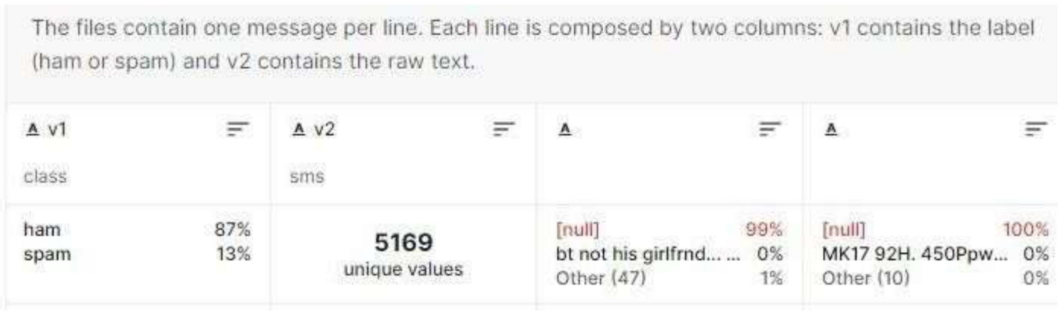
# ASSIGNMENT - 4

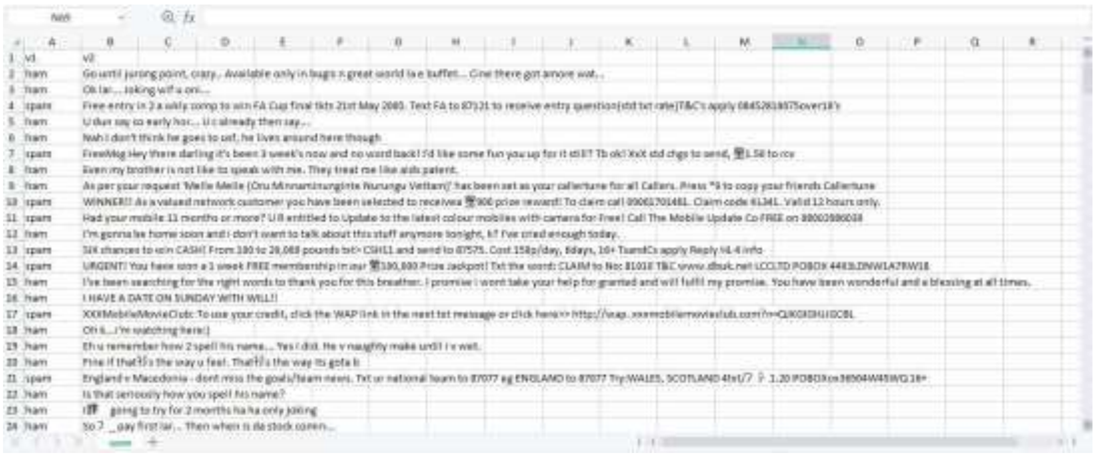
1. Download the Data set:- Data set

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



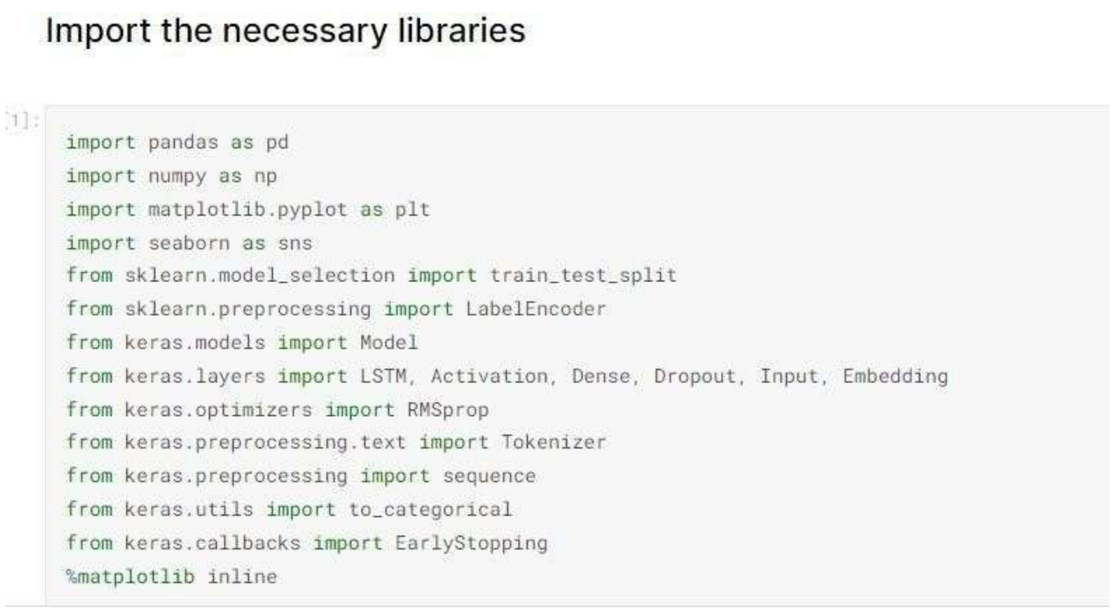
The files contain one message per line. Each line is composed by two columns: v1 contains the label (ham or spam) and v2 contains the raw text.

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



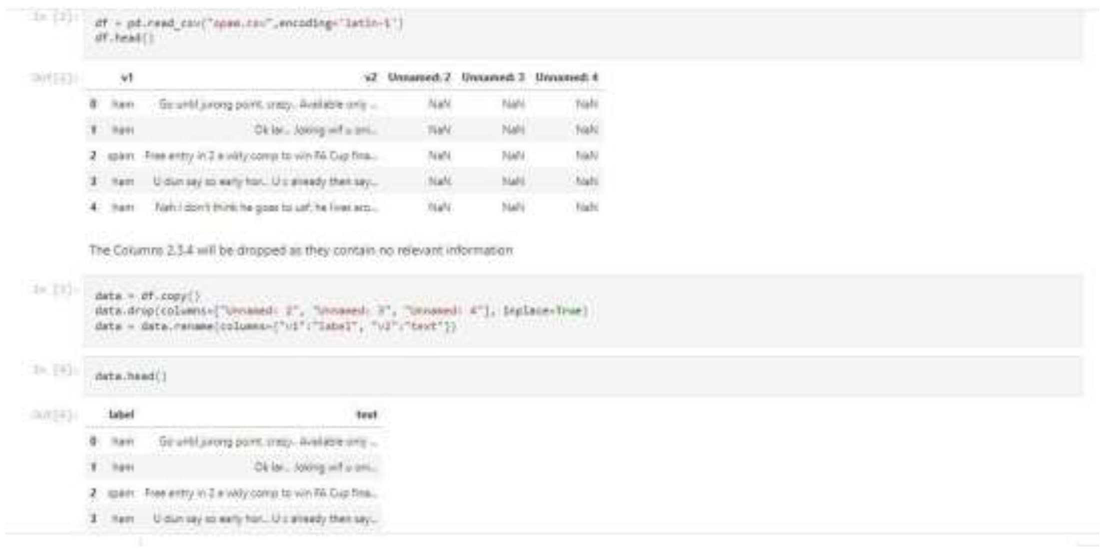
| | A | B |
|---|---|---|
| 1 | v1 | v2 |
| 2 | ham | Go until jurong point, crazy.. Available only in bugis n great world la e buffet... Cine there got amore wat... |
| 3 | ham | Ok lar... Joking wif u oni... |
| 4 | spam | Free entry in 2 a wkly comp to win FA Cup final tkts 21st May 2005. Text FA 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, 拢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 拢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 拢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鈥檚 the way u feel. That鈥檚 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/ú1.20 POBOXox36504W45WQ 16+ |
| 22 | ham | Is that seriously how you spell his name? |
| 23 | ham | I鈥榤 going to try for 2 months ha ha only joking |
| 24 | ham | So ü 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
```

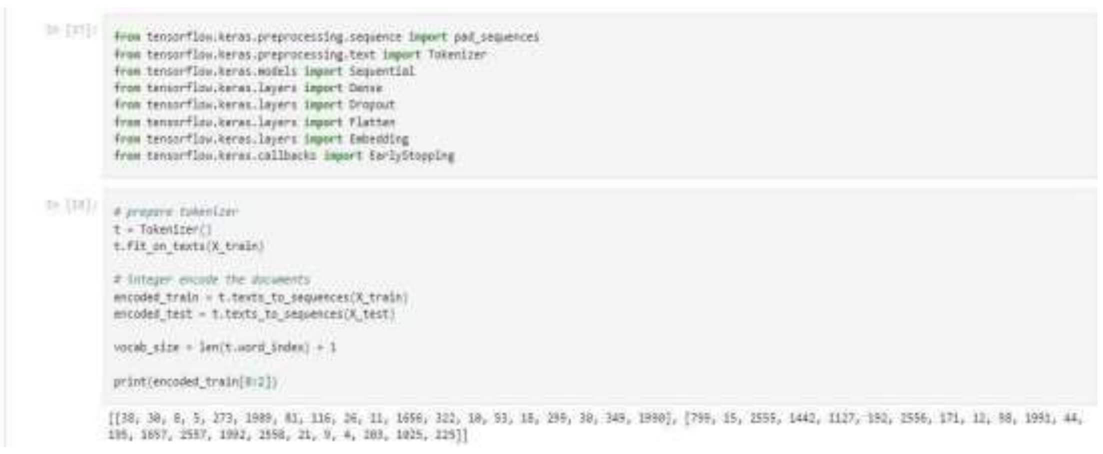
The Columns 2,3,4 will be dropped as they contain no relevant information

```
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:

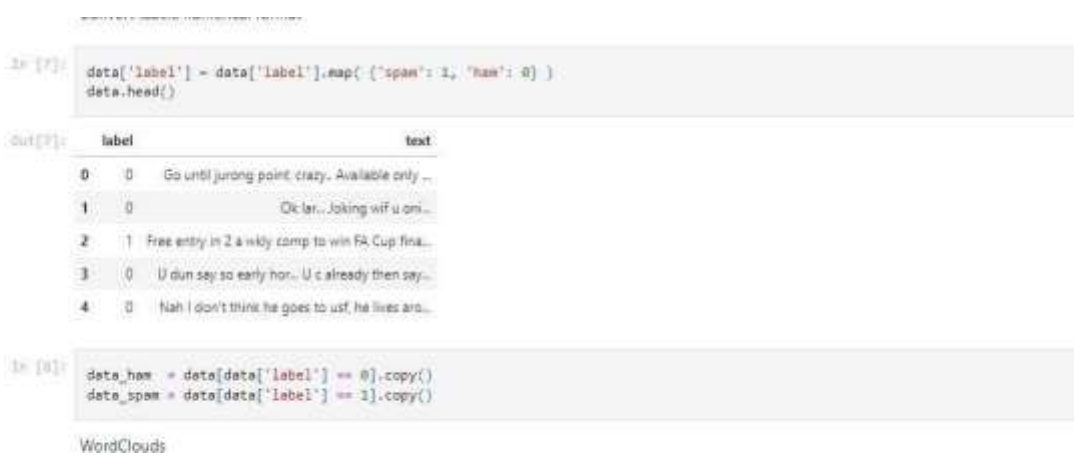


```
In [17]:
from tensorflow.keras.preprocessing.sequence import pad_sequences
from tensorflow.keras.preprocessing.text import Tokenizer
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense
from tensorflow.keras.layers import Dropout
from tensorflow.keras.layers import 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



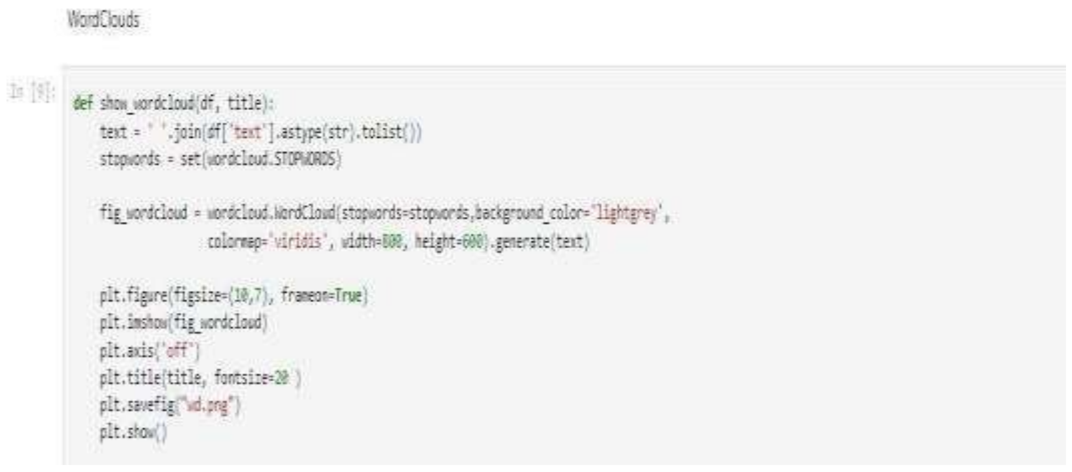
```
In [7]:
data['label'] = data['label'].map( {'spam': 1, 'ham': 0} )
data.head()
```

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

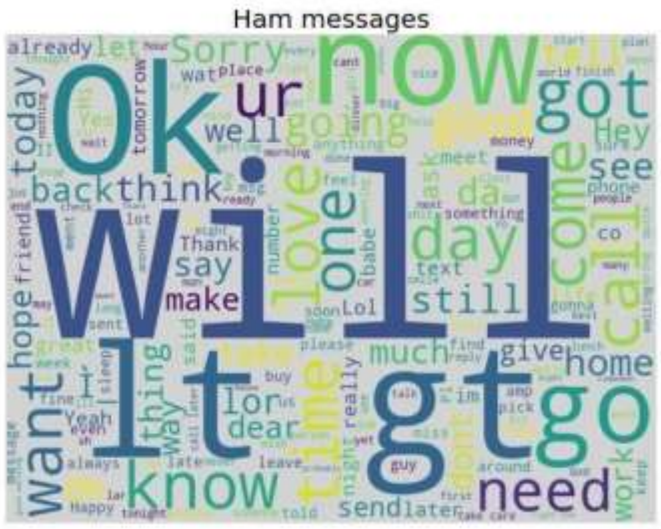


WordClouds

```
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()
```

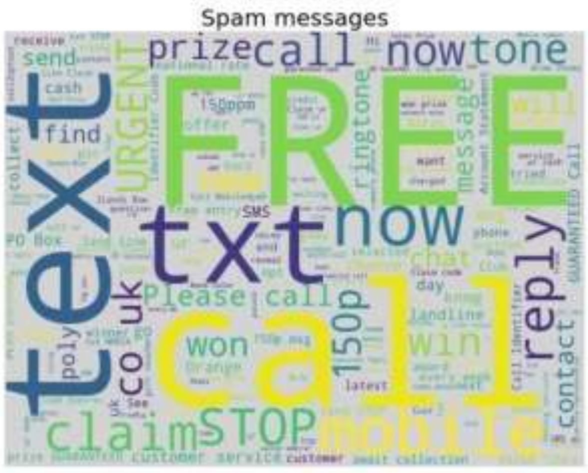
WordCloud: Ham messages

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

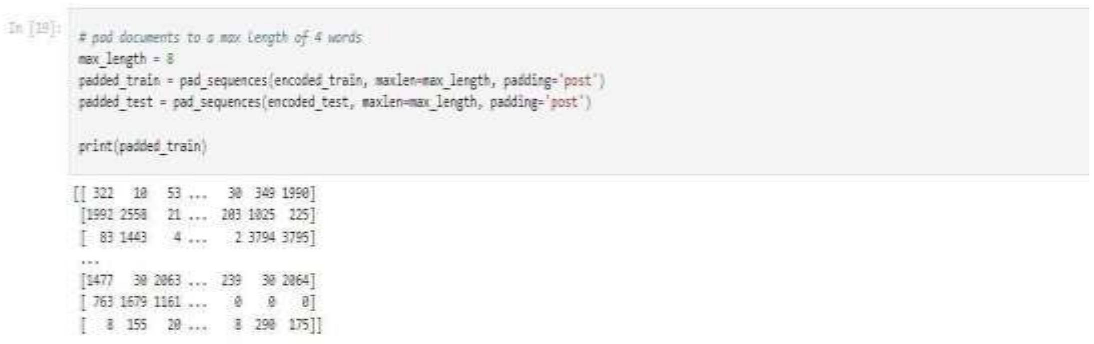


WordCloud: Spam messages

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

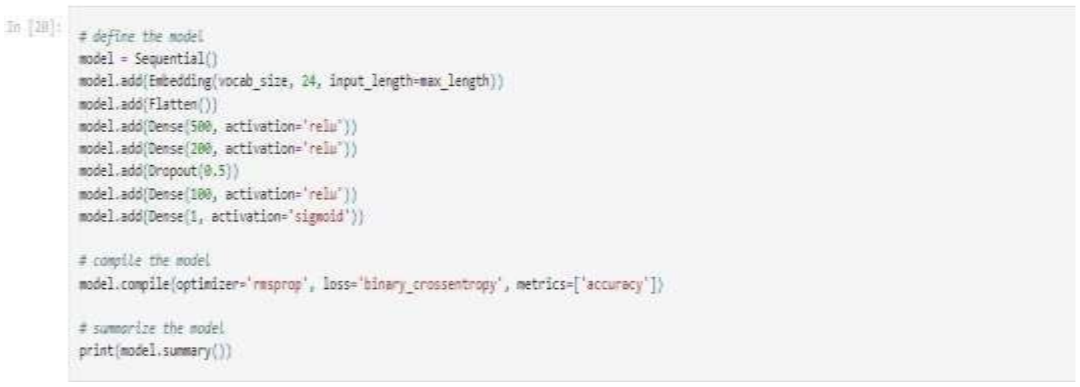


**5. Add Layers (LSTM, Dense-(Hidden Layers), Output) 6. Compile the Mode**

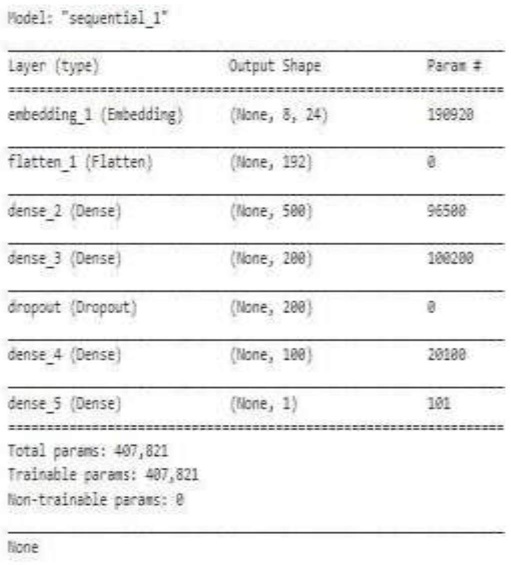


```
In [19]:
# pad documents to a max length of 4 words
max_length = 8
padded_train = pad_sequences(encoded_train, maxlen=max_length, padding='post')
padded_test = pad_sequences(encoded_test, maxlen=max_length, padding='post')

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]]
```

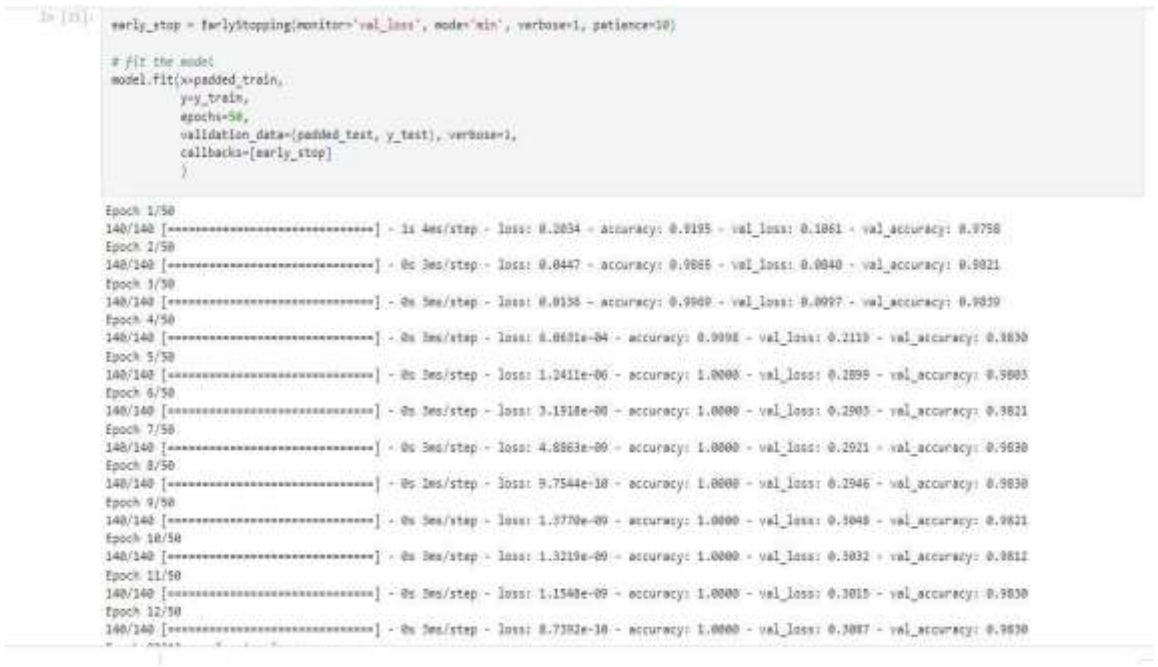


```
In [20]:
# define the model
model = Sequential()
model.add(Embedding(vocab_size, 24, input_length=max_length))
model.add(Flatten())
model.add(Dense(500, activation='relu'))
model.add(Dense(200, activation='relu'))
model.add(Dropout(0.5))
model.add(Dense(100, activation='relu'))
model.add(Dense(1,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

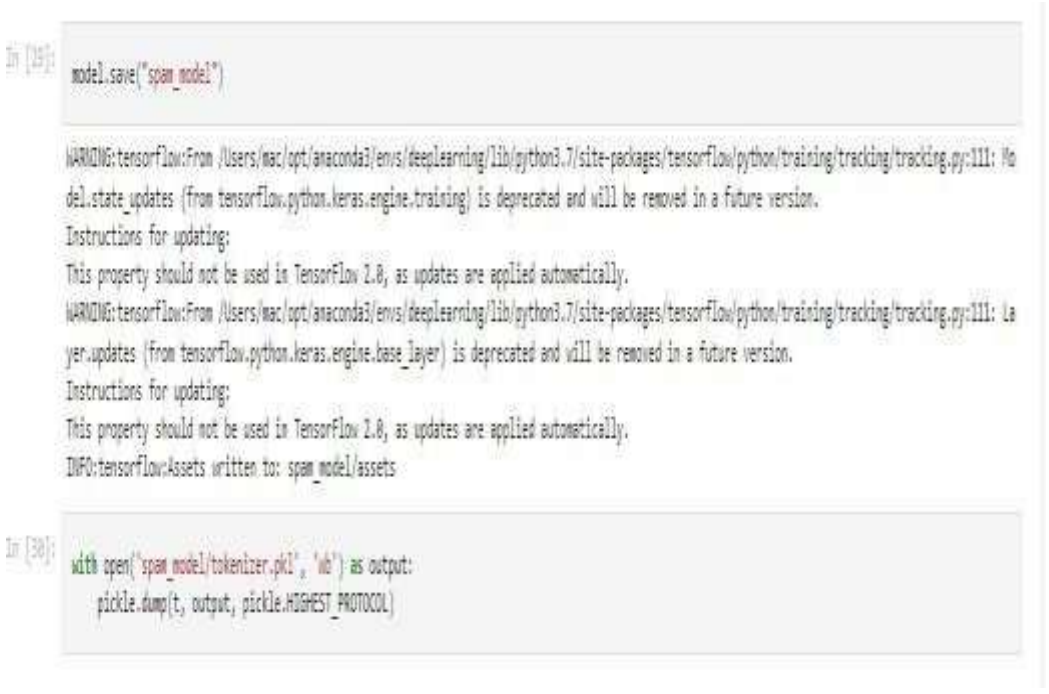
## 7. Fit the Model



```
In [25]: 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: 0.0138 - accuracy: 0.9960 - 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 3ms/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: 1.1540e-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

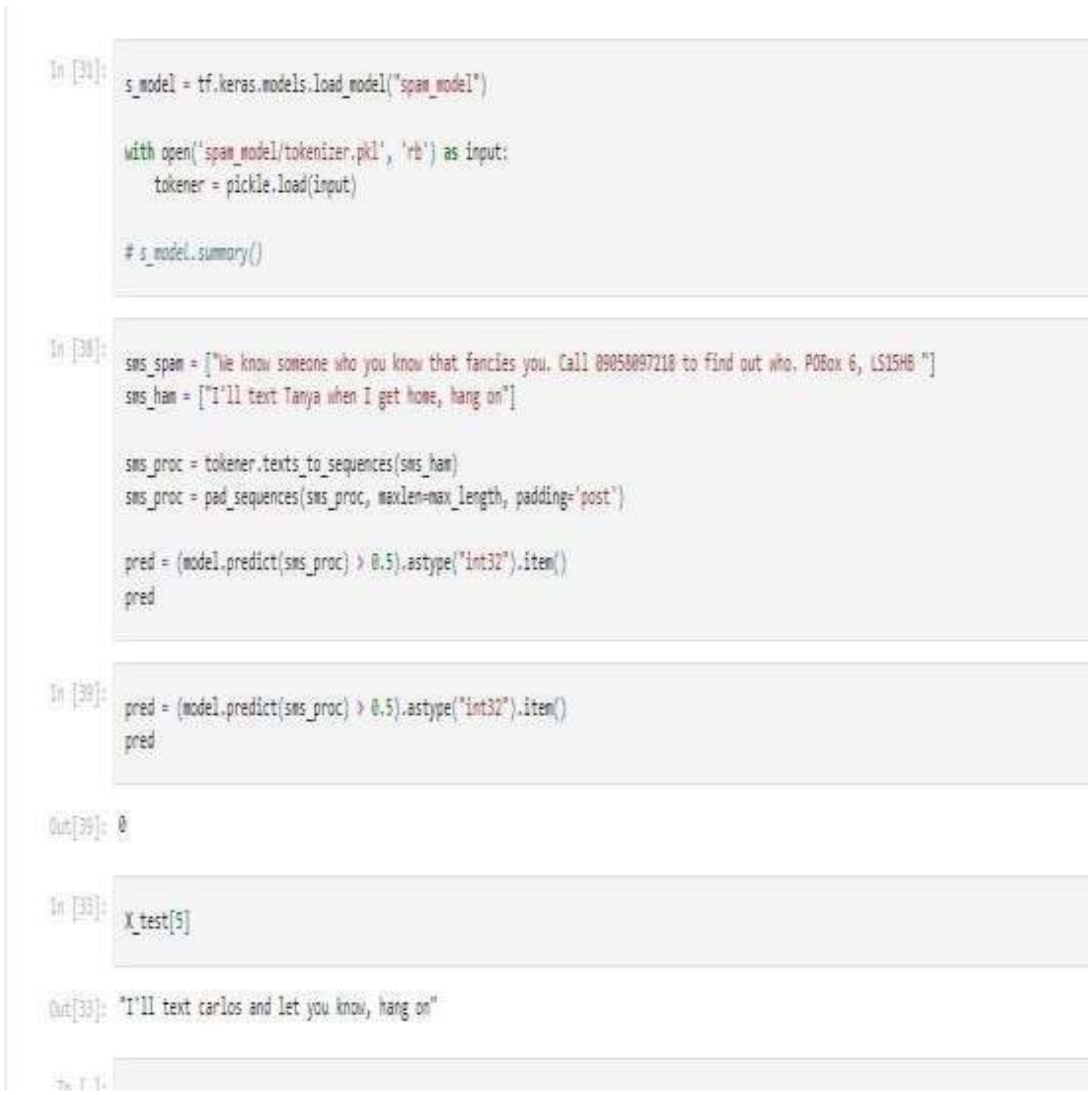


```
In [29]: model.save("spam_model")
```

```
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 [ ]:
```