EMAIL SPAM DETECTION

We've all been the recipient of spam emails before. Spam mail, or junk mail, is a type of email that is sent to a massive number of users at one time, frequently containing cryptic messages, scams, or most dangerously, phishing content.

In this Project, use Python to build an email spam detector. Then, use machine learning to train the spam detector to recognize and classify emails into spam and non-spam. Let's get started!

Importing required libraries

In [1]:
```python
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
```

Read the CSV file

In [8]:
```python
email = pd.read_csv('spam.csv', encoding = 'ISO-8859-1')
email
```

Out[8]:

	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
...	...	...	...	...	...
5567	spam	This is the 2nd time we have tried 2 contact u...	NaN	NaN	NaN
5568	ham	Will Ì_ b going to esplanade fr home?	NaN	NaN	NaN
5569	ham	Pity, * was in mood for that. So...any other s...	NaN	NaN	NaN
5570	ham	The guy did some bitching but I acted like i'd...	NaN	NaN	NaN
5571	ham	Rofl. Its true to its name	NaN	NaN	NaN

5572 rows × 5 columns

In [9]:
```python
email.head()
```

Out[9]:

	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

In [10]:
```python
email.tail()
```

Out[10]:

	v1	v2	Unnamed: 2	Unnamed: 3	Unnamed: 4
5567	spam	This is the 2nd time we have tried 2 contact u...	NaN	NaN	NaN
5568	ham	Will Ì_ b going to esplanade fr home?	NaN	NaN	NaN
5569	ham	Pity, * was in mood for that. So...any other s...	NaN	NaN	NaN
5570	ham	The guy did some bitching but I acted like i'd...	NaN	NaN	NaN
5571	ham	Rofl. Its true to its name	NaN	NaN	NaN

In [11]:
```python
email.columns
```

Out[11]:
```
Index(['v1', 'v2', 'Unnamed: 2', 'Unnamed: 3', 'Unnamed: 4'], dtype='object')
```

In [14]:
```python
email.shape
```

Out[14]:
```
(5572, 5)
```

In [12]:
```python
email.size
```

Out[12]:
```
27860
```

In [17]:
```python
email.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 5572 entries, 0 to 5571
Data columns (total 5 columns):
 #   Column      Non-Null Count  Dtype 
---  ------      --------------  ----- 
 0   v1          5572 non-null   object
 1   v2          5572 non-null   object
 2   Unnamed: 2  50 non-null     object
 3   Unnamed: 3  12 non-null     object
 4   Unnamed: 4  6 non-null      object
dtypes: object(5)
memory usage: 217.8+ KB
```

In [16]:
```python
email.describe()
```

Out[16]:

	v1	v2	Unnamed: 2	Unnamed: 3	Unnamed: 4
count	5572	5572	50	12	6
unique	2	5169	43	10	5
top	ham	Sorry, I'll call later	bt not his girlfrnd... G o o d n i g h t . . .@"	GE	GNT:-)"
freq	4825	30	3	2	2

Data Cleaning

In [ ]:
```python
email.drop(columns=['Unnamed: 2', 'Unnamed: 3', 'Unnamed: 4'],inplace=True)
```

In [44]:
```python
email
```

Out[44]:

	v1	v2
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...
...	...	...
5567	spam	This is the 2nd time we have tried 2 contact u...
5568	ham	Will Ì_ b going to esplanade fr home?
5569	ham	Pity, * was in mood for that. So...any other s...
5570	ham	The guy did some bitching but I acted like i'd...
5571	ham	Rofl. Its true to its name

5572 rows × 2 columns

In [47]:
```python
email = email.rename(columns={'v1':'Target','v2':'Message'})
email
```

Out[47]:

	Target	Message
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...
...	...	...
5567	spam	This is the 2nd time we have tried 2 contact u...
5568	ham	Will Ì_ b going to esplanade fr home?
5569	ham	Pity, * was in mood for that. So...any other s...
5570	ham	The guy did some bitching but I acted like i'd...
5571	ham	Rofl. Its true to its name

5572 rows × 2 columns

In [49]:
```python
email.isnull().sum()
```

Out[49]:
```
Target     0
Message    0
dtype: int64
```

In [50]:
```python
email.duplicated().sum()
```

Out[50]:
```
403
```

In [51]:
```python
email.drop_duplicates(keep='first',inplace=True)
```

In [53]:
```python
email.duplicated().sum()
```

Out[53]:
```
0
```

In [54]:
```python
email.size
```

Out[54]:
```
10338
```

Label Encoding

In [55]:
```python
from sklearn.preprocessing import LabelEncoder
encoder=LabelEncoder()
email['Target']=encoder.fit_transform(email['Target'])
email['Target']
```

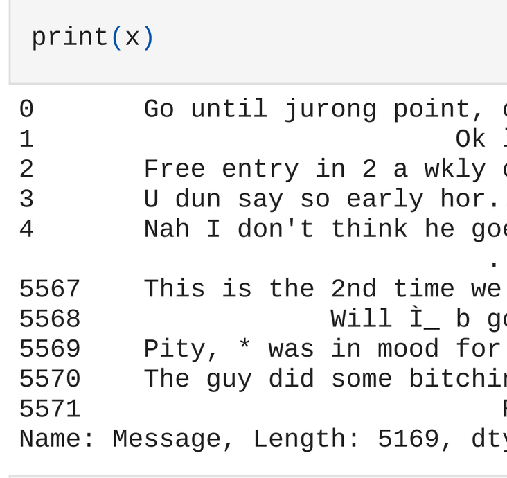
Out[55]:
```
0       0
1       0
2       1
3       0
4       0
       ..
5567    1
5568    0
5569    0
5570    0
5571    0
Name: Target, Length: 5169, dtype: int32
```

In [56]:
```python
email.head()
```

Out[56]:

	Target	Message
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 [57]:
```python
plt.pie(email['Target'].value_counts(), labels = ['ham', 'spam'], autopct = "%0.2f")
plt.show()
```



In [58]:
```python
x=email['Message']
y=email['Target']
```

In [59]:
```python
print(x)
```

```
0       Go until jurong point, crazy.. Available only ...
1                           Ok lar... Joking wif u oni...
2       Free entry in 2 a wkly comp to win FA Cup fina...
3       U dun say so early hor... U c already then say...
4       Nah I don't think he goes to usf, he lives aro...
                              ...
5567    This is the 2nd time we have tried 2 contact u...
5568                Will Ì_ b going to esplanade fr home?
5569    Pity, * was in mood for that. So...any other s...
5570    The guy did some bitching but I acted like i'd...
5571                           Rofl. Its true to its name
Name: Message, Length: 5169, dtype: object
```

In [60]:
```python
print(y)
```

```
0       0
1       0
2       1
3       0
4       0
       ..
5567    1
5568    0
5569    0
5570    0
5571    0
Name: Target, Length: 5169, dtype: int32
```

Training the Model

In [61]:
```python
from sklearn.model_selection import train_test_split
x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.2, random_state=3)
```

In [62]:
```python
from sklearn.feature_extraction.text import  CountVectorizer
from sklearn import svm
```

In [63]:
```python
cv=CountVectorizer()
```

In [64]:
```python
x_train_cv = cv.fit_transform(x_train)
x_test_cv = cv.transform(x_test)
```

In [65]:
```python
print(x_train_cv)
```

```
  (0, 1879)	1
  (0, 1170)	1
  (0, 6840)	1
  (0, 6610)	1
  (0, 2779)	1
  (1, 1939)	1
  (1, 4467)	1
  (1, 453)	1
  (1, 7176)	1
  (1, 7594)	1
  (1, 1577)	1
  (1, 203)	1
  (1, 4768)	1
  (1, 7175)	1
  (1, 7390)	1
  (1, 7590)	1
  (1, 4309)	1
  (1, 5157)	1
  (1, 3732)	1
  (1, 3015)	1
  (1, 2333)	1
  (1, 5210)	1
  (1, 4577)	1
  (1, 4731)	1
  (1, 5615)	1
  :	:
  (4134, 3290)	2
  (4134, 4817)	1
  (4134, 1546)	1
  (4134, 4195)	1
  (4134, 891)	1
  (4134, 1092)	1
  (4134, 1261)	1
  (4134, 7302)	1
  (4134, 6595)	1
  (4134, 1624)	1
  (4134, 1977)	1
  (4134, 7438)	1
  (4134, 6189)	1
  (4134, 6815)	1
  (4134, 2357)	1
  (4134, 4093)	1
  (4134, 6583)	1
  (4134, 5934)	1
  (4134, 1661)	1
  (4134, 5153)	1
  (4134, 6292)	1
  (4134, 3707)	1
  (4134, 6172)	1
  (4134, 3624)	1
  (4134, 4785)	1
```

Logistic Regresssion

In [66]:
```python
from sklearn.linear_model import LogisticRegression
lr=LogisticRegression()
```

In [67]:
```python
lr.fit(x_train_cv,y_train)
prediction_train=lr.predict(x_train_cv)
```

In [68]:
```python
from sklearn.metrics import accuracy_score
print(accuracy_score(y_train, prediction_train)*100)
```

```
99.75816203143893
```

In [69]:
```python
prediction_test = lr.predict(x_test_cv)
```

In [70]:
```python
from sklearn.metrics import accuracy_score
print(accuracy_score(y_test, prediction_test)*100)
```

```
97.58220502901354
```