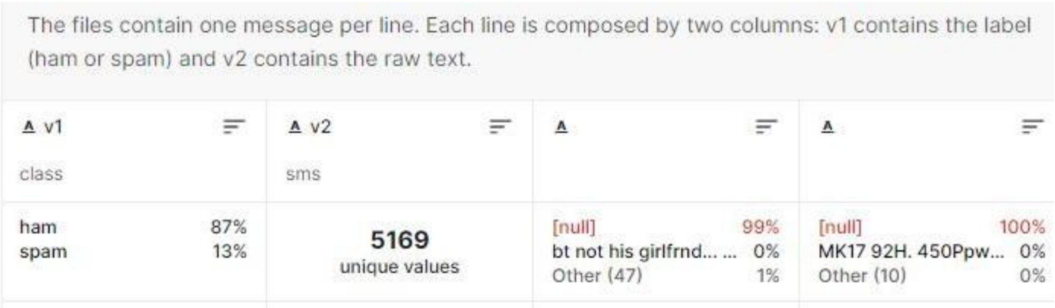
ASSIGNMENT - 4

Problem Statement :- SMS SPAM Classification

Assignment Date	29 October 2022
Student Name	S.DHAMODHARAN
Student Reg Number	737819ECR026
Maximum Marks	2 Marks

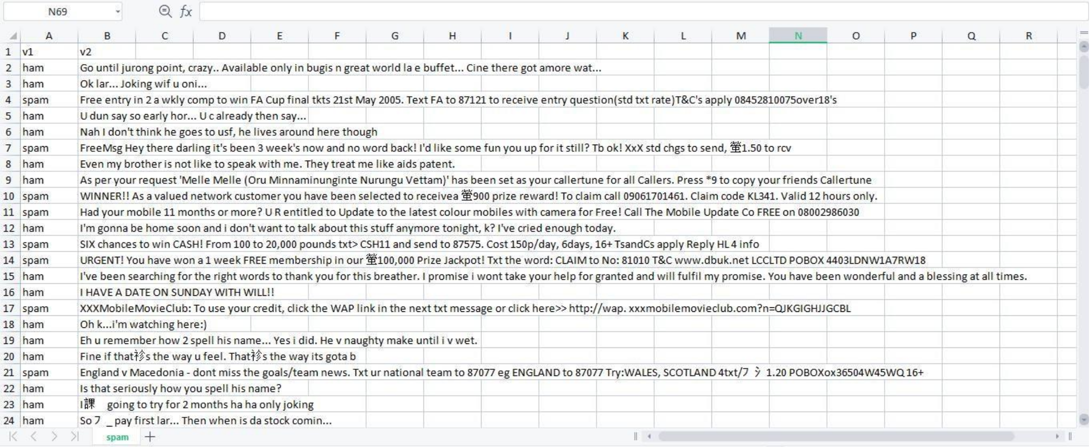
1. Download the Data set:- Data set

https://www.kaggle.com/code/kredy10/simple-lstm-for-text-classification/data



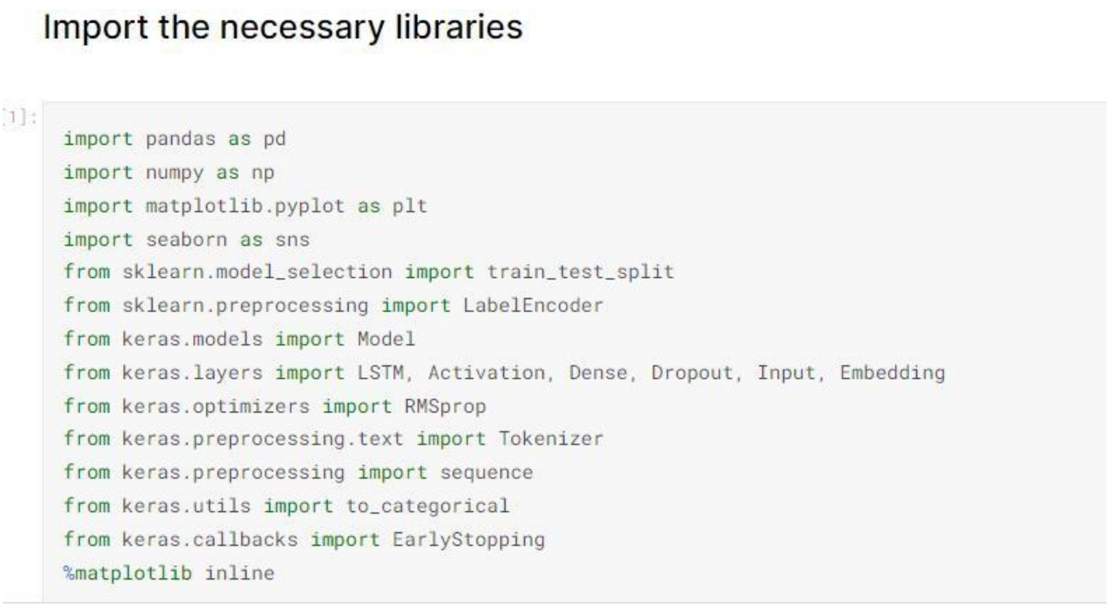
The files contain one message per line. Each line is composed by two columns: v1 contains the label (ham or spam) and v2 contains the raw text.

A v1	A v2	A	A
class	sms		
ham 87% spam 13%	5169 unique values	[null] 99% bt not his girlfrnd... ... 0% Other (47) 1%	[null] 100% MK17 92H. 450Ppw... 0% Other (10) 0%



	A	B
1	v1	v2
2	ham	Go until jurong point, crazy.. Available only in bugis n great world la e buffet... Cine there got amore wat...
3	ham	Ok lar... Joking wif u oni...
4	spam	Free entry in 2 a wkly comp to win FA Cup final tkts 21st May 2005. Text FA to 87121 to receive entry question(std txt rate)T&C's apply 08452810075over18's
5	ham	U dun say so early hor... U c already then say...
6	ham	Nah I don't think he goes to usf, he lives around here though
7	spam	FreeMsg Hey there darling it's been 3 week's now and no word back! I'd like some fun you up for it still? Tb ok! XxX std chgs to send, 螢1.50 to rcv
8	ham	Even my brother is not like to speak with me. They treat me like aids patent.
9	ham	As per your request 'Melle Melle (Oru Minnaminunginte Nurungu Vettam)' has been set as your callertune for all Callers. Press *9 to copy your friends Callertune
10	spam	WINNER!! As a valued network customer you have been selected to receivea 螢900 prize reward! To claim call 09061701461. Claim code KL341. Valid 12 hours only.
11	spam	Had your mobile 11 months or more? U R entitled to Update to the latest colour mobiles with camera for Free! Call The Mobile Update Co FREE on 08002986030
12	ham	I'm gonna be home soon and i don't want to talk about this stuff anymore tonight, k? I've cried enough today.
13	spam	SIX chances to win CASH! From 100 to 20,000 pounds txt> CSH11 and send to 87575. Cost 150p/day, 6days, 16+ TsandCs apply Reply HL 4 info
14	spam	URGENT! You have won a 1 week FREE membership in our 螢100,000 Prize Jackpot! Txt the word: CLAIM to No: 81010 T&C www.dbuk.net LCCLTD POBOX 4403LDNW1A7RW18
15	ham	I've been searching for the right words to thank you for this breather. I promise i wont take your help for granted and will fulfil my promise. You have been wonderful and a blessing at all times.
16	ham	I HAVE A DATE ON SUNDAY WITH WILL!!
17	spam	XXXMobileMovieClub: To use your credit, click the WAP link in the next txt message or click here>> http://wap. xxxmobilemovieclub.com?n=QJKGIGHJJGCBL
18	ham	Oh k...i'm watching here:)
19	ham	Eh u remember how 2 spell his name... Yes i did. He v naughty make until i v wet.
20	ham	Fine if that衫s the way u feel. That衫s the way its gota b
21	spam	England v Macedonia - dont miss the goals/team news. Txt ur national team to 87077 eg ENGLAND to 87077 Try:WALES, SCOTLAND 4txt/ア ジ 1.20 POBOXox36504W45WQ 16+
22	ham	Is that seriously how you spell his name?
23	ham	I課 going to try for 2 months ha ha only joking
24	ham	So ７ _pay first lar... Then when is da stock comin...

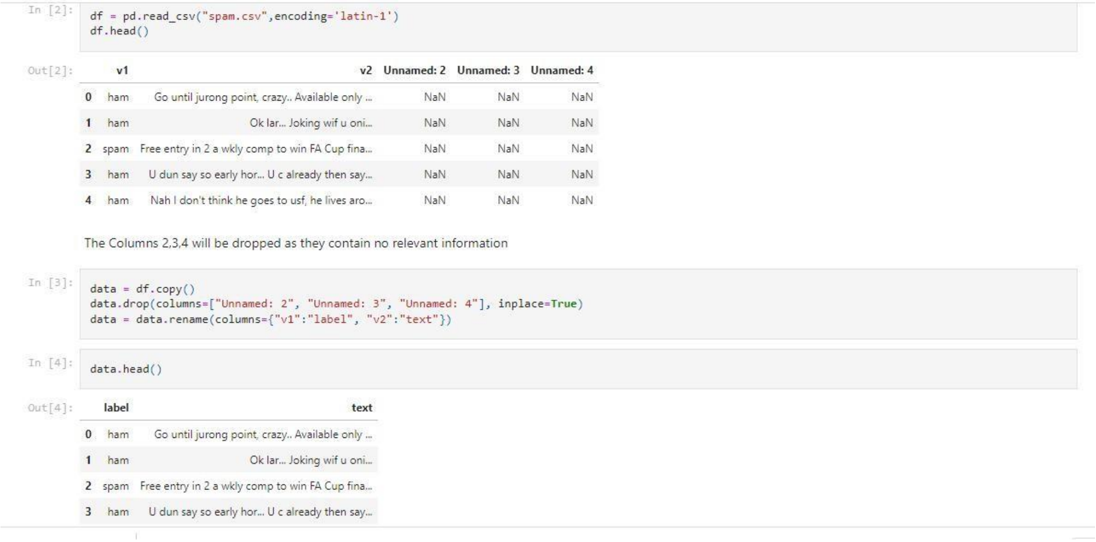
2. Import required library



Import the necessary libraries

```
[1]:
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 keras.models import Model
from keras.layers import LSTM, Activation, Dense, Dropout, Input, Embedding
from keras.optimizers import RMSprop
from keras.preprocessing.text import Tokenizer
from keras.preprocessing import sequence
from keras.utils import to_categorical
from keras.callbacks import EarlyStopping
%matplotlib inline
```

3. Read dataset and do pre-processing



```
In [2]:
df = pd.read_csv("spam.csv",encoding='latin-1')
df.head()
```

Out[2]:

	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

The Columns 2,3,4 will be dropped as they contain no relevant information

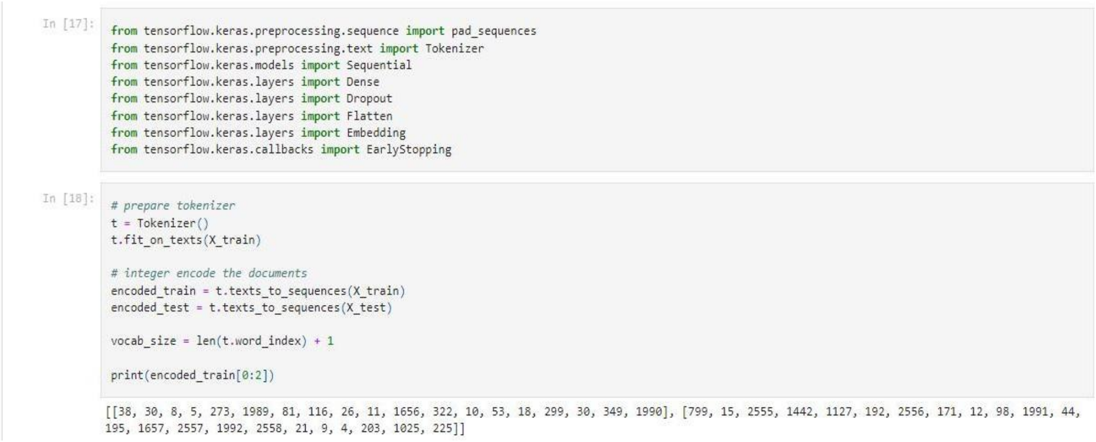
```
In [3]:
data = df.copy()
data.drop(columns=["Unnamed: 2", "Unnamed: 3", "Unnamed: 4"], inplace=True)
data = data.rename(columns={"v1":"label", "v2":"text"})
```

```
In [4]:
data.head()
```

Out[4]:

	label	text
0	ham	Go until jurong point, crazy.. Available only ...
1	ham	Ok lar... Joking wif u oni...
2	spam	Free entry in 2 a wkly comp to win FA Cup fina...
3	ham	U dun say so early hor... U c already then say...

Preproceesing:



In [17]:

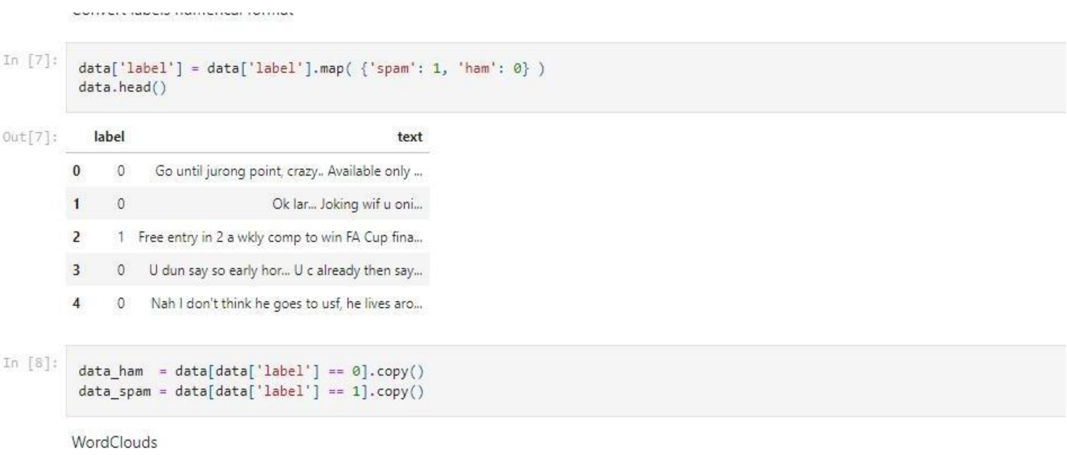
```
from tensorflow.keras.preprocessing.sequence import pad_sequences
from tensorflow.keras.preprocessing.text import Tokenizer
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense
from tensorflow.keras.layers import Dropout
from tensorflow.keras.layers import Flatten
from tensorflow.keras.layers import Embedding
from tensorflow.keras.callbacks import EarlyStopping
```

In [18]:

```
# prepare tokenizer
t = Tokenizer()
t.fit_on_texts(X_train)

# integer encode the documents
encoded_train = t.texts_to_sequences(X_train)
encoded_test = t.texts_to_sequences(X_test)

vocab_size = len(t.word_index) + 1

print(encoded_train[0:2])
```

```
[[38, 30, 8, 5, 273, 1989, 81, 116, 26, 11, 1656, 322, 10, 53, 18, 299, 30, 349, 1990], [799, 15, 2555, 1442, 1127, 192, 2556, 171, 12, 98, 1991, 44,
195, 1657, 2557, 1992, 2558, 21, 9, 4, 203, 1025, 225]]
```

4. Create Model



Convert labels numerical format

In [7]:

```
data['label'] = data['label'].map( {'spam': 1, 'ham': 0} )
data.head()
```

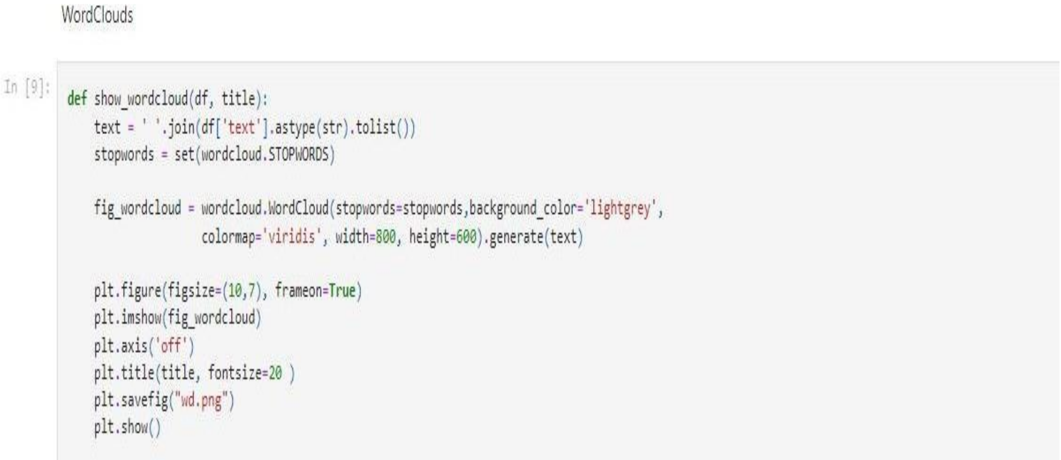
Out[7]:

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

In [8]:

```
data_ham  = data[data['label'] == 0].copy()
data_spam = data[data['label'] == 1].copy()
```

WordClouds



WordClouds

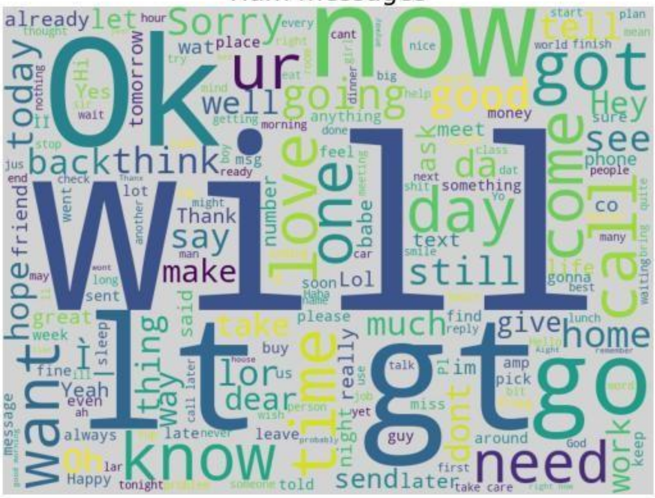
In [9]:

```
def show_wordcloud(df, title):
    text = ' '.join(df['text'].astype(str).tolist())
    stopwords = set(wordcloud.STOPWORDS)

    fig_wordcloud = wordcloud.WordCloud(stopwords=stopwords,background_color='lightgrey',
                    colormap='viridis', width=800, height=600).generate(text)

    plt.figure(figsize=(10,7), frameon=True)
    plt.imshow(fig_wordcloud)
    plt.axis('off')
    plt.title(title, fontsize=20 )
    plt.savefig("wd.png")
    plt.show()
```

WordCloud: Ham messages

```
In [10]: show_wordcloud(data_ham, "Ham messages")
```

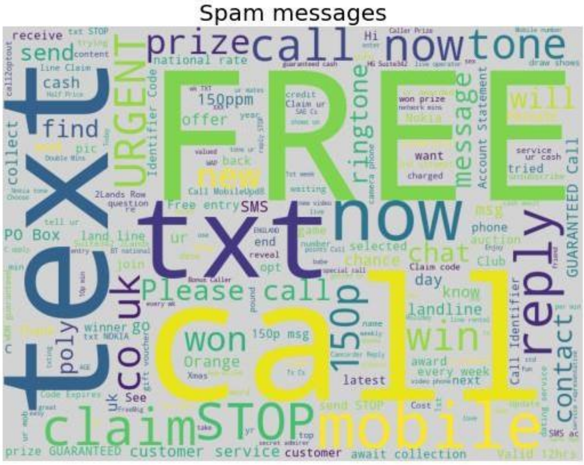
Ham messages



WordCloud: Spam messages

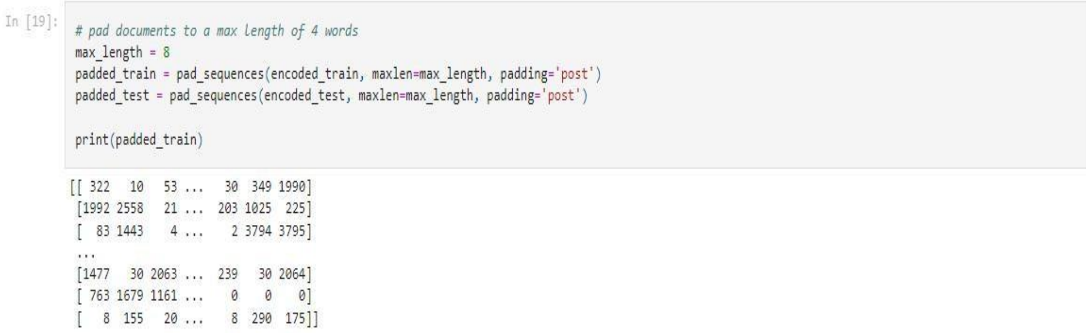
```
In [11]: show_wordcloud(data_spam, "Spam messages")
```

Spam messages



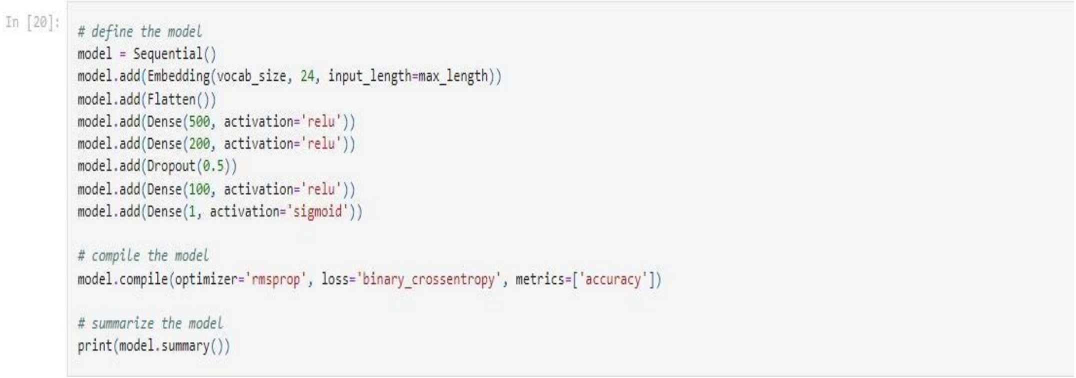
5. Add Layers (LSTM, Dense-(Hidden Layers), Output)

6. Compile the Model

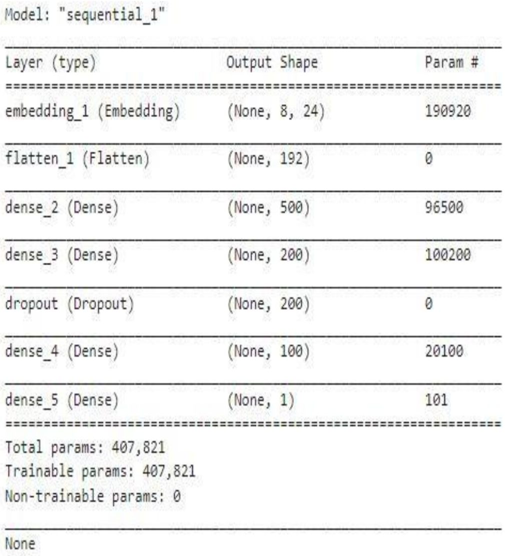


```
In [19]:  # pad documents to a max length of 4 words
          max_length = 8
          padded_train = pad_sequences(encoded_train, maxlen=max_length, padding='post')
          padded_test = pad_sequences(encoded_test, maxlen=max_length, padding='post')

          print(padded_train)
```

```
[[ 322   10   53 ...   30  349 1990]
 [1992 2558   21 ...  203 1025  225]
 [  83 1443    4 ...    2 3794 3795]
 ...
 [1477   30 2063 ...  239   30 2064]
 [ 763 1679 1161 ...    0    0    0]
 [   8  155   20 ...    8  290  175]]
```

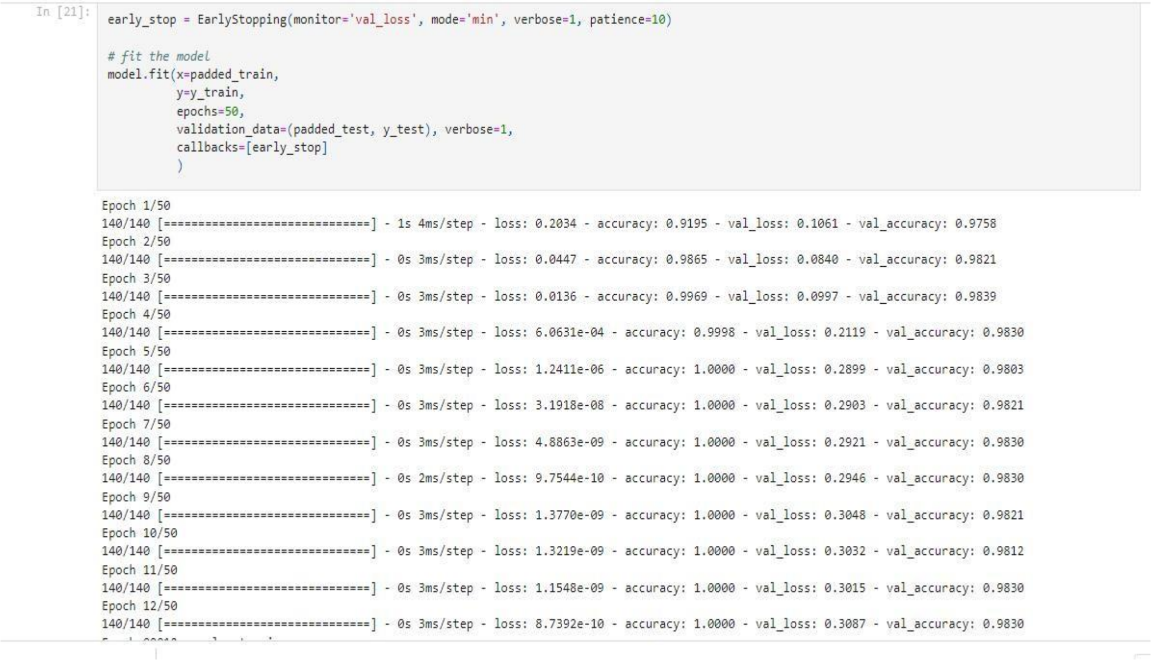


```
In [20]:  # define the model
          model = Sequential()
          model.add(Embedding(vocab_size, 24, input_length=max_length))
          model.add(Flatten())
          model.add(Dense(500, activation='relu'))
          model.add(Dense(200, activation='relu'))
          model.add(Dropout(0.5))
          model.add(Dense(100, activation='relu'))
          model.add(Dense(1, activation='sigmoid'))

          # compile the model
          model.compile(optimizer='rmsprop', loss='binary_crossentropy', metrics=['accuracy'])

          # summarize the model
          print(model.summary())
```



```
Model: "sequential_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
embedding_1 (Embedding)      (None, 8, 24)             190920
_________________________________________________________________
flatten_1 (Flatten)          (None, 192)               0
_________________________________________________________________
dense_2 (Dense)              (None, 500)               96500
_________________________________________________________________
dense_3 (Dense)              (None, 200)               100200
_________________________________________________________________
dropout (Dropout)            (None, 200)               0
_________________________________________________________________
dense_4 (Dense)              (None, 100)               20100
_________________________________________________________________
dense_5 (Dense)              (None, 1)                 101
=================================================================
Total params: 407,821
Trainable params: 407,821
Non-trainable params: 0
_________________________________________________________________
None
```

7.Fit the Model

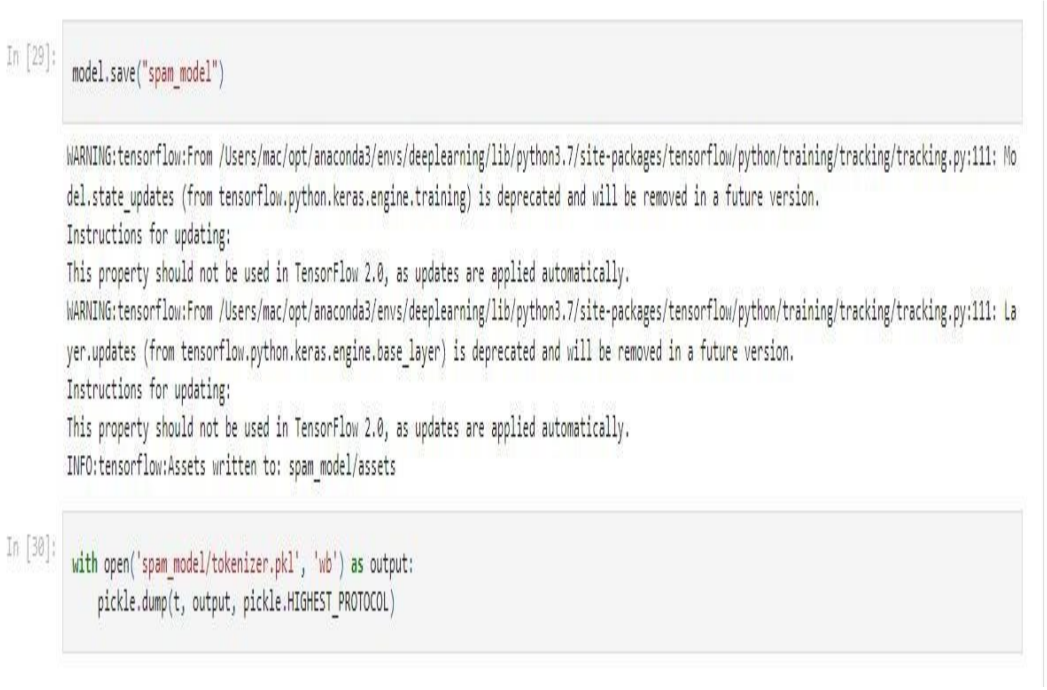


In [21]:

```
early_stop = EarlyStopping(monitor='val_loss', mode='min', verbose=1, patience=10)

# fit the model
model.fit(x=padded_train,
          y=y_train,
          epochs=50,
          validation_data=(padded_test, y_test), verbose=1,
          callbacks=[early_stop]
          )
```

```
Epoch 1/50
140/140 [==============================] - 1s 4ms/step - loss: 0.2034 - accuracy: 0.9195 - val_loss: 0.1061 - val_accuracy: 0.9758
Epoch 2/50
140/140 [==============================] - 0s 3ms/step - loss: 0.0447 - accuracy: 0.9865 - val_loss: 0.0840 - val_accuracy: 0.9821
Epoch 3/50
140/140 [==============================] - 0s 3ms/step - loss: 0.0136 - accuracy: 0.9969 - val_loss: 0.0997 - val_accuracy: 0.9839
Epoch 4/50
140/140 [==============================] - 0s 3ms/step - loss: 6.0631e-04 - accuracy: 0.9998 - val_loss: 0.2119 - val_accuracy: 0.9830
Epoch 5/50
140/140 [==============================] - 0s 3ms/step - loss: 1.2411e-06 - accuracy: 1.0000 - val_loss: 0.2899 - val_accuracy: 0.9803
Epoch 6/50
140/140 [==============================] - 0s 3ms/step - loss: 3.1918e-08 - accuracy: 1.0000 - val_loss: 0.2903 - val_accuracy: 0.9821
Epoch 7/50
140/140 [==============================] - 0s 3ms/step - loss: 4.8863e-09 - accuracy: 1.0000 - val_loss: 0.2921 - val_accuracy: 0.9830
Epoch 8/50
140/140 [==============================] - 0s 2ms/step - loss: 9.7544e-10 - accuracy: 1.0000 - val_loss: 0.2946 - val_accuracy: 0.9830
Epoch 9/50
140/140 [==============================] - 0s 3ms/step - loss: 1.3770e-09 - accuracy: 1.0000 - val_loss: 0.3048 - val_accuracy: 0.9821
Epoch 10/50
140/140 [==============================] - 0s 3ms/step - loss: 1.3219e-09 - accuracy: 1.0000 - val_loss: 0.3032 - val_accuracy: 0.9812
Epoch 11/50
140/140 [==============================] - 0s 3ms/step - loss: 1.1548e-09 - accuracy: 1.0000 - val_loss: 0.3015 - val_accuracy: 0.9830
Epoch 12/50
140/140 [==============================] - 0s 3ms/step - loss: 8.7392e-10 - accuracy: 1.0000 - val_loss: 0.3087 - val_accuracy: 0.9830
```

8. Save The Model



In [29]:

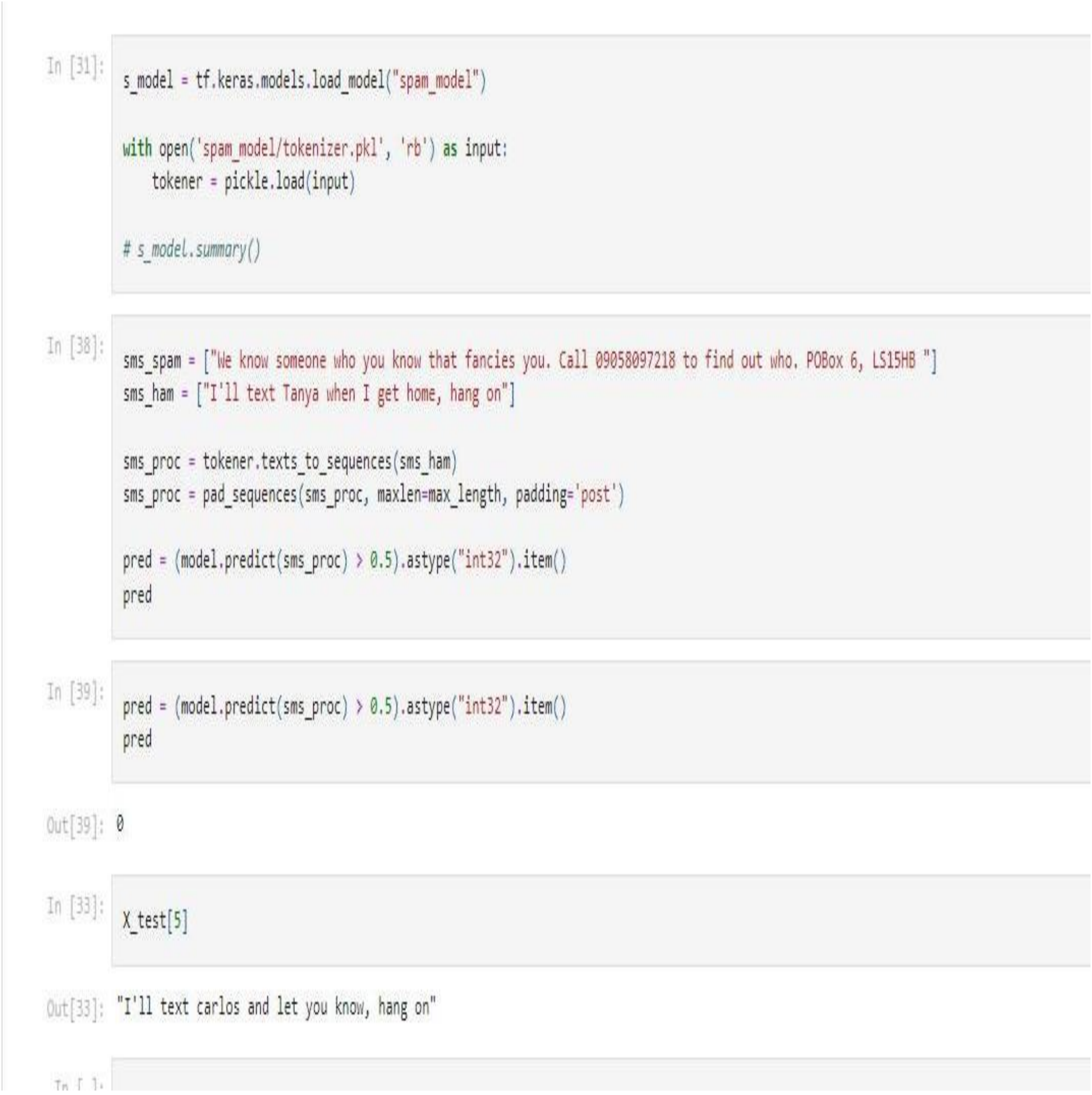
```
model.save("spam_model")
```

```
WARNING:tensorflow:From /Users/mac/opt/anaconda3/envs/deeplearning/lib/python3.7/site-packages/tensorflow/python/training/tracking/tracking.py:111: Mo
del.state_updates (from tensorflow.python.keras.engine.training) is deprecated and will be removed in a future version.
Instructions for updating:
This property should not be used in TensorFlow 2.0, as updates are applied automatically.
WARNING:tensorflow:From /Users/mac/opt/anaconda3/envs/deeplearning/lib/python3.7/site-packages/tensorflow/python/training/tracking/tracking.py:111: La
yer.updates (from tensorflow.python.keras.engine.base_layer) is deprecated and will be removed in a future version.
Instructions for updating:
This property should not be used in TensorFlow 2.0, as updates are applied automatically.
INFO:tensorflow:Assets written to: spam_model/assets
```

In [30]:

```
with open('spam_model/tokenizer.pkl', 'wb') as output:
    pickle.dump(t, output, pickle.HIGHEST_PROTOCOL)
```

9. Test The Model



In [31]:

```
s_model = tf.keras.models.load_model("spam_model")

with open('spam_model/tokenizer.pkl', 'rb') as input:
    tokener = pickle.load(input)

# s_model.summary()
```

In [38]:

```
sms_spam = ["We know someone who you know that fancies you. Call 09058097218 to find out who. POBox 6, LS15HB "]
sms_ham = ["I'll text Tanya when I get home, hang on"]

sms_proc = tokener.texts_to_sequences(sms_ham)
sms_proc = pad_sequences(sms_proc, maxlen=max_length, padding='post')

pred = (model.predict(sms_proc) > 0.5).astype("int32").item()
pred
```

In [39]:

```
pred = (model.predict(sms_proc) > 0.5).astype("int32").item()
pred
```

Out[39]:

```
0
```

In [33]:

```
X_test[5]
```

Out[33]:

```
"I'll text carlos and let you know, hang on"
```

In [ ]: