```
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 pad_sequences
from keras.utils import to_categorical
from keras.callbacks import EarlyStopping
```

READ DATASET AND PRE PROCESSING

```
df = pd.read_csv('/content/spam.csv',delimiter=',',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

```
'Unnamed: 4'],axis=1,inplace=True)
```

Saving...

```
<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
```

```
X = df.v2
Y = df.v1
le = LabelEncoder()
Y = le.fit_transform(Y)
Y = Y.reshape(-1,1)
```

```
X_train,X_test,Y_train,Y_test = train_test_split(X,Y,test_size=0.15)


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 = pad_sequences(sequences,maxlen=max_len)
```

Create Model and Add Layers (LSTM, Dense-(Hidden Layers), Output)

```
inputs = Input(name='inputs',shape=[max_len])
layer = Embedding(max_words,50,input_length=max_len)(inputs)
layer = LSTM(64)(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('sigmoid')(layer)
model = Model(inputs=inputs,outputs=layer)

model.summary()
```

```
Model: "model"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 inputs (InputLayer)         [(None, 150)]             0

 embedding (Embedding)       (None, 150, 50)           50000

 lstm (LSTM)                 (None, 64)                29440

 FC1 (Dense)                 (None, 256)               16640

 activation (Activation)     (None, 256)               0

 dropout (Dropout)           (None, 256)               0

 out_layer (Dense)           (None, 1)                 257

 activation_1 (Activation)   (None, 1)                 0

=================================================================
Total params: 96,337
Trainable params: 96,337
Non-trainable params: 0
_________________________________________________________________
```

Compile the Model

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

Train and Fit the Model

```
model.fit(sequences_matrix,Y_train,batch_size=128,epochs=10,
          validation_split=0.2)
```

```
Epoch 1/10
30/30 [==============================] - 12s 286ms/step - loss: 0.3377 - accuracy: 0
Epoch 2/10
30/30 [==============================] - 9s 301ms/step - loss: 0.0934 - accuracy: 0.9
Epoch 3/10
30/30 [==============================] - 10s 327ms/step - loss: 0.0395 - accuracy: 0
Epoch 4/10
30/30 [==============================] - 9s 317ms/step - loss: 0.0311 - accuracy: 0.9
Epoch 5/10
30/30 [==============================] - 9s 294ms/step - loss: 0.0213 - accuracy: 0.9
Epoch 6/10
30/30 [==============================] - 9s 305ms/step - loss: 0.0167 - accuracy: 0.9
Epoch 7/10
30/30 [==============================] - 9s 316ms/step - loss: 0.0115 - accuracy: 0.9
Epoch 8/10
30/30 [==============================] - 9s 286ms/step - loss: 0.0081 - accuracy: 0.9
Epoch 9/10
30/30 [==============================] - 9s 310ms/step - loss: 0.0065 - accuracy: 0.9
Epoch 10/10
30/30 [==============================] - 10s 346ms/step - loss: 0.0064 - accuracy: 0
<keras.callbacks.History at 0x7f03f70fe810>
```

Save The Model

Saving...

Preprocessing the Test Dataset

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

Testing the Model

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

```
27/27 [==============================] - 1s 23ms/step - loss: 0.1346 - accuracy: 0.98
```

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

```
Test set
  Loss: 0.135
  Accuracy: 0.982
```