In [1]:

```python
#خواندن دیتا
import pandas as pd
Email_Data = pd.read_csv("C:\\Users\\ShahinN\\Desktop\\SMSSpamCollection.txt

Email_Data.columns

```

Out[1]:

```
Index(['Target', 'Email'], dtype='object')
```

In [2]:

```python
Email_Data.head()
```

Out[2]:

	Target	Email
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...
4	ham	Nah I don't think he goes to usf, he lives aro...

In [3]:

```python
#import
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import string
from nltk.stem import SnowballStemmer
from nltk.corpus import stopwords
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.model_selection import train_test_split
import os
from textblob import TextBlob
from nltk.stem import PorterStemmer
from textblob import Word
from sklearn.feature_extraction.text import CountVectorizer, TfidfVectorizer
import sklearn.feature_extraction.text as text
```

پیش پردازش متن دیتاست (پیامک ها

In [4]:

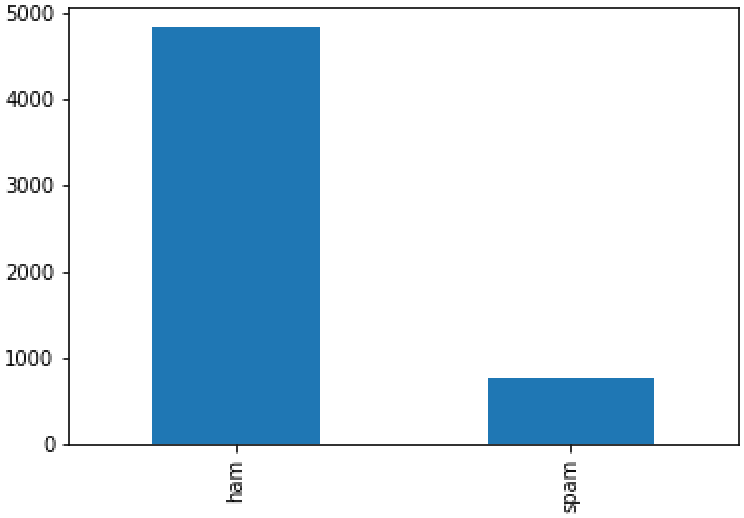
```
#lowercase
Email_Data['Email'] =  Email_Data['Email'].apply(lambda x:  " ".join(x.lower
# stopword filtering
stop = stopwords.words('english')
Email_Data['Email'] =  Email_Data['Email'].apply(lambda x: " ".join (x for x
#stemming
st = PorterStemmer()
Email_Data['Email'] =  Email_Data['Email'].apply(lambda x: " ".join ([st.ste
#lemmatize
Email_Data['Email'] =  Email_Data['Email'].apply(lambda x: " ".join ([Word(w
Email_Data.head()
```

Out[4]:

	Target	Email
0	ham	go jurong point, crazy.. avail bugi n great wo...
1	ham	ok lar... joke wif u oni...
2	spam	free entri 2 wkli comp win fa cup final tkt 21...
3	ham	u dun say earli hor... u c alreadi say...
4	ham	nah think goe usf, live around though

In [5]:

```
result=Email_Data['Target'].value_counts()
result.plot(kind='bar');
```



In [12]:

```
# بخش بندی دیتاست
train, test = train_test_split(Email_Data[['Email', 'Target']] , test_size=0
```

تعریف سری طول ها، ماکزیمم تعداد واژگان و ابعاد گنجاند یا امبدینگ

In [13]:

```
MAX_SEQUENCE_LENGTH = 300
```

In [14]:

```python
# 20000 واژگان برتر
MAX_NB_WORDS = 20000
```

In [16]:

```python
from keras.preprocessing.text import Tokenizer

#نحوه شناسایی واژگان معمولی  که موارد استفاده قرار میگیرند
tokenizer = Tokenizer(num_words=MAX_NB_WORDS)
tokenizer.fit_on_texts(train.Email)
train_sequences = tokenizer.texts_to_sequences(train.Email)
test_sequences = tokenizer.texts_to_sequences(test.Email)
```

```
Using TensorFlow backend.
```

In [17]:

```python
# dictionary containing words and their index
word_index = tokenizer.word_index
# print(tokenizer.word_index)
# total words in the corpus
print('Found %s unique tokens.' % len(word_index))
```

```
Found 7576 unique tokens.
```

In [19]:

```python
from keras.preprocessing.sequence import pad_sequences

# get only the top frequent words on train
train_data = pad_sequences(train_sequences, maxlen=MAX_SEQUENCE_LENGTH)
```

In [20]:

```python
# get only the top frequent words on test
test_data = pad_sequences(test_sequences, maxlen=MAX_SEQUENCE_LENGTH)

```

In [21]:

```python
print(train_data.shape)
print(test_data.shape)
```

```
(4457, 300)
(1115, 300)
```

In [22]:

```python
train_labels = train['Target']
test_labels = test['Target']
```

In [23]:

```python
from sklearn.preprocessing import LabelEncoder
```

In [24]:

```python
le = LabelEncoder()
le.fit(train_labels)
train_labels = le.transform(train_labels)
test_labels = le.transform(test_labels)
```

In [25]:

```
print(le.classes_)
print(np.unique(train_labels, return_counts=True))
print(np.unique(test_labels, return_counts=True))
```

```
['ham' 'spam']
(array([0, 1]), array([3859,  598], dtype=int64))
(array([0, 1]), array([966, 149], dtype=int64))
```

In [28]:

```
from keras import utils as np_utils
from keras.utils import to_categorical
# changing data types
labels_train = to_categorical(np.asarray(train_labels))
labels_test = to_categorical(np.asarray(test_labels))
print('Shape of data tensor:', train_data.shape)
print('Shape of label tensor:', labels_train.shape)
print('Shape of label tensor:', labels_test.shape)
```

```
Shape of data tensor: (4457, 300)
Shape of label tensor: (4457, 2)
Shape of label tensor: (1115, 2)
```

In [29]:

```
EMBEDDING_DIM = 100
print(MAX_SEQUENCE_LENGTH)
```

```
300
```

ساخت مدل شبکه عصبی CNN

In [30]:

```
# Import Libraries
import sys, os, re, csv, codecs, numpy as np, pandas as pd
from keras.preprocessing.text import Tokenizer
from keras.preprocessing.sequence import pad_sequences
from keras.utils import to_categorical
from keras.layers import Dense, Input, LSTM, Embedding, Dropout, Activation
from keras.layers import Bidirectional, GlobalMaxPool1D, Conv1D, SimpleRNN
from keras.models import Model
from keras.models import Sequential
from keras import initializers, regularizers, constraints, optimizers, layer
from keras.layers import Dense, Input, Flatten, Dropout, BatchNormalization
from keras.layers import Conv1D, MaxPooling1D, Embedding
from keras.models import Sequential
```

In [31]:

```
print('Training CNN 1D model.')
```

```
Training CNN 1D model.
```

In [37]:

```
model = Sequential()
model.add(Embedding(MAX_NB_WORDS, EMBEDDING_DIM, input_length=MAX_SEQUENCE_L
model.add(Dropout(0.5))
model.add(Conv1D(128, 5, activation='relu'))
model.add(MaxPooling1D(5))
model.add(Dropout(0.5))
model.add(BatchNormalization())
model.add(Conv1D(128, 5, activation='relu'))
model.add(MaxPooling1D(5))
model.add(Dropout(0.5))
model.add(BatchNormalization())
model.add(Flatten())
model.add(Dense(128, activation='relu'))
model.add(Dense(2, activation='softmax'))
```

In [38]:

```
model.compile(loss='categorical_crossentropy',optimizer='adam', metrics=['ac
```

In [39]:

```
model.fit(train_data, labels_train ,validation_data=(test_data, labels_test)
```

```
WARNING:tensorflow:From C:\Users\ShahinN\Anaconda3\lib\site-packages\keras\back
end\tensorflow_backend.py:422: The name tf.global_variables is deprecated. Plea
se use tf.compat.v1.global_variables instead.

Train on 4457 samples, validate on 1115 samples
Epoch 1/5
4457/4457 [==============================] - 86s 19ms/step - loss: 0.3881 - acc
uracy: 0.8470 - val_loss: 0.4676 - val_accuracy: 0.8664
Epoch 2/5
4457/4457 [==============================] - 91s 20ms/step - loss: 0.1372 - acc
uracy: 0.9594 - val_loss: 0.9748 - val_accuracy: 0.8664
Epoch 3/5
4457/4457 [==============================] - 75s 17ms/step - loss: 0.0568 - acc
uracy: 0.9852 - val_loss: 1.0995 - val_accuracy: 0.8664
Epoch 4/5
4457/4457 [==============================] - 75s 17ms/step - loss: 0.0366 - acc
uracy: 0.9919 - val_loss: 0.9774 - val_accuracy: 0.8664
Epoch 5/5
4457/4457 [==============================] - 74s 17ms/step - loss: 0.0198 - acc
uracy: 0.9960 - val_loss: 0.8521 - val_accuracy: 0.8664
```

Out[39]:

```
<keras.callbacks.callbacks.History at 0x11bb71079b0>
```

RNN model

In [46]:

```
#import library
from keras.layers.recurrent import SimpleRNN

#model training
print('Training SIMPLERNN model.')

model = Sequential()
model.add(Embedding(MAX_NB_WORDS, EMBEDDING_DIM, input_length=MAX_SEQUENCE_L

model.add(SimpleRNN(2, input_shape=(None,1)))
model.add(Dense(2,activation='softmax'))
```

```
Training SIMPLERNN model.
```

In [47]:

```
model.compile(loss = 'binary_crossentropy', optimizer='adam',metrics = ['acc

```

In [48]:

```
model.fit(train_data, labels_train, batch_size=16, epochs=5, validation_data
```

```
Train on 4457 samples, validate on 1115 samples
Epoch 1/5
4457/4457 [==============================] - 54s 12ms/step - loss: 0.3455 - acc
uracy: 0.9446 - val_loss: 0.2078 - val_accuracy: 0.9848
Epoch 2/5
4457/4457 [==============================] - 53s 12ms/step - loss: 0.1159 - acc
uracy: 0.9915 - val_loss: 0.1419 - val_accuracy: 0.9740
Epoch 3/5
4457/4457 [==============================] - 62s 14ms/step - loss: 0.0513 - acc
uracy: 0.9969 - val_loss: 0.1246 - val_accuracy: 0.9740
Epoch 4/5
4457/4457 [==============================] - 55s 12ms/step - loss: 0.0271 - acc
uracy: 0.9991 - val_loss: 0.1216 - val_accuracy: 0.9668
Epoch 5/5
4457/4457 [==============================] - 56s 12ms/step - loss: 0.0165 - acc
uracy: 0.9996 - val_loss: 0.1190 - val_accuracy: 0.9668
```

Out[48]:

```
<keras.callbacks.callbacks.History at 0x11bced75240>
```

In [49]:

```
# prediction on test data
predicted_Srnn=model.predict(test_data)
predicted_Srnn
```

Out[49]:

```
array([[0.68528855, 0.31471145],
       [0.9151998 , 0.08480018],
       [0.995443  , 0.004557  ],
       ...,
       [0.9783735 , 0.02162646],
       [0.9677645 , 0.03223554],
       [0.84436935, 0.15563057]], dtype=float32)
```

In [50]:

```
#model evaluation
from sklearn.metrics import precision_recall_fscore_support as score
precision, recall, fscore, support = score(labels_test, predicted_Srnn.round

```

In [51]:

```
print('precision: {}'.format(precision))
print('recall: {}'.format(recall))
print('fscore: {}'.format(fscore))
print('support: {}'.format(support))
print("############################")
print(sklearn.metrics.classification_report(labels_test, predicted_Srnn.roun

```

```
precision: [0.96777442 0.95901639]
recall: [0.99482402 0.7852349 ]
fscore: [0.98111281 0.86346863]
support: [966 149]
############################
              precision    recall  f1-score   support

           0       0.97      0.99      0.98       966
           1       0.96      0.79      0.86       149

   micro avg       0.97      0.97      0.97      1115
   macro avg       0.96      0.89      0.92      1115
weighted avg       0.97      0.97      0.97      1115
 samples avg       0.97      0.97      0.97      1115
```

ساخت مدل LSTM

In [52]:

```
#model training
print('Training LSTM model.')
model = Sequential()

model.add(Embedding(MAX_NB_WORDS, EMBEDDING_DIM, input_length=MAX_SEQUENCE_L
model.add(LSTM(output_dim=16, activation='relu', inner_activation='hard_sigm
model.add(Dropout(0.2))
model.add(BatchNormalization())
model.add(Flatten())
model.add(Dense(2,activation='softmax'))
```

```
Training LSTM model.

C:\Users\ShahinN\Anaconda3\lib\site-packages\ipykernel_launcher.py:6: UserWarni
ng: Update your `LSTM` call to the Keras 2 API: `LSTM(activation="relu", return
_sequences=True, units=16, recurrent_activation="hard_sigmoid")`
```

In [53]:

```
model.compile(loss = 'binary_crossentropy', optimizer='adam',metrics = ['acc

```

In [54]:

```
model.fit(train_data, labels_train, batch_size=16, epochs=5, validation_data

```

```
Train on 4457 samples, validate on 1115 samples
Epoch 1/5
4457/4457 [==============================] - 299s 67ms/step - loss: 0.1342 - ac
curacy: 0.9545 - val_loss: 0.2203 - val_accuracy: 0.9184
Epoch 2/5
4457/4457 [==============================] - 293s 66ms/step - loss: 0.0184 - ac
curacy: 0.9951 - val_loss: 0.0745 - val_accuracy: 0.9812
Epoch 3/5
4457/4457 [==============================] - 401s 90ms/step - loss: 0.0041 - ac
curacy: 0.9993 - val_loss: 0.0766 - val_accuracy: 0.9803
Epoch 4/5
4457/4457 [==============================] - 406s 91ms/step - loss: 0.0012 - ac
curacy: 0.9998 - val_loss: 0.1059 - val_accuracy: 0.9812
Epoch 5/5
4457/4457 [==============================] - 415s 93ms/step - loss: 0.0011 - ac
curacy: 0.9998 - val_loss: 0.1062 - val_accuracy: 0.9821
```

Out[54]:

```
<keras.callbacks.callbacks.History at 0x11bffedbf28>
```

In [55]:

```
#prediction on text data
predicted_lstm=model.predict(test_data)
predicted_lstm
```

Out[55]:

```
array([[1.4820095e-10, 1.0000000e+00],
       [9.9995458e-01, 4.5383797e-05],
       [1.0000000e+00, 2.9247932e-10],
       ...,
       [9.9998820e-01, 1.1766316e-05],
       [9.9436921e-01, 5.6307805e-03],
       [9.9959332e-01, 4.0665350e-04]], dtype=float32)
```

In [56]:

```
from sklearn.metrics import precision_recall_fscore_support as score

precision, recall, fscore, support = score(labels_test, predicted_lstm.round

print('precision: {}'.format(precision))
print('recall: {}'.format(recall))
print('fscore: {}'.format(fscore))
print('support: {}'.format(support))
print("############################")
print(sklearn.metrics.classification_report(labels_test,predicted_lstm.round

```

```
precision: [0.97971602 1.        ]
recall: [1.         0.86577181]
fscore: [0.9897541  0.92805755]
support: [966 149]
############################
              precision    recall  f1-score   support

           0       0.98      1.00      0.99       966
           1       1.00      0.87      0.93       149

   micro avg       0.98      0.98      0.98      1115
   macro avg       0.99      0.93      0.96      1115
weighted avg       0.98      0.98      0.98      1115
 samples avg       0.98      0.98      0.98      1115
```

In [ ]:

```

```