Simple Spam Classification

In [1]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

In [2]:

```
df = pd.read_csv("spam.tsv", sep="\t")
```

In [3]:

```
df.head()
```

Out[3]:

	label	message	length	punct
0	ham	Go until jurong point, crazy.. Available only ...	111	9
1	ham	Ok lar... Joking wif u oni...	29	6
2	spam	Free entry in 2 a wkly comp to win FA Cup fina...	155	6
3	ham	U dun say so early hor... U c already then say...	49	6
4	ham	Nah I don't think he goes to usf, he lives aro...	61	2

In [4]:

```
df.shape
```

Out[4]:

```
(5572, 4)
```

In [5]:

```
# Checking null values
df.isnull().sum()
```

Out[5]:

```
label      0
message    0
length     0
punct      0
dtype: int64
```

In [6]:

```
# checking number of ham and spam present
df['label'].value_counts()
```

Out[6]:

```
ham     4825
spam     747
Name: label, dtype: int64
```

It is an Imbalanced dataset, so we need to first make it balanced.

Balancing the Dataset

In [7]:

```
ham = df[df['label'] == 'ham']
ham.head()
```

Out[7]:

	label	message	length	punct
0	ham	Go until jurong point, crazy.. Available only ...	111	9
1	ham	Ok lar... Joking wif u oni...	29	6
3	ham	U dun say so early hor... U c already then say...	49	6
4	ham	Nah I don't think he goes to usf, he lives aro...	61	2
6	ham	Even my brother is not like to speak with me. ...	77	2

In [8]:

```
spam = df[df['label'] == 'spam']
spam.head()
```

Out[8]:

	label	message	length	punct
2	spam	Free entry in 2 a wkly comp to win FA Cup fina...	155	6
5	spam	FreeMsg Hey there darling it's been 3 week's n...	147	8
8	spam	WINNER!! As a valued network customer you have...	157	6
9	spam	Had your mobile 11 months or more? U R entitle...	154	2
11	spam	SIX chances to win CASH! From 100 to 20,000 po...	136	8

In [9]:

```
ham.shape, spam.shape
```

Out[9]:

```
((4825, 4), (747, 4))
```

In [10]:

```
# Randomly Selecting 747 rows of ham
ham = ham.sample(spam.shape[0])
```

In [11]:

```
ham.shape
```

Out[11]:

```
(747, 4)
```

In [12]:

```
# Now appending ham and spam
data = ham.append(spam, ignore_index=True)
data.head()
```

Out[12]:

	label	message	length	punct
0	ham	Nowadays people are notixiquating the laxinorf...	274	12
1	ham	I uploaded mine to Facebook	27	0
2	ham	hanks lotsly!	13	1
3	ham	Hi Shanil,Rakhesh here.thanks,i have exchanged...	120	6
4	ham	Gal n boy walking in d park. gal-can i hold ur...	160	13

In [13]:

```
data.tail()
```

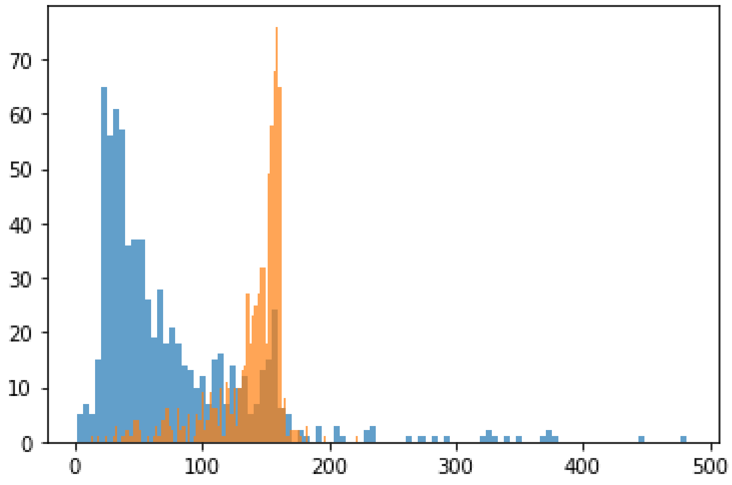
Out[13]:

	label	message	length	punct
1489	spam	Want explicit SEX in 30 secs? Ring 02073162414...	90	3
1490	spam	ASKED 3MOBILE IF 0870 CHATLINES INCLU IN FREE ...	158	5
1491	spam	Had your contract mobile 11 Mnths? Latest Moto...	160	8
1492	spam	REMINDER FROM O2: To get 2.50 pounds free call...	147	3
1493	spam	This is the 2nd time we have tried 2 contact u...	160	8

Exploratory Data Analysis

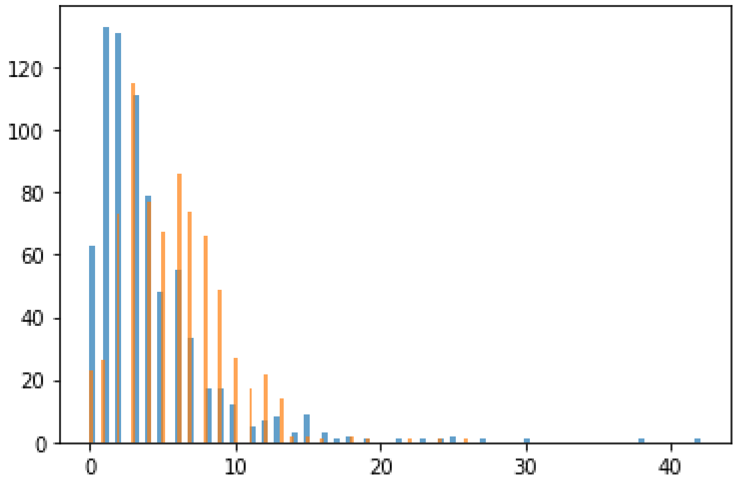
In [15]:

```
plt.hist(data[data['label'] == 'ham']['length'], bins = 100, alpha = 0.7)
plt.hist(data[data['label'] == 'spam']['length'], bins = 100, alpha = 0.7)
plt.show()
```



In [16]:

```
plt.hist(data[data['label'] == 'ham']['punct'], bins = 100, alpha = 0.7)
plt.hist(data[data['label'] == 'spam']['punct'], bins = 100, alpha = 0.7)
plt.show()
```



Highly overlapping, no information can be gathered

Preparing the data

In [17]:

```
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestClassifier
from sklearn.svm import SVC
from sklearn.metrics import accuracy_score, classification_report, confusion_matrix
from sklearn.pipeline import Pipeline
from sklearn.feature_extraction.text import TfidfVectorizer
```

In [25]:

```
# Splitting the data
X = data['message']
y = data['label']
x_train,x_test,y_train,y_test = train_test_split(X, y, test_size = 0.3, random_state = 
0,
                                shuffle = True, stratify = y)
```

In [19]:

```
x_train.shape, x_test.shape
```

Out[19]:

```
((1045,), (449,))
```

Bag of word

In [20]:

```
vectorizer = TfidfVectorizer()
```

In [21]:

```
x_train = vectorizer.fit_transform(x_train)
```

In [22]:

```
x_train.shape
```

Out[22]:

```
(1045, 3721)
```

Pipline and Random Forest

In [23]:

```
clf = Pipeline([('tfidf', TfidfVectorizer()),
            ('clf', RandomForestClassifier(n_estimators=100, n_jobs=-100))])
```

In [26]:

```
clf.fit(x_train,y_train)
```

Out[26]:

```
Pipeline(memory=None,
         steps=[('tfidf',
                 TfidfVectorizer(analyzer='word', binary=False,
                                 decode_error='strict',
                                 dtype=<class 'numpy.float64'>,
                                 encoding='utf-8', input='content',
                                 lowercase=True, max_df=1.0, max_features=
None,
                                 min_df=1, ngram_range=(1, 1), norm='l2',
                                 preprocessor=None, smooth_idf=True,
                                 stop_words=None, strip_accents=None,
                                 sublinear_tf=False,
                                 token_pattern='...
                 RandomForestClassifier(bootstrap=True, class_weight=None,
                                        criterion='gini', max_depth=None,
                                        max_features='auto',
                                        max_leaf_nodes=None,
                                        min_impurity_decrease=0.0,
                                        min_impurity_split=None,
                                        min_samples_leaf=1, min_samples_sp
lit=2,
                                        min_weight_fraction_leaf=0.0,
                                        n_estimators=100, n_jobs=-100,
                                        oob_score=False, random_state=Non
e,
                                        verbose=0, warm_start=False))],
         verbose=False)
```

In [27]:

```
y_pred = clf.predict(x_test)
```

In [29]:

```
print(confusion_matrix(y_test, y_pred))
```

```
[[222   3]
 [ 23 201]]
```

In [30]:

```
print(classification_report(y_test, y_pred))
```

```
              precision    recall  f1-score   support

         ham       0.91      0.99      0.94       225
        spam       0.99      0.90      0.94       224

    accuracy                           0.94       449
   macro avg       0.95      0.94      0.94       449
weighted avg       0.95      0.94      0.94       449
```

In [31]:

```
print(accuracy_score(y_test, y_pred))
```

```
0.9420935412026726
```

Predicting some real messages

In [32]:

```
clf.predict(["congratulations! you are shortlisted for the preliminary interview round"
])
```

Out[32]:

```
array(['ham'], dtype=object)
```

In [34]:

```
clf.predict(["Hurray! yow have won free air tickets to Singapore. Text 'WON' to 556677"
])
```

Out[34]:

```
array(['spam'], dtype=object)
```

In [35]:

```
clf.predict(["This is a very simple spam classification using nlp"])
```

Out[35]:

```
array(['ham'], dtype=object)
```

Pipline and SVM

In [45]:

```
clf = Pipeline([('tfidf', TfidfVectorizer()),
            ('clf', SVC(C = 2000, gamma='auto'))])
```

In [46]:

```
clf.fit(x_train,y_train)
```

Out[46]:

```
Pipeline(memory=None,
         steps=[('tfidf',
                 TfidfVectorizer(analyzer='word', binary=False,
                                 decode_error='strict',
                                 dtype=<class 'numpy.float64'>,
                                 encoding='utf-8', input='content',
                                 lowercase=True, max_df=1.0, max_features=
None,
                                 min_df=1, ngram_range=(1, 1), norm='l2',
                                 preprocessor=None, smooth_idf=True,
                                 stop_words=None, strip_accents=None,
                                 sublinear_tf=False,
                                 token_pattern='(?u)\\b\\w\\w+\\b',
                                 tokenizer=None, use_idf=True,
                                 vocabulary=None)),
                ('clf',
                 SVC(C=2000, cache_size=200, class_weight=None, coef0=0.0,
                     decision_function_shape='ovr', degree=3, gamma='aut
o',
                     kernel='rbf', max_iter=-1, probability=False,
                     random_state=None, shrinking=True, tol=0.001,
                     verbose=False))],
         verbose=False)
```

In [47]:

```
y_pred = clf.predict(x_test)
```

In [48]:

```
print(confusion_matrix(y_test, y_pred))
```

```
[[221   4]
 [ 20 204]]
```

In [49]:

```
print(classification_report(y_test, y_pred))
```

```
              precision    recall  f1-score   support

         ham       0.92      0.98      0.95       225
        spam       0.98      0.91      0.94       224

    accuracy                           0.95       449
   macro avg       0.95      0.95      0.95       449
weighted avg       0.95      0.95      0.95       449
```

In [50]:

```
print(accuracy_score(y_test, y_pred))
```

```
0.9465478841870824
```

Prediction

In [51]:

```
clf.predict(["congratulations! you are shortlisted for the preliminary interview round"
])
```

Out[51]:

```
array(['ham'], dtype=object)
```

In [52]:

```
clf.predict(["Hurray! yow have won free air tickets to Singapore. Text 'WON' to 556677"
])
```

Out[52]:

```
array(['spam'], dtype=object)
```

In [53]:

```
clf.predict(["This is a very simple spam classification using nlp"])
```

Out[53]:

```
array(['ham'], dtype=object)
```

Summary

- SVM classifier works better than Random Forest classifier