 0.7307
Epoch 13/100
2/2 [==============================] - 0s 244ms/step - loss: 1.2603 - accuracy: 0.7002 - val_loss:
1.0777 - val_accuracy: 0.7296
Epoch 14/100
2/2 [==============================] - 0s 245ms/step - loss: 1.2479 - accuracy: 0.7006 - val_loss:
1.0753 - val_accuracy: 0.7304
```

```
Epoch 15/100
2/2 [==============================] - 0s 248ms/step - loss: 1.2353 - accuracy: 0.7007 - val_loss:
1.0738 - val_accuracy: 0.7302
Epoch 16/100
2/2 [==============================] - 0s 255ms/step - loss: 1.2272 - accuracy: 0.7007 - val_loss:
1.0751 - val_accuracy: 0.7302
Epoch 17/100
2/2 [==============================] - 0s 243ms/step - loss: 1.2200 - accuracy: 0.7007 - val_loss:
1.0738 - val_accuracy: 0.7302
Epoch 18/100
2/2 [==============================] - 0s 251ms/step - loss: 1.2142 - accuracy: 0.7009 - val_loss:
1.0675 - val_accuracy: 0.7302
Epoch 19/100
2/2 [==============================] - 0s 247ms/step - loss: 1.2095 - accuracy: 0.7011 - val_loss:
1.0623 - val_accuracy: 0.7302
Epoch 20/100
2/2 [==============================] - 0s 246ms/step - loss: 1.2069 - accuracy: 0.7014 - val_loss:
1.0578 - val_accuracy: 0.7317
Epoch 21/100
2/2 [==============================] - 0s 247ms/step - loss: 1.2027 - accuracy: 0.7017 - val_loss:
1.0584 - val_accuracy: 0.7317
Epoch 22/100
2/2 [==============================] - 0s 248ms/step - loss: 1.2002 - accuracy: 0.7020 - val_loss:
1.0486 - val_accuracy: 0.7319
Epoch 23/100
2/2 [==============================] - 0s 245ms/step - loss: 1.1965 - accuracy: 0.7024 - val_loss:
1.0518 - val_accuracy: 0.7329
Epoch 24/100
2/2 [==============================] - 0s 250ms/step - loss: 1.1923 - accuracy: 0.7029 - val_loss:
1.0409 - val_accuracy: 0.7337
Epoch 25/100
2/2 [==============================] - 0s 247ms/step - loss: 1.2019 - accuracy: 0.7034 - val_loss:
1.0625 - val_accuracy: 0.7334
Epoch 26/100
2/2 [==============================] - 0s 248ms/step - loss: 1.1967 - accuracy: 0.7035 - val_loss:
1.0441 - val_accuracy: 0.7349
Epoch 27/100
2/2 [==============================] - 0s 245ms/step - loss: 1.1923 - accuracy: 0.7040 - val_loss:
1.0488 - val_accuracy: 0.7354
Epoch 28/100
2/2 [==============================] - 0s 246ms/step - loss: 1.1869 - accuracy: 0.7046 - val_loss:
1.0453 - val_accuracy: 0.7342
Epoch 29/100
2/2 [==============================] - 0s 246ms/step - loss: 1.1822 - accuracy: 0.7043 - val_loss:
1.0379 - val_accuracy: 0.7342
Epoch 30/100
2/2 [==============================] - 0s 246ms/step - loss: 1.1782 - accuracy: 0.7047 - val_loss:
1.0412 - val_accuracy: 0.7364
Epoch 31/100
2/2 [==============================] - 0s 242ms/step - loss: 1.1746 - accuracy: 0.7055 - val_loss:
1.0311 - val_accuracy: 0.7364
Epoch 32/100
2/2 [==============================] - 0s 250ms/step - loss: 1.1713 - accuracy: 0.7058 - val_loss:
1.0314 - val_accuracy: 0.7372
Epoch 33/100
2/2 [==============================] - 0s 250ms/step - loss: 1.1661 - accuracy: 0.7055 - val_loss:
1.0245 - val_accuracy: 0.7374
Epoch 34/100
2/2 [==============================] - 0s 248ms/step - loss: 1.1620 - accuracy: 0.7064 - val_loss:
1.0214 - val_accuracy: 0.7369
Epoch 35/100
2/2 [==============================] - 0s 246ms/step - loss: 1.1581 - accuracy: 0.7067 - val_loss:
1.0207 - val_accuracy: 0.7369
Epoch 36/100
2/2 [==============================] - 0s 250ms/step - loss: 1.1536 - accuracy: 0.7073 - val_loss:
1.0159 - val_accuracy: 0.7399
Epoch 37/100
2/2 [==============================] - 0s 246ms/step - loss: 1.1487 - accuracy: 0.7084 - val_loss:
1.0137 - val_accuracy: 0.7382
Epoch 38/100
2/2 [==============================] - 0s 253ms/step - loss: 1.1442 - accuracy: 0.7090 - val_loss:
1.0124 - val_accuracy: 0.7394
Epoch 39/100
2/2 [==============================] - 0s 247ms/step - loss: 1.1405 - accuracy: 0.7095 - val_loss:
1.0288 - val_accuracy: 0.7405
Epoch 40/100
2/2 [==============================] - 0s 245ms/step - loss: 1.1432 - accuracy: 0.7097 - val_loss:
```

```
1.0192 - val_accuracy: 0.7389
Epoch 41/100
2/2 [==============================] - 0s 249ms/step - loss: 1.1373 - accuracy: 0.7103 - val_loss: 
1.0044 - val_accuracy: 0.7394
Epoch 42/100
2/2 [==============================] - 0s 250ms/step - loss: 1.1358 - accuracy: 0.7103 - val_loss: 
1.0054 - val_accuracy: 0.7392
Epoch 43/100
2/2 [==============================] - 0s 254ms/step - loss: 1.1307 - accuracy: 0.7105 - val_loss: 
1.0016 - val_accuracy: 0.7397
Epoch 44/100
2/2 [==============================] - 0s 245ms/step - loss: 1.1280 - accuracy: 0.7109 - val_loss: 
1.0062 - val_accuracy: 0.7422
Epoch 45/100
2/2 [==============================] - 0s 255ms/step - loss: 1.1232 - accuracy: 0.7114 - val_loss: 
0.9998 - val_accuracy: 0.7440
Epoch 46/100
2/2 [==============================] - 0s 247ms/step - loss: 1.1171 - accuracy: 0.7132 - val_loss: 
0.9826 - val_accuracy: 0.7412
Epoch 47/100
2/2 [==============================] - 0s 250ms/step - loss: 1.1198 - accuracy: 0.7135 - val_loss: 
0.9919 - val_accuracy: 0.7435
Epoch 48/100
2/2 [==============================] - 0s 249ms/step - loss: 1.1127 - accuracy: 0.7141 - val_loss: 
0.9935 - val_accuracy: 0.7425
Epoch 49/100
2/2 [==============================] - 1s 251ms/step - loss: 1.1106 - accuracy: 0.7145 - val_loss: 
0.9842 - val_accuracy: 0.7442
Epoch 50/100
2/2 [==============================] - 0s 250ms/step - loss: 1.1043 - accuracy: 0.7157 - val_loss: 
0.9851 - val_accuracy: 0.7462
Epoch 51/100
2/2 [==============================] - 1s 263ms/step - loss: 1.1014 - accuracy: 0.7163 - val_loss: 
0.9794 - val_accuracy: 0.7462
Epoch 52/100
2/2 [==============================] - 0s 253ms/step - loss: 1.0987 - accuracy: 0.7169 - val_loss: 
0.9742 - val_accuracy: 0.7485
Epoch 53/100
2/2 [==============================] - 0s 248ms/step - loss: 1.0934 - accuracy: 0.7175 - val_loss: 
0.9830 - val_accuracy: 0.7467
Epoch 54/100
2/2 [==============================] - 0s 250ms/step - loss: 1.0893 - accuracy: 0.7182 - val_loss: 
0.9660 - val_accuracy: 0.7467
Epoch 55/100
2/2 [==============================] - 0s 249ms/step - loss: 1.1011 - accuracy: 0.7173 - val_loss: 
0.9721 - val_accuracy: 0.7467
Epoch 56/100
2/2 [==============================] - 0s 249ms/step - loss: 1.0963 - accuracy: 0.7173 - val_loss: 
0.9701 - val_accuracy: 0.7467
Epoch 57/100
2/2 [==============================] - 0s 253ms/step - loss: 1.0872 - accuracy: 0.7182 - val_loss: 
0.9799 - val_accuracy: 0.7513
Epoch 58/100
2/2 [==============================] - 0s 250ms/step - loss: 1.0839 - accuracy: 0.7199 - val_loss: 
0.9592 - val_accuracy: 0.7525
Epoch 59/100
2/2 [==============================] - 0s 256ms/step - loss: 1.0823 - accuracy: 0.7203 - val_loss: 
0.9751 - val_accuracy: 0.7427
Epoch 60/100
2/2 [==============================] - 0s 251ms/step - loss: 1.0905 - accuracy: 0.7184 - val_loss: 
0.9692 - val_accuracy: 0.7490
Epoch 61/100
2/2 [==============================] - 0s 251ms/step - loss: 1.0928 - accuracy: 0.7165 - val_loss: 
0.9578 - val_accuracy: 0.7472
Epoch 62/100
2/2 [==============================] - 0s 252ms/step - loss: 1.0831 - accuracy: 0.7177 - val_loss: 
0.9674 - val_accuracy: 0.7420
Epoch 63/100
2/2 [==============================] - 0s 252ms/step - loss: 1.0801 - accuracy: 0.7176 - val_loss: 
0.9701 - val_accuracy: 0.7452
Epoch 64/100
2/2 [==============================] - 0s 251ms/step - loss: 1.0743 - accuracy: 0.7196 - val_loss: 
0.9506 - val_accuracy: 0.7495
Epoch 65/100
2/2 [==============================] - 0s 250ms/step - loss: 1.0728 - accuracy: 0.7207 - val_loss: 
0.9515 - val_accuracy: 0.7500
Epoch 66/100
```

```
Epoch 66/100
2/2 [==============================] - 0s 252ms/step - loss: 1.0667 - accuracy: 0.7216 - val_loss:
0.9716 - val_accuracy: 0.7492
Epoch 67/100
2/2 [==============================] - 0s 251ms/step - loss: 1.0658 - accuracy: 0.7217 - val_loss:
0.9490 - val_accuracy: 0.7477
Epoch 68/100
2/2 [==============================] - 1s 262ms/step - loss: 1.0626 - accuracy: 0.7218 - val_loss:
0.9500 - val_accuracy: 0.7490
Epoch 69/100
2/2 [==============================] - 0s 252ms/step - loss: 1.0592 - accuracy: 0.7222 - val_loss:
0.9498 - val_accuracy: 0.7490
Epoch 70/100
2/2 [==============================] - 0s 253ms/step - loss: 1.0546 - accuracy: 0.7229 - val_loss:
0.9418 - val_accuracy: 0.7475
Epoch 71/100
2/2 [==============================] - 0s 251ms/step - loss: 1.0524 - accuracy: 0.7227 - val_loss:
0.9459 - val_accuracy: 0.7513
Epoch 72/100
2/2 [==============================] - 0s 258ms/step - loss: 1.0500 - accuracy: 0.7228 - val_loss:
0.9371 - val_accuracy: 0.7492
Epoch 73/100
2/2 [==============================] - 0s 251ms/step - loss: 1.0487 - accuracy: 0.7232 - val_loss:
0.9431 - val_accuracy: 0.7475
Epoch 74/100
2/2 [==============================] - 0s 252ms/step - loss: 1.0499 - accuracy: 0.7230 - val_loss:
0.9401 - val_accuracy: 0.7530
Epoch 75/100
2/2 [==============================] - 0s 250ms/step - loss: 1.0455 - accuracy: 0.7230 - val_loss:
0.9307 - val_accuracy: 0.7503
Epoch 76/100
2/2 [==============================] - 0s 255ms/step - loss: 1.0459 - accuracy: 0.7235 - val_loss:
0.9465 - val_accuracy: 0.7447
Epoch 77/100
2/2 [==============================] - 0s 251ms/step - loss: 1.0573 - accuracy: 0.7221 - val_loss:
0.9366 - val_accuracy: 0.7515
Epoch 78/100
2/2 [==============================] - 0s 252ms/step - loss: 1.0547 - accuracy: 0.7213 - val_loss:
0.9283 - val_accuracy: 0.7513
Epoch 79/100
2/2 [==============================] - 1s 253ms/step - loss: 1.0456 - accuracy: 0.7223 - val_loss:
0.9419 - val_accuracy: 0.7475
Epoch 80/100
2/2 [==============================] - 0s 251ms/step - loss: 1.0449 - accuracy: 0.7226 - val_loss:
0.9360 - val_accuracy: 0.7482
Epoch 81/100
2/2 [==============================] - 0s 250ms/step - loss: 1.0387 - accuracy: 0.7237 - val_loss:
0.9269 - val_accuracy: 0.7540
Epoch 82/100
2/2 [==============================] - 0s 253ms/step - loss: 1.0357 - accuracy: 0.7243 - val_loss:
0.9259 - val_accuracy: 0.7505
Epoch 83/100
2/2 [==============================] - 1s 259ms/step - loss: 1.0325 - accuracy: 0.7246 - val_loss:
0.9286 - val_accuracy: 0.7487
Epoch 84/100
2/2 [==============================] - 0s 256ms/step - loss: 1.0299 - accuracy: 0.7248 - val_loss:
0.9287 - val_accuracy: 0.7510
Epoch 85/100
2/2 [==============================] - 0s 253ms/step - loss: 1.0277 - accuracy: 0.7249 - val_loss:
0.9232 - val_accuracy: 0.7523
Epoch 86/100
2/2 [==============================] - 0s 251ms/step - loss: 1.0234 - accuracy: 0.7254 - val_loss:
0.9224 - val_accuracy: 0.7500
Epoch 87/100
2/2 [==============================] - 1s 256ms/step - loss: 1.0234 - accuracy: 0.7256 - val_loss:
0.9175 - val_accuracy: 0.7510
Epoch 88/100
2/2 [==============================] - 0s 254ms/step - loss: 1.0246 - accuracy: 0.7255 - val_loss:
0.9156 - val_accuracy: 0.7535
Epoch 89/100
2/2 [==============================] - 0s 249ms/step - loss: 1.0181 - accuracy: 0.7259 - val_loss:
0.9307 - val_accuracy: 0.7525
Epoch 90/100
2/2 [==============================] - 1s 252ms/step - loss: 1.0191 - accuracy: 0.7260 - val_loss:
0.9194 - val_accuracy: 0.7543
Epoch 91/100
2/2 [==============================] - 1s 252ms/step - loss: 1.0133 - accuracy: 0.7265 - val_loss:
0.9205 - val_accuracy: 0.7515
```

```
Epoch 92/100
2/2 [==============================] - 1s 259ms/step - loss: 1.0140 - accuracy: 0.7265 - val_loss: 
0.9084 - val_accuracy: 0.7523
Epoch 93/100
2/2 [==============================] - 0s 253ms/step - loss: 1.0105 - accuracy: 0.7263 - val_loss: 
0.9255 - val_accuracy: 0.7503
Epoch 94/100
2/2 [==============================] - 1s 252ms/step - loss: 1.0168 - accuracy: 0.7261 - val_loss: 
0.9594 - val_accuracy: 0.7467
Epoch 95/100
2/2 [==============================] - 0s 255ms/step - loss: 1.0370 - accuracy: 0.7223 - val_loss: 
0.9110 - val_accuracy: 0.7520
Epoch 96/100
2/2 [==============================] - 0s 254ms/step - loss: 1.0333 - accuracy: 0.7216 - val_loss: 
0.9341 - val_accuracy: 0.7500
Epoch 97/100
2/2 [==============================] - 0s 254ms/step - loss: 1.0243 - accuracy: 0.7227 - val_loss: 
0.9180 - val_accuracy: 0.7455
Epoch 98/100
2/2 [==============================] - 0s 252ms/step - loss: 1.0206 - accuracy: 0.7222 - val_loss: 
0.9208 - val_accuracy: 0.7503
Epoch 99/100
2/2 [==============================] - 1s 252ms/step - loss: 1.0174 - accuracy: 0.7251 - val_loss: 
0.9145 - val_accuracy: 0.7538
Epoch 100/100
2/2 [==============================] - 0s 253ms/step - loss: 1.0126 - accuracy: 0.7265 - val_loss: 
0.9065 - val_accuracy: 0.7528
```

Out[26]:

```
<tensorflow.python.keras.callbacks.History at 0x7f36ee2a7bd0>
```

In [28]:

```python
x=model.predict(source_padded_docs_test[:1])[0]
```

In [29]:

```python
index_to_words = {id: word for word, id in target_tokenizer.word_index.items()}
index_to_words[0] = '<PAD>'
''.join([index_to_words[prediction] for prediction in np.argmax(x, 1)])
```

Out[29]:

```
'Photo page..                         <PAD><PAD>   k                    <PAD><PAD><PAD><PAD><PAD><PAD><PAD>
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```

In [30]:

```python
print(y_test[:1])
```

```
1108    Photo page. You mean the website. OK, I'll go ...
Name: target, dtype: object
```

In [31]:

```python
X_test[:1]
```

Out[31]:

```
1108    Photo page... U mean e website huh... Kk, i'll...
Name: source, dtype: object
```

In [33]:

```python
def prediction(x):

  index_to_words = {id: word for word, id in target_tokenizer.word_index.items()}
  index_to_words[0] = '<PAD>'

  y=''.join([index_to_words[prediction] for prediction in np.argmax(x, 1)])
  return y
for i in range(20):
  print("Input text: ")
  a=list(X_test[i:i+1])
  print(a[0])

  print("Actual Output: ")
  b=list(y_test[i:i+1])
  print(b[0])

  print("Predicted Output: ")
```

```
    x=model.predict(source_padded_docs_test[i:i+1])
    y=prediction(x[0])
    y=y.split(' ')
    y_lst=[]
    for i in y:
        y_lst.append(i)
    print(' '.join(y_lst))
    print('>'*180)
```

```
Input text:
Photo page... U mean e website huh... Kk, i'll go mail u now...
Actual Output:
Photo page. You mean the website. OK, I'll go to mail you now.
Predicted Output:
Photo page..                       <PAD><PAD>   k                    <PAD><PAD><PAD><PAD><PAD><PAD><PAD>
<PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD>
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Input text:
Eh. I'm still at the bus stop... Missed the bus. So i might be later than you
Actual Output:
I'm still at the bus stop. I missed the bus. So I might be later than you.
Predicted Output:
Eh.  'm  till  t tte     s    <PAD><PAD>    sss   e                         e   t      <PAD><PAD><PAD><PAD>
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Input text:
Tomw depends on wat time si going to meet us lah... If she not so early maybe we meet bugis else meet
orchard lor
Actual Output:
Tomorrow depends on what time Si is going to meet us. If she is not so early, maybe we meet at Bugis,
else meet at Orchard.
Predicted Output:
Tomw deeends on wwt tttm  i   iiggg                                                e               ee
eeeeeeee e<PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD>
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Input text:
Ok. I going soon and also send xyan home at the same time. Call u when reaching k.
Actual Output:
Ok. I am going soon and also send xyan home at the same time. Call you when reaching.
Predicted Output:
Ok. I  oingg  on nnn        nd   an   n                  mm                          <PAD><PAD><PAD><PAD><
D><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><P
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Input text:
WHAT NUMBER? MOBILE OR NOT ?
Actual Output:
What number? Mobile or not?
Predicted Output:
What n         b  l    e      <PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD>
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Input text:
HI, R U GAL OR BOY
Actual Output:
Hi, are you girl or boy?
Predicted Output:
Hi, Rru                 <PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><
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Input text:
My painting almost done liao. But my house outside havent start yet. Haiz....
Actual Output:
My painting is almost done. But my house outside haven't started yet. Sigh.
Predicted Output:
My paintingg lmo t  onn    o.                  sse   veee  tt tt  tt  aaa   <PAD><PAD><PAD><PAD><PAD><PAD
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Input text:
Fine. Gt posted to SAFTI as a medic
Actual Output:
Fine. Got posted to SAFTI as a medic.
Predicted Output:
Fine. Gt po tte tt  a ti a  a      e<PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD
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Input text:
No la... Not attached... He's always pesterin me, dunno y... Haha, i find him a jerk oso lor...
Actual Output:
No. Not attached. He's always pestering me, I don't know why. Haha, I find him a jerk also.
Predicted Output:
No                   <PAD><PAD><PAD>                                  <PAD><PAD>
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Input text:
WHAT TIME U WRKIN?
Actual Output:
What time are you working?
Predicted Output:
What Ttmm              <PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><P
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Input text:
I thk dun wan da glasses lar... Seldom use it anyway... Save some money... Hee...
Actual Output:
I think I don't want the glasses. Seldom use it anyway. Save some money. Hee.
Predicted Output:
I thk d n   n   ssssss   <PAD>   <PAD><PAD><PAD><PAD><PA
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Input text:
Hi babe its me thanks for coming even though it didnt go that well!i just wanted my bed! Hope to see you soon love and kisses
Actual Output:
Hi baby, it's me, thanks for coming, even though it didn't go that well! I just wanted my bed! Hope to s
ee you soon love and kisses.
Predicted Output:
Hi abe its me thanns   r ooonn   eeeee   ddd
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Input text:
Hello.... Are you free later for a chat?
Actual Output:
Hello. Are you free later for a chat?
Predicted Output:
Hello. I   e   r   <PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><
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Input text:
Me very hungry... Ü come down faster lei...
Actual Output:
Me very hungry. You come down faster.
Predicted Output:
Me very ynnnyy   o o o o   ee<PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD>
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Input text:
Mmm thats better now i got a roast down me! i'd b better if i had a few drinks down me 2! Good indian?
Actual Output:
That's better now, I got a roast down me! I'd be better if I had a few drinks down me too! Good Indian?
Predicted Output:
Mmm mhats etttte   aat
nn<PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><P
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Input text:
Yup... I will be going with my hall.
Actual Output:
Yes. I will be going with my hall.
Predicted Output:
Yes. I      l        g             <PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD>
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Input text:
Huh... oh! Thats the wooden one right? the aluminium one cheaper
Actual Output:
Huh. Oh! That's the wooden one right? The aluminium one is cheaper.
Predicted Output:
Huh. I                               <PAD>           i             e<PAD><PAD><PAD><PAD><PAD><PAD><PAD><P
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Input text:
Yupz...Kk...Den i anyhow wear...Vv hot...Haha
Actual Output:
Yes. Ok. Then I anyhow wear. It's very hot. Haha.
Predicted Output:
Yes.    k                    <PAD><PAD><PAD>       <PAD><PAD>    <PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD>
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Input text:
So how are you spending yr weekend?
Actual Output:
So how are you spending your weekend?
Predicted Output:
So how are you spendinggyr  eeeeed?<PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD
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Input text:
Hey....I know its rude of me not to do something abt e fone.N i'm sorry it died on u.
Actual Output:
Hey, I know it's rude of me not to do something about the phone. And I'm sorry it died on you.
Predicted Output:
Hey. I                                                     <PAD>                          <PAD><PAD><PAD>
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```

In [34]:

```python
import nltk.translate.bleu_score as bleu

bleu_score=[]
for i in range(20):
  b=list(y_test[i:i+1])
  x=model.predict(source_padded_docs_test[i:i+1])
  y=prediction(x[0])
  y=y.split(' ')
  y_lst=[]
  for i in y:
    if '<' in i:
      continue
    else:
      y_lst.append(i)
  bleu_score.append(bleu.sentence_bleu([b[0].split(),],y_lst))
print(bleu_score)
print("The Average Bleu Score is: ",sum(bleu_score)/20)
```

```
/usr/local/lib/python3.7/dist-packages/nltk/translate/bleu_score.py:490: UserWarning:
Corpus/Sentence contains 0 counts of 2-gram overlaps.
BLEU scores might be undesirable; use SmoothingFunction().
  warnings.warn(_msg)
/usr/local/lib/python3.7/dist-packages/nltk/translate/bleu_score.py:490: UserWarning:
Corpus/Sentence contains 0 counts of 3-gram overlaps.
BLEU scores might be undesirable; use SmoothingFunction().
  warnings.warn(_msg)
[0.3839817133079349, 0, 0.3375804740497263, 0.15042653060571137, 0.46173663094410267,
0.4854917717073234, 0.3976353643835253, 0.5946035575013605, 0, 0.5081327481546147, 0.3549481056010053,
0.3138995505196357, 0.42728700639623407, 0.25650569096216347, 0, 0.22679164443904004, 0.3672056269893592,
0.4172261448611506, 0.43012508513132625, 0.3354232998654124]
The Average Bleu Score is:  0.32245004727098137
```

Model2:

In [35]:

```python
input=tf.keras.layers.Input(shape=(199,))
embed=tf.keras.layers.Embedding(source_vocab_size,256, input_length=source_padded_docs_train.shape[1])(in
lstm1=tf.keras.layers.Bidirectional(tf.keras.layers.LSTM(128, return_sequences=True))(embed)
dense=tf.keras.layers.TimeDistributed(tf.keras.layers.Dense(512,activation='relu'))(lstm1)
drop=tf.keras.layers.Dropout(0.5)(dense)
output=tf.keras.layers.TimeDistributed(tf.keras.layers.Dense(target_vocab_size, activation='softmax'))(dr
model=tf.keras.models.Model(inputs=input,outputs=output)
model.summary()
```

```
Model: "model_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #   
=================================================================
input_2 (InputLayer)         [(None, 199)]             0         
_________________________________________________________________
embedding_1 (Embedding)      (None, 199, 256)          26624     
_________________________________________________________________
bidirectional (Bidirectional (None, 199, 256)          394240    
_________________________________________________________________
time_distributed_2 (TimeDist (None, 199, 512)          131584    
_________________________________________________________________
dropout_1 (Dropout)          (None, 199, 512)          0         
_________________________________________________________________
time_distributed_3 (TimeDist (None, 199, 91)           46683     
=================================================================
Total params: 599,131
Trainable params: 599,131
Non-trainable params: 0
_________________________________________________________________
```

In [36]:

```python
# Compile model
model.compile(optimizer=tf.keras.optimizers.Adam(0.01),
              loss='sparse_categorical_crossentropy',metrics=['accuracy'])
```

In [37]:

```python
model.fit(source_padded_docs_train,target_padded_docs_train,batch_size=1024,epochs=100,
          validation_data=(source_padded_docs_test,target_padded_docs_test))
```

```
Epoch 1/100
2/2 [==============================] - 4s 989ms/step - loss: 3.9742 - accuracy: 0.3335 - val_loss:
```

```
4.5931 - val_accuracy: 0.6756
Epoch 2/100
2/2 [==============================] - 1s 369ms/step - loss: 3.5696 - accuracy: 0.6468 - val_loss:
1.9741 - val_accuracy: 0.6161
Epoch 3/100
2/2 [==============================] - 1s 375ms/step - loss: 1.9752 - accuracy: 0.5189 - val_loss:
1.2263 - val_accuracy: 0.6955
Epoch 4/100
2/2 [==============================] - 1s 367ms/step - loss: 1.4786 - accuracy: 0.6602 - val_loss:
1.1741 - val_accuracy: 0.6952
Epoch 5/100
2/2 [==============================] - 1s 370ms/step - loss: 1.4346 - accuracy: 0.6614 - val_loss:
1.1194 - val_accuracy: 0.7286
Epoch 6/100
2/2 [==============================] - 1s 364ms/step - loss: 1.3858 - accuracy: 0.6898 - val_loss:
1.0952 - val_accuracy: 0.7281
Epoch 7/100
2/2 [==============================] - 1s 368ms/step - loss: 1.3693 - accuracy: 0.6989 - val_loss:
1.0850 - val_accuracy: 0.7302
Epoch 8/100
2/2 [==============================] - 1s 368ms/step - loss: 1.3481 - accuracy: 0.6989 - val_loss:
1.0940 - val_accuracy: 0.7281
Epoch 9/100
2/2 [==============================] - 1s 366ms/step - loss: 1.3194 - accuracy: 0.6948 - val_loss:
1.1282 - val_accuracy: 0.7279
Epoch 10/100
2/2 [==============================] - 1s 369ms/step - loss: 1.2980 - accuracy: 0.6916 - val_loss:
1.1399 - val_accuracy: 0.7279
Epoch 11/100
2/2 [==============================] - 1s 369ms/step - loss: 1.2773 - accuracy: 0.6979 - val_loss:
1.0905 - val_accuracy: 0.7302
Epoch 12/100
2/2 [==============================] - 1s 371ms/step - loss: 1.2618 - accuracy: 0.6995 - val_loss:
1.0764 - val_accuracy: 0.7302
Epoch 13/100
2/2 [==============================] - 1s 374ms/step - loss: 1.2526 - accuracy: 0.6998 - val_loss:
1.0866 - val_accuracy: 0.7302
Epoch 14/100
2/2 [==============================] - 1s 376ms/step - loss: 1.2482 - accuracy: 0.6998 - val_loss:
1.0806 - val_accuracy: 0.7302
Epoch 15/100
2/2 [==============================] - 1s 370ms/step - loss: 1.2394 - accuracy: 0.6999 - val_loss:
1.0676 - val_accuracy: 0.7302
Epoch 16/100
2/2 [==============================] - 1s 369ms/step - loss: 1.2330 - accuracy: 0.7000 - val_loss:
1.0748 - val_accuracy: 0.7302
Epoch 17/100
2/2 [==============================] - 1s 370ms/step - loss: 1.2281 - accuracy: 0.7003 - val_loss:
1.0798 - val_accuracy: 0.7314
Epoch 18/100
2/2 [==============================] - 1s 373ms/step - loss: 1.2261 - accuracy: 0.7005 - val_loss:
1.0651 - val_accuracy: 0.7314
Epoch 19/100
2/2 [==============================] - 1s 370ms/step - loss: 1.2241 - accuracy: 0.7008 - val_loss:
1.0701 - val_accuracy: 0.7314
Epoch 20/100
2/2 [==============================] - 1s 371ms/step - loss: 1.2206 - accuracy: 0.7009 - val_loss:
1.0672 - val_accuracy: 0.7314
Epoch 21/100
2/2 [==============================] - 1s 368ms/step - loss: 1.2169 - accuracy: 0.7010 - val_loss:
1.0585 - val_accuracy: 0.7314
Epoch 22/100
2/2 [==============================] - 1s 378ms/step - loss: 1.2145 - accuracy: 0.7010 - val_loss:
1.0650 - val_accuracy: 0.7314
Epoch 23/100
2/2 [==============================] - 1s 368ms/step - loss: 1.2126 - accuracy: 0.7011 - val_loss:
1.0647 - val_accuracy: 0.7314
Epoch 24/100
2/2 [==============================] - 1s 373ms/step - loss: 1.2103 - accuracy: 0.7014 - val_loss:
1.0580 - val_accuracy: 0.7337
Epoch 25/100
2/2 [==============================] - 1s 374ms/step - loss: 1.2076 - accuracy: 0.7017 - val_loss:
1.0624 - val_accuracy: 0.7347
Epoch 26/100
2/2 [==============================] - 1s 379ms/step - loss: 1.2054 - accuracy: 0.7018 - val_loss:
1.0490 - val_accuracy: 0.7344
Epoch 27/100
```

```
2/2 [==============================] - 1s 377ms/step - loss: 1.2038 - accuracy: 0.7020 - val_loss: 1.0628 - val_accuracy: 0.7347
Epoch 28/100
2/2 [==============================] - 1s 375ms/step - loss: 1.2023 - accuracy: 0.7021 - val_loss: 1.0416 - val_accuracy: 0.7344
Epoch 29/100
2/2 [==============================] - 1s 371ms/step - loss: 1.2054 - accuracy: 0.7022 - val_loss: 1.0614 - val_accuracy: 0.7344
Epoch 30/100
2/2 [==============================] - 1s 369ms/step - loss: 1.2010 - accuracy: 0.7022 - val_loss: 1.0411 - val_accuracy: 0.7344
Epoch 31/100
2/2 [==============================] - 1s 387ms/step - loss: 1.2002 - accuracy: 0.7022 - val_loss: 1.0594 - val_accuracy: 0.7344
Epoch 32/100
2/2 [==============================] - 1s 376ms/step - loss: 1.1984 - accuracy: 0.7023 - val_loss: 1.0489 - val_accuracy: 0.7344
Epoch 33/100
2/2 [==============================] - 1s 373ms/step - loss: 1.1957 - accuracy: 0.7023 - val_loss: 1.0527 - val_accuracy: 0.7344
Epoch 34/100
2/2 [==============================] - 1s 374ms/step - loss: 1.1943 - accuracy: 0.7023 - val_loss: 1.0494 - val_accuracy: 0.7344
Epoch 35/100
2/2 [==============================] - 1s 381ms/step - loss: 1.1920 - accuracy: 0.7024 - val_loss: 1.0444 - val_accuracy: 0.7347
Epoch 36/100
2/2 [==============================] - 1s 376ms/step - loss: 1.1918 - accuracy: 0.7025 - val_loss: 1.0513 - val_accuracy: 0.7347
Epoch 37/100
2/2 [==============================] - 1s 379ms/step - loss: 1.1909 - accuracy: 0.7025 - val_loss: 1.0416 - val_accuracy: 0.7347
Epoch 38/100
2/2 [==============================] - 1s 380ms/step - loss: 1.1890 - accuracy: 0.7025 - val_loss: 1.0471 - val_accuracy: 0.7347
Epoch 39/100
2/2 [==============================] - 1s 381ms/step - loss: 1.1872 - accuracy: 0.7027 - val_loss: 1.0443 - val_accuracy: 0.7347
Epoch 40/100
2/2 [==============================] - 1s 374ms/step - loss: 1.1869 - accuracy: 0.7026 - val_loss: 1.0346 - val_accuracy: 0.7347
Epoch 41/100
2/2 [==============================] - 1s 375ms/step - loss: 1.1870 - accuracy: 0.7028 - val_loss: 1.0384 - val_accuracy: 0.7352
Epoch 42/100
2/2 [==============================] - 1s 377ms/step - loss: 1.1830 - accuracy: 0.7029 - val_loss: 1.0376 - val_accuracy: 0.7357
Epoch 43/100
2/2 [==============================] - 1s 384ms/step - loss: 1.1817 - accuracy: 0.7030 - val_loss: 1.0325 - val_accuracy: 0.7362
Epoch 44/100
2/2 [==============================] - 1s 376ms/step - loss: 1.1833 - accuracy: 0.7030 - val_loss: 1.0210 - val_accuracy: 0.7359
Epoch 45/100
2/2 [==============================] - 1s 386ms/step - loss: 1.1918 - accuracy: 0.7032 - val_loss: 1.0431 - val_accuracy: 0.7367
Epoch 46/100
2/2 [==============================] - 1s 379ms/step - loss: 1.1848 - accuracy: 0.7032 - val_loss: 1.0258 - val_accuracy: 0.7367
Epoch 47/100
2/2 [==============================] - 1s 384ms/step - loss: 1.1819 - accuracy: 0.7035 - val_loss: 1.0475 - val_accuracy: 0.7369
Epoch 48/100
2/2 [==============================] - 1s 383ms/step - loss: 1.1803 - accuracy: 0.7035 - val_loss: 1.0222 - val_accuracy: 0.7372
Epoch 49/100
2/2 [==============================] - 1s 379ms/step - loss: 1.1787 - accuracy: 0.7036 - val_loss: 1.0411 - val_accuracy: 0.7367
Epoch 50/100
2/2 [==============================] - 1s 381ms/step - loss: 1.1764 - accuracy: 0.7039 - val_loss: 1.0273 - val_accuracy: 0.7369
Epoch 51/100
2/2 [==============================] - 1s 379ms/step - loss: 1.1742 - accuracy: 0.7040 - val_loss: 1.0238 - val_accuracy: 0.7372
Epoch 52/100
2/2 [==============================] - 1s 383ms/step - loss: 1.1717 - accuracy: 0.7042 - val_loss: 1.0369 - val_accuracy: 0.7377
```

```
Epoch 53/100
2/2 [==============================] - 1s 383ms/step - loss: 1.1716 - accuracy: 0.7041 - val_loss:
1.0224 - val_accuracy: 0.7382
Epoch 54/100
2/2 [==============================] - 1s 382ms/step - loss: 1.1691 - accuracy: 0.7041 - val_loss:
1.0223 - val_accuracy: 0.7387
Epoch 55/100
2/2 [==============================] - 1s 394ms/step - loss: 1.1671 - accuracy: 0.7045 - val_loss:
1.0283 - val_accuracy: 0.7387
Epoch 56/100
2/2 [==============================] - 1s 385ms/step - loss: 1.1662 - accuracy: 0.7047 - val_loss:
1.0161 - val_accuracy: 0.7387
Epoch 57/100
2/2 [==============================] - 1s 382ms/step - loss: 1.1644 - accuracy: 0.7048 - val_loss:
1.0244 - val_accuracy: 0.7389
Epoch 58/100
2/2 [==============================] - 1s 382ms/step - loss: 1.1631 - accuracy: 0.7049 - val_loss:
1.0152 - val_accuracy: 0.7384
Epoch 59/100
2/2 [==============================] - 1s 387ms/step - loss: 1.1617 - accuracy: 0.7051 - val_loss:
1.0216 - val_accuracy: 0.7387
Epoch 60/100
2/2 [==============================] - 1s 384ms/step - loss: 1.1615 - accuracy: 0.7052 - val_loss:
1.0180 - val_accuracy: 0.7387
Epoch 61/100
2/2 [==============================] - 1s 384ms/step - loss: 1.1599 - accuracy: 0.7054 - val_loss:
1.0116 - val_accuracy: 0.7394
Epoch 62/100
2/2 [==============================] - 1s 382ms/step - loss: 1.1585 - accuracy: 0.7056 - val_loss:
1.0123 - val_accuracy: 0.7399
Epoch 63/100
2/2 [==============================] - 1s 385ms/step - loss: 1.1564 - accuracy: 0.7060 - val_loss:
1.0118 - val_accuracy: 0.7397
Epoch 64/100
2/2 [==============================] - 1s 383ms/step - loss: 1.1539 - accuracy: 0.7060 - val_loss:
1.0042 - val_accuracy: 0.7399
Epoch 65/100
2/2 [==============================] - 1s 390ms/step - loss: 1.1532 - accuracy: 0.7063 - val_loss:
1.0193 - val_accuracy: 0.7389
Epoch 66/100
2/2 [==============================] - 1s 385ms/step - loss: 1.1575 - accuracy: 0.7063 - val_loss:
1.0208 - val_accuracy: 0.7392
Epoch 67/100
2/2 [==============================] - 1s 381ms/step - loss: 1.1540 - accuracy: 0.7064 - val_loss:
1.0026 - val_accuracy: 0.7392
Epoch 68/100
2/2 [==============================] - 1s 385ms/step - loss: 1.1529 - accuracy: 0.7069 - val_loss:
1.0180 - val_accuracy: 0.7392
Epoch 69/100
2/2 [==============================] - 1s 383ms/step - loss: 1.1514 - accuracy: 0.7067 - val_loss:
0.9968 - val_accuracy: 0.7399
Epoch 70/100
2/2 [==============================] - 1s 386ms/step - loss: 1.1498 - accuracy: 0.7071 - val_loss:
1.0110 - val_accuracy: 0.7417
Epoch 71/100
2/2 [==============================] - 1s 379ms/step - loss: 1.1470 - accuracy: 0.7073 - val_loss:
0.9977 - val_accuracy: 0.7415
Epoch 72/100
2/2 [==============================] - 1s 387ms/step - loss: 1.1452 - accuracy: 0.7074 - val_loss:
1.0066 - val_accuracy: 0.7417
Epoch 73/100
2/2 [==============================] - 1s 382ms/step - loss: 1.1435 - accuracy: 0.7078 - val_loss:
0.9967 - val_accuracy: 0.7420
Epoch 74/100
2/2 [==============================] - 1s 383ms/step - loss: 1.1420 - accuracy: 0.7081 - val_loss:
0.9997 - val_accuracy: 0.7417
Epoch 75/100
2/2 [==============================] - 1s 387ms/step - loss: 1.1395 - accuracy: 0.7085 - val_loss:
0.9920 - val_accuracy: 0.7425
Epoch 76/100
2/2 [==============================] - 1s 384ms/step - loss: 1.1381 - accuracy: 0.7086 - val_loss:
1.0012 - val_accuracy: 0.7415
Epoch 77/100
2/2 [==============================] - 1s 378ms/step - loss: 1.1383 - accuracy: 0.7089 - val_loss:
0.9937 - val_accuracy: 0.7422
Epoch 78/100
2/2 [==============================] - 1s 381ms/step - loss: 1.1350 - accuracy: 0.7091 - val_loss:
```

```
0.9941 - val_accuracy: 0.7427
Epoch 79/100
2/2 [==============================] - 1s 380ms/step - loss: 1.1337 - accuracy: 0.7093 - val_loss: 
0.9921 - val_accuracy: 0.7420
Epoch 80/100
2/2 [==============================] - 1s 374ms/step - loss: 1.1320 - accuracy: 0.7101 - val_loss: 
0.9889 - val_accuracy: 0.7415
Epoch 81/100
2/2 [==============================] - 1s 383ms/step - loss: 1.1308 - accuracy: 0.7099 - val_loss: 
0.9850 - val_accuracy: 0.7422
Epoch 82/100
2/2 [==============================] - 1s 379ms/step - loss: 1.1291 - accuracy: 0.7104 - val_loss: 
0.9932 - val_accuracy: 0.7422
Epoch 83/100
2/2 [==============================] - 1s 374ms/step - loss: 1.1287 - accuracy: 0.7108 - val_loss: 
0.9961 - val_accuracy: 0.7405
Epoch 84/100
2/2 [==============================] - 1s 380ms/step - loss: 1.1305 - accuracy: 0.7103 - val_loss: 
0.9911 - val_accuracy: 0.7410
Epoch 85/100
2/2 [==============================] - 1s 380ms/step - loss: 1.1256 - accuracy: 0.7108 - val_loss: 
0.9773 - val_accuracy: 0.7432
Epoch 86/100
2/2 [==============================] - 1s 375ms/step - loss: 1.1259 - accuracy: 0.7111 - val_loss: 
0.9859 - val_accuracy: 0.7437
Epoch 87/100
2/2 [==============================] - 1s 381ms/step - loss: 1.1246 - accuracy: 0.7115 - val_loss: 
0.9888 - val_accuracy: 0.7432
Epoch 88/100
2/2 [==============================] - 1s 379ms/step - loss: 1.1241 - accuracy: 0.7114 - val_loss: 
0.9881 - val_accuracy: 0.7427
Epoch 89/100
2/2 [==============================] - 1s 378ms/step - loss: 1.1242 - accuracy: 0.7124 - val_loss: 
0.9871 - val_accuracy: 0.7425
Epoch 90/100
2/2 [==============================] - 1s 381ms/step - loss: 1.1215 - accuracy: 0.7123 - val_loss: 
0.9903 - val_accuracy: 0.7420
Epoch 91/100
2/2 [==============================] - 1s 375ms/step - loss: 1.1215 - accuracy: 0.7129 - val_loss: 
0.9796 - val_accuracy: 0.7435
Epoch 92/100
2/2 [==============================] - 1s 375ms/step - loss: 1.1175 - accuracy: 0.7134 - val_loss: 
0.9733 - val_accuracy: 0.7440
Epoch 93/100
2/2 [==============================] - 1s 385ms/step - loss: 1.1153 - accuracy: 0.7136 - val_loss: 
0.9769 - val_accuracy: 0.7460
Epoch 94/100
2/2 [==============================] - 1s 376ms/step - loss: 1.1149 - accuracy: 0.7142 - val_loss: 
0.9843 - val_accuracy: 0.7442
Epoch 95/100
2/2 [==============================] - 1s 374ms/step - loss: 1.1129 - accuracy: 0.7142 - val_loss: 
0.9785 - val_accuracy: 0.7450
Epoch 96/100
2/2 [==============================] - 1s 376ms/step - loss: 1.1117 - accuracy: 0.7145 - val_loss: 
0.9703 - val_accuracy: 0.7472
Epoch 97/100
2/2 [==============================] - 1s 376ms/step - loss: 1.1085 - accuracy: 0.7149 - val_loss: 
0.9649 - val_accuracy: 0.7447
Epoch 98/100
2/2 [==============================] - 1s 376ms/step - loss: 1.1117 - accuracy: 0.7145 - val_loss: 
0.9667 - val_accuracy: 0.7450
Epoch 99/100
2/2 [==============================] - 1s 375ms/step - loss: 1.1093 - accuracy: 0.7152 - val_loss: 
0.9867 - val_accuracy: 0.7445
Epoch 100/100
2/2 [==============================] - 1s 373ms/step - loss: 1.1069 - accuracy: 0.7162 - val_loss: 
0.9626 - val_accuracy: 0.7457
```

Out[37]:

```
<tensorflow.python.keras.callbacks.History at 0x7f3612e2b9d0>
```

In [38]:

```
model.fit(source_padded_docs_train,target_padded_docs_train,batch_size=1024,epochs=100,
          validation_data=(source_padded_docs_test,target_padded_docs_test))
```

```
Epoch 1/100
2/2 [==============================] - 1s 394ms/step - loss: 1.1057 - accuracy: 0.7160 - val_loss: 
0.9645 - val_accuracy: 0.7460
Epoch 2/100
```

```
2/2 [==============================] - 1s 368ms/step - loss: 1.1036 - accuracy: 0.7166 - val_loss: 0.9765 - val_accuracy: 0.7462
Epoch 3/100
2/2 [==============================] - 1s 368ms/step - loss: 1.1021 - accuracy: 0.7174 - val_loss: 0.9615 - val_accuracy: 0.7487
Epoch 4/100
2/2 [==============================] - 1s 368ms/step - loss: 1.0997 - accuracy: 0.7174 - val_loss: 0.9702 - val_accuracy: 0.7455
Epoch 5/100
2/2 [==============================] - 1s 370ms/step - loss: 1.0990 - accuracy: 0.7170 - val_loss: 0.9556 - val_accuracy: 0.7467
Epoch 6/100
2/2 [==============================] - 1s 372ms/step - loss: 1.0960 - accuracy: 0.7182 - val_loss: 0.9704 - val_accuracy: 0.7475
Epoch 7/100
2/2 [==============================] - 1s 377ms/step - loss: 1.0952 - accuracy: 0.7189 - val_loss: 0.9628 - val_accuracy: 0.7482
Epoch 8/100
2/2 [==============================] - 1s 373ms/step - loss: 1.0926 - accuracy: 0.7179 - val_loss: 0.9533 - val_accuracy: 0.7485
Epoch 9/100
2/2 [==============================] - 1s 371ms/step - loss: 1.0898 - accuracy: 0.7189 - val_loss: 0.9595 - val_accuracy: 0.7467
Epoch 10/100
2/2 [==============================] - 1s 375ms/step - loss: 1.0892 - accuracy: 0.7192 - val_loss: 0.9524 - val_accuracy: 0.7472
Epoch 11/100
2/2 [==============================] - 1s 371ms/step - loss: 1.0863 - accuracy: 0.7194 - val_loss: 0.9556 - val_accuracy: 0.7485
Epoch 12/100
2/2 [==============================] - 1s 371ms/step - loss: 1.0853 - accuracy: 0.7197 - val_loss: 0.9575 - val_accuracy: 0.7465
Epoch 13/100
2/2 [==============================] - 1s 372ms/step - loss: 1.0843 - accuracy: 0.7201 - val_loss: 0.9569 - val_accuracy: 0.7487
Epoch 14/100
2/2 [==============================] - 1s 371ms/step - loss: 1.0835 - accuracy: 0.7197 - val_loss: 0.9476 - val_accuracy: 0.7490
Epoch 15/100
2/2 [==============================] - 1s 382ms/step - loss: 1.0811 - accuracy: 0.7203 - val_loss: 0.9583 - val_accuracy: 0.7477
Epoch 16/100
2/2 [==============================] - 1s 375ms/step - loss: 1.0838 - accuracy: 0.7208 - val_loss: 0.9690 - val_accuracy: 0.7457
Epoch 17/100
2/2 [==============================] - 1s 374ms/step - loss: 1.0873 - accuracy: 0.7194 - val_loss: 0.9434 - val_accuracy: 0.7497
Epoch 18/100
2/2 [==============================] - 1s 379ms/step - loss: 1.0788 - accuracy: 0.7214 - val_loss: 0.9536 - val_accuracy: 0.7472
Epoch 19/100
2/2 [==============================] - 1s 372ms/step - loss: 1.0771 - accuracy: 0.7216 - val_loss: 0.9412 - val_accuracy: 0.7477
Epoch 20/100
2/2 [==============================] - 1s 376ms/step - loss: 1.0744 - accuracy: 0.7216 - val_loss: 0.9445 - val_accuracy: 0.7487
Epoch 21/100
2/2 [==============================] - 1s 377ms/step - loss: 1.0722 - accuracy: 0.7225 - val_loss: 0.9432 - val_accuracy: 0.7477
Epoch 22/100
2/2 [==============================] - 1s 376ms/step - loss: 1.0701 - accuracy: 0.7228 - val_loss: 0.9419 - val_accuracy: 0.7503
Epoch 23/100
2/2 [==============================] - 1s 377ms/step - loss: 1.0680 - accuracy: 0.7222 - val_loss: 0.9377 - val_accuracy: 0.7487
Epoch 24/100
2/2 [==============================] - 1s 377ms/step - loss: 1.0665 - accuracy: 0.7231 - val_loss: 0.9395 - val_accuracy: 0.7492
Epoch 25/100
2/2 [==============================] - 1s 376ms/step - loss: 1.0651 - accuracy: 0.7233 - val_loss: 0.9435 - val_accuracy: 0.7508
Epoch 26/100
2/2 [==============================] - 1s 380ms/step - loss: 1.0742 - accuracy: 0.7228 - val_loss: 0.9871 - val_accuracy: 0.7425
Epoch 27/100
2/2 [==============================] - 1s 384ms/step - loss: 1.1019 - accuracy: 0.7158 - val_loss: 0.9395 - val_accuracy: 0.7475
```

```
Epoch 28/100
2/2 [==============================] - 1s 383ms/step - loss: 1.0921 - accuracy: 0.7165 - val_loss:
0.9533 - val_accuracy: 0.7435
Epoch 29/100
2/2 [==============================] - 1s 384ms/step - loss: 1.0887 - accuracy: 0.7166 - val_loss:
0.9423 - val_accuracy: 0.7480
Epoch 30/100
2/2 [==============================] - 1s 381ms/step - loss: 1.0840 - accuracy: 0.7172 - val_loss:
0.9477 - val_accuracy: 0.7495
Epoch 31/100
2/2 [==============================] - 1s 378ms/step - loss: 1.0802 - accuracy: 0.7185 - val_loss:
0.9419 - val_accuracy: 0.7485
Epoch 32/100
2/2 [==============================] - 1s 384ms/step - loss: 1.0756 - accuracy: 0.7198 - val_loss:
0.9362 - val_accuracy: 0.7497
Epoch 33/100
2/2 [==============================] - 1s 374ms/step - loss: 1.0720 - accuracy: 0.7208 - val_loss:
0.9390 - val_accuracy: 0.7503
Epoch 34/100
2/2 [==============================] - 1s 380ms/step - loss: 1.0688 - accuracy: 0.7215 - val_loss:
0.9332 - val_accuracy: 0.7497
Epoch 35/100
2/2 [==============================] - 1s 384ms/step - loss: 1.0664 - accuracy: 0.7221 - val_loss:
0.9315 - val_accuracy: 0.7497
Epoch 36/100
2/2 [==============================] - 1s 388ms/step - loss: 1.0639 - accuracy: 0.7225 - val_loss:
0.9280 - val_accuracy: 0.7482
Epoch 37/100
2/2 [==============================] - 1s 379ms/step - loss: 1.0618 - accuracy: 0.7224 - val_loss:
0.9262 - val_accuracy: 0.7503
Epoch 38/100
2/2 [==============================] - 1s 384ms/step - loss: 1.0598 - accuracy: 0.7234 - val_loss:
0.9347 - val_accuracy: 0.7508
Epoch 39/100
2/2 [==============================] - 1s 383ms/step - loss: 1.0582 - accuracy: 0.7234 - val_loss:
0.9196 - val_accuracy: 0.7495
Epoch 40/100
2/2 [==============================] - 1s 385ms/step - loss: 1.0592 - accuracy: 0.7234 - val_loss:
0.9217 - val_accuracy: 0.7510
Epoch 41/100
2/2 [==============================] - 1s 387ms/step - loss: 1.0555 - accuracy: 0.7238 - val_loss:
0.9255 - val_accuracy: 0.7510
Epoch 42/100
2/2 [==============================] - 1s 391ms/step - loss: 1.0523 - accuracy: 0.7243 - val_loss:
0.9183 - val_accuracy: 0.7520
Epoch 43/100
2/2 [==============================] - 1s 384ms/step - loss: 1.0500 - accuracy: 0.7241 - val_loss:
0.9222 - val_accuracy: 0.7513
Epoch 44/100
2/2 [==============================] - 1s 384ms/step - loss: 1.0479 - accuracy: 0.7244 - val_loss:
0.9147 - val_accuracy: 0.7508
Epoch 45/100
2/2 [==============================] - 1s 387ms/step - loss: 1.0466 - accuracy: 0.7249 - val_loss:
0.9149 - val_accuracy: 0.7513
Epoch 46/100
2/2 [==============================] - 1s 389ms/step - loss: 1.0456 - accuracy: 0.7248 - val_loss:
0.9176 - val_accuracy: 0.7528
Epoch 47/100
2/2 [==============================] - 1s 385ms/step - loss: 1.0436 - accuracy: 0.7252 - val_loss:
0.9126 - val_accuracy: 0.7525
Epoch 48/100
2/2 [==============================] - 1s 385ms/step - loss: 1.0409 - accuracy: 0.7254 - val_loss:
0.9089 - val_accuracy: 0.7525
Epoch 49/100
2/2 [==============================] - 1s 383ms/step - loss: 1.0408 - accuracy: 0.7256 - val_loss:
0.9087 - val_accuracy: 0.7530
Epoch 50/100
2/2 [==============================] - 1s 386ms/step - loss: 1.0383 - accuracy: 0.7253 - val_loss:
0.9115 - val_accuracy: 0.7540
Epoch 51/100
2/2 [==============================] - 1s 384ms/step - loss: 1.0401 - accuracy: 0.7257 - val_loss:
0.9344 - val_accuracy: 0.7543
Epoch 52/100
2/2 [==============================] - 1s 387ms/step - loss: 1.0507 - accuracy: 0.7247 - val_loss:
0.9046 - val_accuracy: 0.7533
Epoch 53/100
2/2 [==============================] - 1s 383ms/step - loss: 1.0391 - accuracy: 0.7256 - val_loss:
```

```
0.9121 - val_accuracy: 0.7540
Epoch 54/100
2/2 [==============================] - 1s 393ms/step - loss: 1.0374 - accuracy: 0.7260 - val_loss:
0.9068 - val_accuracy: 0.7560
Epoch 55/100
2/2 [==============================] - 1s 389ms/step - loss: 1.0361 - accuracy: 0.7254 - val_loss:
0.9078 - val_accuracy: 0.7538
Epoch 56/100
2/2 [==============================] - 1s 381ms/step - loss: 1.0322 - accuracy: 0.7269 - val_loss:
0.9083 - val_accuracy: 0.7535
Epoch 57/100
2/2 [==============================] - 1s 382ms/step - loss: 1.0303 - accuracy: 0.7271 - val_loss:
0.9045 - val_accuracy: 0.7513
Epoch 58/100
2/2 [==============================] - 1s 381ms/step - loss: 1.0318 - accuracy: 0.7265 - val_loss:
0.9014 - val_accuracy: 0.7550
Epoch 59/100
2/2 [==============================] - 1s 380ms/step - loss: 1.0284 - accuracy: 0.7270 - val_loss:
0.9016 - val_accuracy: 0.7558
Epoch 60/100
2/2 [==============================] - 1s 400ms/step - loss: 1.0254 - accuracy: 0.7272 - val_loss:
0.9033 - val_accuracy: 0.7508
Epoch 61/100
2/2 [==============================] - 1s 377ms/step - loss: 1.0243 - accuracy: 0.7272 - val_loss:
0.9051 - val_accuracy: 0.7560
Epoch 62/100
2/2 [==============================] - 1s 379ms/step - loss: 1.0250 - accuracy: 0.7268 - val_loss:
0.8984 - val_accuracy: 0.7508
Epoch 63/100
2/2 [==============================] - 1s 380ms/step - loss: 1.0210 - accuracy: 0.7277 - val_loss:
0.8953 - val_accuracy: 0.7530
Epoch 64/100
2/2 [==============================] - 1s 380ms/step - loss: 1.0186 - accuracy: 0.7282 - val_loss:
0.8973 - val_accuracy: 0.7555
Epoch 65/100
2/2 [==============================] - 1s 379ms/step - loss: 1.0169 - accuracy: 0.7283 - val_loss:
0.9028 - val_accuracy: 0.7500
Epoch 66/100
2/2 [==============================] - 1s 374ms/step - loss: 1.0255 - accuracy: 0.7263 - val_loss:
0.8930 - val_accuracy: 0.7550
Epoch 67/100
2/2 [==============================] - 1s 374ms/step - loss: 1.0219 - accuracy: 0.7273 - val_loss:
0.9110 - val_accuracy: 0.7508
Epoch 68/100
2/2 [==============================] - 1s 381ms/step - loss: 1.0196 - accuracy: 0.7278 - val_loss:
0.8932 - val_accuracy: 0.7535
Epoch 69/100
2/2 [==============================] - 1s 377ms/step - loss: 1.0159 - accuracy: 0.7284 - val_loss:
0.8991 - val_accuracy: 0.7548
Epoch 70/100
2/2 [==============================] - 1s 381ms/step - loss: 1.0178 - accuracy: 0.7285 - val_loss:
0.9049 - val_accuracy: 0.7553
Epoch 71/100
2/2 [==============================] - 1s 377ms/step - loss: 1.0187 - accuracy: 0.7280 - val_loss:
0.8888 - val_accuracy: 0.7530
Epoch 72/100
2/2 [==============================] - 1s 377ms/step - loss: 1.0146 - accuracy: 0.7285 - val_loss:
0.8951 - val_accuracy: 0.7535
Epoch 73/100
2/2 [==============================] - 1s 377ms/step - loss: 1.0119 - accuracy: 0.7286 - val_loss:
0.8888 - val_accuracy: 0.7538
Epoch 74/100
2/2 [==============================] - 1s 379ms/step - loss: 1.0066 - accuracy: 0.7292 - val_loss:
0.8956 - val_accuracy: 0.7528
Epoch 75/100
2/2 [==============================] - 1s 378ms/step - loss: 1.0046 - accuracy: 0.7297 - val_loss:
0.8897 - val_accuracy: 0.7550
Epoch 76/100
2/2 [==============================] - 1s 377ms/step - loss: 1.0036 - accuracy: 0.7293 - val_loss:
0.8830 - val_accuracy: 0.7530
Epoch 77/100
2/2 [==============================] - 1s 376ms/step - loss: 1.0021 - accuracy: 0.7297 - val_loss:
0.8853 - val_accuracy: 0.7520
Epoch 78/100
2/2 [==============================] - 1s 374ms/step - loss: 0.9988 - accuracy: 0.7299 - val_loss:
0.8832 - val_accuracy: 0.7558
Epoch 79/100
```

```
2/2 [==============================] - 1s 379ms/step - loss: 0.9983 - accuracy: 0.7302 - val_loss: 0.8836 - val_accuracy: 0.7560
Epoch 80/100
2/2 [==============================] - 1s 372ms/step - loss: 0.9967 - accuracy: 0.7303 - val_loss: 0.8854 - val_accuracy: 0.7518
Epoch 81/100
2/2 [==============================] - 1s 377ms/step - loss: 0.9997 - accuracy: 0.7300 - val_loss: 0.8771 - val_accuracy: 0.7538
Epoch 82/100
2/2 [==============================] - 1s 381ms/step - loss: 0.9944 - accuracy: 0.7303 - val_loss: 0.8817 - val_accuracy: 0.7553
Epoch 83/100
2/2 [==============================] - 1s 373ms/step - loss: 0.9918 - accuracy: 0.7312 - val_loss: 0.8780 - val_accuracy: 0.7573
Epoch 84/100
2/2 [==============================] - 1s 376ms/step - loss: 0.9885 - accuracy: 0.7311 - val_loss: 0.8916 - val_accuracy: 0.7520
Epoch 85/100
2/2 [==============================] - 1s 373ms/step - loss: 1.0144 - accuracy: 0.7268 - val_loss: 0.8836 - val_accuracy: 0.7533
Epoch 86/100
2/2 [==============================] - 1s 377ms/step - loss: 1.0202 - accuracy: 0.7247 - val_loss: 0.8879 - val_accuracy: 0.7530
Epoch 87/100
2/2 [==============================] - 1s 377ms/step - loss: 1.0122 - accuracy: 0.7254 - val_loss: 0.8868 - val_accuracy: 0.7487
Epoch 88/100
2/2 [==============================] - 1s 372ms/step - loss: 1.0023 - accuracy: 0.7277 - val_loss: 0.8834 - val_accuracy: 0.7550
Epoch 89/100
2/2 [==============================] - 1s 371ms/step - loss: 0.9998 - accuracy: 0.7293 - val_loss: 0.8868 - val_accuracy: 0.7530
Epoch 90/100
2/2 [==============================] - 1s 373ms/step - loss: 0.9948 - accuracy: 0.7306 - val_loss: 0.8951 - val_accuracy: 0.7508
Epoch 91/100
2/2 [==============================] - 1s 372ms/step - loss: 0.9924 - accuracy: 0.7309 - val_loss: 0.8838 - val_accuracy: 0.7535
Epoch 92/100
2/2 [==============================] - 1s 369ms/step - loss: 0.9894 - accuracy: 0.7308 - val_loss: 0.8803 - val_accuracy: 0.7533
Epoch 93/100
2/2 [==============================] - 1s 375ms/step - loss: 0.9878 - accuracy: 0.7307 - val_loss: 0.8786 - val_accuracy: 0.7515
Epoch 94/100
2/2 [==============================] - 1s 373ms/step - loss: 0.9830 - accuracy: 0.7316 - val_loss: 0.8748 - val_accuracy: 0.7535
Epoch 95/100
2/2 [==============================] - 1s 374ms/step - loss: 0.9799 - accuracy: 0.7322 - val_loss: 0.8824 - val_accuracy: 0.7543
Epoch 96/100
2/2 [==============================] - 1s 372ms/step - loss: 0.9804 - accuracy: 0.7319 - val_loss: 0.8784 - val_accuracy: 0.7545
Epoch 97/100
2/2 [==============================] - 1s 376ms/step - loss: 0.9781 - accuracy: 0.7323 - val_loss: 0.8754 - val_accuracy: 0.7535
Epoch 98/100
2/2 [==============================] - 1s 372ms/step - loss: 0.9733 - accuracy: 0.7325 - val_loss: 0.8747 - val_accuracy: 0.7553
Epoch 99/100
2/2 [==============================] - 1s 376ms/step - loss: 0.9747 - accuracy: 0.7328 - val_loss: 0.8796 - val_accuracy: 0.7563
Epoch 100/100
2/2 [==============================] - 1s 371ms/step - loss: 0.9815 - accuracy: 0.7318 - val_loss: 0.8754 - val_accuracy: 0.7523
```

Out[38]:

```
<tensorflow.python.keras.callbacks.History at 0x7f357deb3290>
```

In [43]:

```
model.save_weights('model2.h5')
x=model.predict(source_padded_docs_test[:1])[0]
```

In [44]:

```
index_to_words = {id: word for word, id in target_tokenizer.word_index.items()}
index_to_words[0] = '<PAD>'
''.join([index_to_words[prediction] for prediction in np.argmax(x, 1)])
```

Out[44]:

```
'Photo page.          ee e              k            <PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><P
D><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><P
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<PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD>'
```

In [45]:

```
print(y_test[:1])
```

```
1108    Photo page. You mean the website. OK, I'll go ...
Name: target, dtype: object
```

In [46]:

```
X_test[:1]
```

Out[46]:

```
1108    Photo page... U mean e website huh... Kk, i'll...
Name: source, dtype: object
```

In [47]:

```
def prediction(x):

  index_to_words = {id: word for word, id in target_tokenizer.word_index.items()}
  index_to_words[0] = '<PAD>'

  y=''.join([index_to_words[prediction] for prediction in np.argmax(x, 1)])
  return y
for i in range(20):
  print("Input text: ")
  a=list(X_test[i:i+1])
  print(a[0])

  print("Actual Output: ")
  b=list(y_test[i:i+1])
  print(b[0])

  print("Predicted Output: ")
  x=model.predict(source_padded_docs_test[i:i+1])
  y=prediction(x[0])
  y=y.split(' ')
  y_lst=[]
  for i in y:
      y_lst.append(i)
  print(' '.join(y_lst))
  print('>'*180)
```

```
Input text:
Photo page... U mean e website huh... Kk, i'll go mail u now...
Actual Output:
Photo page. You mean the website. OK, I'll go to mail you now.
Predicted Output:
Photo page.          ee e              k            <PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PA
><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD>
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Input text:
Eh. I'm still at the bus stop... Missed the bus. So i might be later than you
Actual Output:
I'm still at the bus stop. I missed the bus. So I might be later than you.
Predicted Output:
Eh   'm  till  t t e     ss p                           i         e  t     <PAD><PAD><PAD><PAD><PAD><PAD>
<PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD>
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```

```
Input text:
Tomw depends on wat time si going to meet us lah... If she not so early maybe we meet bugis else meet
orchard lor
Actual Output:
Tomorrow depends on what time Si is going to meet us. If she is not so early, maybe we meet at Bugis,
else meet at Orchard.
Predicted Output:
Tomw depeeds  n              ii                                                    eeee             e ee
ee <PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><
PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD>
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>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
Input text:
Ok. I going soon and also send xyan home at the same time. Call u when reaching k.
Actual Output:
Ok. I am going soon and also send xyan home at the same time. Call you when reaching.
Predicted Output:
Ok. I ggingg oon  nd also send xyan  ome at the same  ime   allll  wee  eachinn k<PAD><PAD><PAD><PAD>
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Input text:
WHAT NUMBER? MOBILE OR NOT ?
Actual Output:
What number? Mobile or not?
Predicted Output:
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Input text:
HI, R U GAL OR BOY
Actual Output:
Hi, are you girl or boy?
Predicted Output:
Hi, R  oo               <PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><
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Input text:
My painting almost done liao. But my house outside havent start yet. Haiz....
Actual Output:
My painting is almost done. But my house outside haven't started yet. Sigh.
Predicted Output:
My painting  lmost  one                 ss   u sss    eee  ttttt <PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD>
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Input text:
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Fine. Gt posted to SAFTI as a medic
Actual Output:
Fine. Got posted to SAFTI as a medic.
Predicted Output:
Fine. G     tte tt                   <PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD>
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Input text:
No la... Not attached... He's always pesterin me, dunno y... Haha, i find him a jerk oso lor...
Actual Output:
No. Not attached. He's always pestering me, I don't know why. Haha, I find him a jerk also.
Predicted Output:
No. a.         tt hee                 eeteein                                      <PAD><PAD><PAD><PAD>
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Input text:
WHAT TIME U WRKIN?
Actual Output:
What time are you working?
Predicted Output:
What Ti m           <PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD>
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Input text:
I thk dun wan da glasses lar... Seldom use it anyway... Save some money... Hee...
Actual Output:
I think I don't want the glasses. Seldom use it anyway. Save some money. Hee.
Predicted Output:
I thk   n              ss                                          m  <PAD><PAD><PAD><PAD><PAD><PAD> <PAD>
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Input text:
Hi babe its me thanks for coming even though it didnt go that well!i just wanted my bed! Hope to see you
soon love and kisses
Actual Output:
Hi baby, it's me, thanks for coming, even though it didn't go that well! I just wanted my bed! Hope to s
ee you soon love and kisses.
Predicted Output:
Hi babe its me ttaa         o      eee    o                 tt
oo o          ss<PAD>s<PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PA
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Input text:
Hello.... Are you free later for a chat?
Actual Output:
```

Hello. Are you free later for a chat?
Predicted Output:
Hello.   ree   er f r a <PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD
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Input text:
Me very hungry... Ü come down faster lei...
Actual Output:
Me very hungry. You come down faster.
Predicted Output:
Me very ungry.   u u   <PAD>e<PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PA
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Input text:
Mmm thats better now i got a roast down me! i'd b better if i had a few drinks down me 2! Good indian?
Actual Output:
That's better now, I got a roast down me! I'd be better if I had a few drinks down me too! Good Indian?
Predicted Output:
Mmm hatss etter
<PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD>
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Input text:
Yup... I will be going with my hall.
Actual Output:
Yes. I will be going with my hall.
Predicted Output:
Yes. I   ng ii<PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD
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Input text:
Huh... oh! Thats the wooden one right? the aluminium one cheaper
Actual Output:
Huh. Oh! That's the wooden one right? The aluminium one is cheaper.
Predicted Output:
Huh.   t   ?   e <PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD
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Input text:
Yupz...Kk...Den i anyhow wear...Vv hot...Haha
Actual Output:
Yes. Ok. Then I anyhow wear. It's very hot. Haha.

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Predicted Output:
Yes..   k.    n           e      v  <PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD>
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Input text:
So how are you spending yr weekend?
Actual Output:
So how are you spending your weekend?
Predicted Output:
So how are you spending yr weekend?<PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD
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Input text:
Hey....I know its rude of me not to do something abt e fone.N i'm sorry it died on u.
Actual Output:
Hey, I know it's rude of me not to do something about the phone. And I'm sorry it died on you.
Predicted Output:
Hey. II                               o      i                          i   iidd    <PAD> <PAD><PAD><PAD>
<PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD><PAD>
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In [48]:

```python
import nltk.translate.bleu_score as bleu

bleu_score=[]
for i in range(20):
  b=list(y_test[i:i+1])
  x=model.predict(source_padded_docs_test[i:i+1])
  y=prediction(x[0])
  y=y.split(' ')
  y_lst=[]
  for i in y:
    if '<' in i:
      continue
    else:
      y_lst.append(i)
  bleu_score.append(bleu.sentence_bleu([b[0].split(),],y_lst))
print(bleu_score)
print("The Average Bleu Score is: ",sum(bleu_score)/20)
```

```
/usr/local/lib/python3.7/dist-packages/nltk/translate/bleu_score.py:490: UserWarning:
Corpus/Sentence contains 0 counts of 3-gram overlaps.
BLEU scores might be undesirable; use SmoothingFunction().
  warnings.warn(_msg)
/usr/local/lib/python3.7/dist-packages/nltk/translate/bleu_score.py:490: UserWarning:
Corpus/Sentence contains 0 counts of 4-gram overlaps.
BLEU scores might be undesirable; use SmoothingFunction().
  warnings.warn(_msg)
/usr/local/lib/python3.7/dist-packages/nltk/translate/bleu_score.py:490: UserWarning:
Corpus/Sentence contains 0 counts of 2-gram overlaps.
BLEU scores might be undesirable; use SmoothingFunction().
  warnings.warn(_msg)
[0.1942053406068837, 0, 0, 0.29456425448249246, 0.4924790605054523, 0.4854917717073234,
0.2086130724305753, 0.4428500142691474, 0.3508439695638686, 0.5266403878479265, 0.35782241396102615,
0.31947155212313627, 0.5491004867761125, 0.25650569096216347, 0, 0.2928298013714698,
0.36889397323344053, 0, 0.6431870218238024, 0]
The Average Bleu Score is:  0.289174940583241
```

In [ ]: