Assignment Date	27 October 2022
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Maximum Marks	2 Marks

SMS SPAM CLASSIFICATION

```
import pandas as pd import numpy as np import
matplotlib.pyplot as plt import seaborn as sns from
sklearn.model_selection import train_test_split from
sklearn.preprocessing import LabelEncoder
```

```
from tensorflow.keras.models import Model from tensorflow.keras.layers import LSTM,
Activation, Dense, Dropout, Input, Embedding from tensorflow.keras.optimizers import
RMSprop from tensorflow.keras.preprocessing.text import Tokenizer from
tensorflow.keras.preprocessing import sequence from tensorflow.keras.utils import
to_categorical from tensorflow.keras.callbacks import EarlyStopping
%matplotlib inline
```

READ DATASET AND DO PREPROCESSING

```
df = pd.read_csv(r'spam.csv',encoding='latin-1')
```

```
df.head()
```

	v1	v2	Unnamed: 2	Unnamed: 3	Unnamed: 4
0	ham	Go until jurong point, crazy.. Available only ...	NaN	NaN	NaN
1	ham	Ok lar... Joking wif u oni...	NaN	NaN	NaN
2	spam	Free entry in 2 a wkly comp to win FA Cup fina...	NaN	NaN	NaN
3	ham	U dun say so early hor... U c already then say...	NaN	NaN	NaN
4	ham	Nah I don't think he goes to usf, he lives aro...	NaN	NaN	NaN

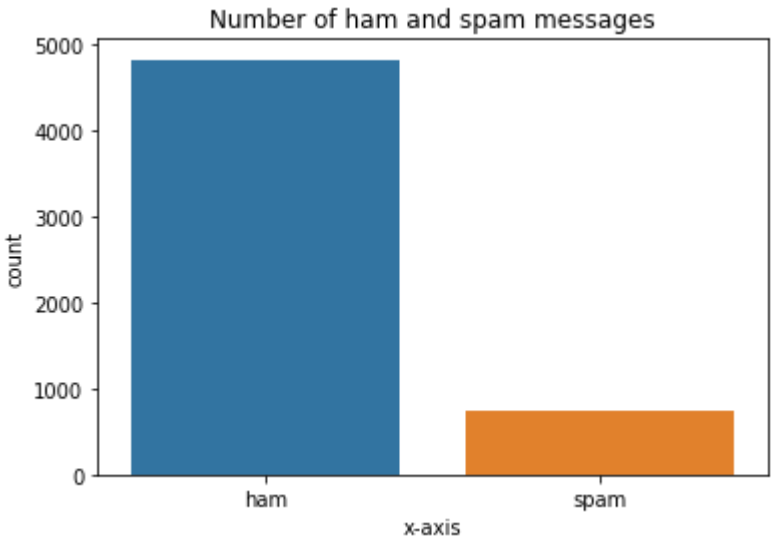
```
df.drop(['Unnamed: 2', 'Unnamed: 3', 'Unnamed: 4'],axis=1,inplace=True)
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 5572 entries, 0 to 5571
Data columns (total 2 columns):
 #   Column  Non-Null Count  Dtype
---  ------  --------------  -----
 0   v1      5572 non-null   object
1   v2      5572 non-null   object
dtypes: object(2) memory usage:
87.2+ KB
```

```
plt.xlabel('x-axis')
plt.title('Number of ham and spam messages')
```

```
/usr/local/lib/python3.7/dist-
packages/seaborn/_decorators.py:43:
FutureWarning: Pass the follo
FutureWarning
Text(0.5, 1.0, 'Number of ham and spam messages')
```



CREATE INPUT VECTORS AND PROCESS LABELS

```
X = df.v2Y
  = df.v1
```

```
le = LabelEncoder()
Y = le.fit_transform(Y)


Y = Y.reshape(-1,1)
```

SPLIT THE TRAINING AND TESTING DATA

```
X_train,X_test,Y_train,Y_test = train_test_split(X,Y,test_size=0.20)
```

PROCESS THE DATA

```
max_words = 1000
max_len = 150
```

```
tok = Tokenizer(num_words=max_words)
tok.fit_on_texts(X_train)
```

```
sequences = tok.texts_to_sequences(X_train)
sequences_matrix = sequence.pad_sequences(sequences,maxlen=max_len)
```

CREATE MODELS AND ADD LAYERS

```
def RNN():
    inputs = Input(name='inputs',shape=[max_len])     layer =
Embedding(max_words,50,input_length=max_len)(inputs)     layer = LSTM(128)(layer)
layer = Dense(256,name='FC1')(layer)     layer = Activation('relu')(layer)
layer = Dropout(0.5)(layer)     layer = Dense(1,name='out_layer')(layer)     layer
= Activation('tanh')(layer)     model = Model(inputs=inputs,outputs=layer) return
model
```

```
model = RNN()


model.summary()
```

```
Model: "model"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
inputs (InputLayer)         [(None, 150)]             0
embedding (Embedding)       (None, 150, 50)           50000
lstm (LSTM)                 (None, 128)               91648
 FC1 (Dense)                 (None, 256)               33024
activation (Activation)     (None, 256)               0
dropout (Dropout)           (None, 256)               0
out_layer (Dense)           (None, 1)                 257
activation_1 (Activation)   (None, 1)                 0
=================================================================
Total params: 174,929
Trainable params: 174,929
Non-trainable params: 0
_________________________________________________________________
```

```
model.compile(loss='binary_crossentropy',optimizer=RMSprop(),metrics=['accuracy','mse','mae'])
```

FIT THE MODEL

```
model.fit(sequences_matrix,Y_train,batch_size=128,epochs=100,
validation_split=0.2,callbacks=[EarlyStopping(monitor='val_loss',min_delta=0.0001)]) Epoch 1/100
```

```
28/28 [==============================] - 13s 460ms/step - loss: 0.0961 - accuracy: 0.9778 - mse
Epoch 2/100
28/28 [==============================] - 14s 507ms/step - loss: 0.0728 - accuracy: 0.9885 - mse
<keras.callbacks.History at 0x7f2c8029f350>
```

```
test_sequences = tok.texts_to_sequences(X_test) test_sequences_matrix =
sequence.pad_sequences(test_sequences,maxlen=max_len)
```

```
accr = model.evaluate(test_sequences_matrix,Y_test)
```

```
35/35 [==============================] - 3s 92ms/step - loss: 0.1390 - accuracy: 0.9821 - mse:
```

```
print('Test set\n  Loss: {:0.3f}\n  Accuracy: {:0.3f}'.format(accr[0],accr[1]))
```

```
Test set
  Loss: 0.139
  Accuracy: 0.982
```

SAVE THE MODEL

```
model.save(r"C:\Users\aruna\OneDrive\Desktop\model_lSTM.h5")
```

TEST THE MODEL

```
from tensorflow.keras.models import load_model m2 =
load_model(r"C:\Users\aruna\OneDrive\Desktop\model_lSTM.h5")
```

```
m2.evaluate(test_sequences_matrix,Y_test)
```

```
35/35 [==============================] - 4s 68ms/step - loss: 0.1390 - accuracy: 0.9821 - mse:
[0.13899557292461395,
0.9820627570152283,
 0.07788368314504623,
 0.23931345343589783]
```