

```

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
from keras.models import load_model
%matplotlib inline

```

```

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

```

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

```

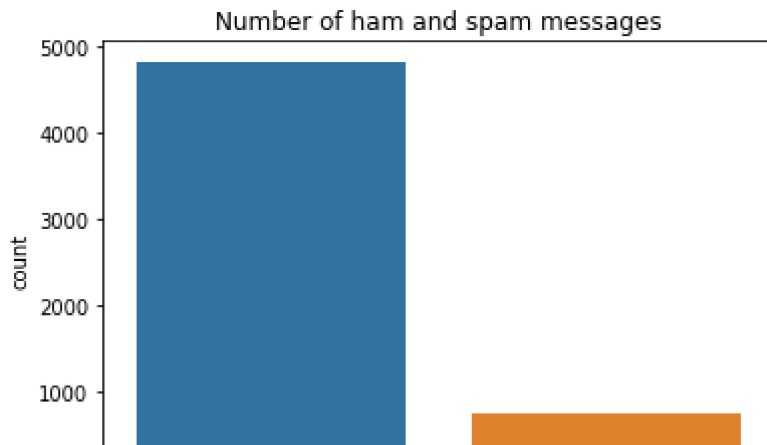
```

# data distribution
sns.countplot(df.v1)
plt.xlabel('Label')
plt.title('Number of ham and spam messages')

```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pas
FutureWarning
```

```
Text(0.5, 1.0, 'Number of ham and spam messages')
```



```
x = df.v2
y = df.v1
le = LabelEncoder()
y = le.fit_transform(y)
y = y.reshape(-1,1)

# test and train split
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 = sequence.pad_sequences(sequences,maxlen=max_len)

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

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

```

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```

model.fit(sequences_matrix,y_train,batch_size=128,epochs=10,
          validation_split=0.2,callbacks=[EarlyStopping(monitor='val_loss',min_delta=0.000

```

```

Epoch 1/10
30/30 [=====] - 8s 31ms/step - loss: 0.3126 - accuracy: 0.8
Epoch 2/10
30/30 [=====] - 0s 12ms/step - loss: 0.0804 - accuracy: 0.9
<keras.callbacks.History at 0x7fafc004ef90>

```



```

# saving a model
model.save("model.h5")

```

## ▼ Testing The model

```

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)

```

```

27/27 [=====] - 0s 6ms/step - loss: 0.0494 - accuracy: 0.99

```



```

print('Test set\n Loss: {:.3f}\n Accuracy: {:.3f}'.format(accr[0],accr[1]))

```

```

Test set
Loss: 0.049
Accuracy: 0.990

```

```
y_pred = model.predict(test_sequences_matrix)
print(y_pred[0:10])
```

```
27/27 [=====] - 1s 5ms/step
[[0.3697627 ]
 [0.00988049]
 [0.0044572 ]
 [0.00297501]
 [0.00561447]
 [0.01391087]
 [0.019729 ]
 [0.00351478]
 [0.02551245]
 [0.03033627]]
```

```
y_test[0:10][0][0]
```

```
0
```

```
labels = {0:'ham',1:'spam'}
for i in range(0,10):
    print(labels[y_test[30:40][i][0]]);
```

```
spam
ham
spam
spam
ham
ham
ham
ham
ham
spam
ham
```

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✓ 0s completed at 9:42 AM

