SPAM SMS DETECTION

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```
# Importing libraries and fetching data

import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
```

```
data = pd.read_csv("spam.csv")
```

```
data
```

	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

Next steps: Generate code with `data` View recommended plots

```
data.describe()
```

	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	bt not his girlfrnd... G o o d	MK17 92H.	GNT:-)"

call later night...@ 450Pgw 16

```
data.info()
```

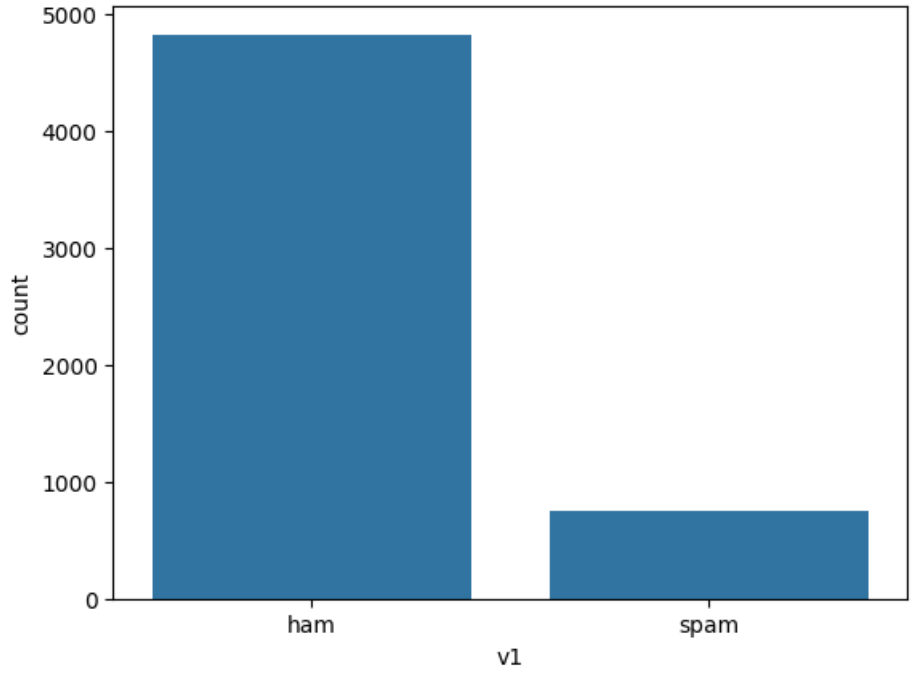
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 5572 entries, 0 to 5571
Data columns (total 5 columns):
 #   Column      Non-Null Count  Dtype 
---  ------      --------------  ----- 
 0   v1          5572 non-null   object
 1   v2          5572 non-null   object
 2   Unnamed: 2  50 non-null  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

```
data.shape
```

```
(5572, 5)
```

```
sns.countplot(x=data.v1)
```

```
<Axes: xlabel='v1', ylabel='count'>
```



We can see that our dataset contains mainly ham messages. This would limit the capability of model to classify correctly, but we can give it a try!

```
# We now look through the information in the dataset

data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 5572 entries, 0 to 5571
Data columns (total 5 columns):
 #   Column      Non-Null Count  Dtype 
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 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
```

We can see that v1 and v2 corresponds to whether the messages are ham/spam and the message text. However, we'll need to look through the Unnamed fields to explore whether they have any effect on the final conclusion.

```
data["Unnamed: 2"].value_counts().head()
```

```
 bt not his girlfrnd... G o o d n i g h t . . .@"       3
 PO Box 5249                                            2
this wont even start........ Datz confidence.."         2
GN                                                      2
 don't miss ur best life for anything... Gud nyt..."    2
Name: Unnamed: 2, dtype: int64
```

So we've 5 columns:

1. Containing the target whether the message is ham/spam
2. Text Field 1
3. Text Field 2
4. Text Field 4
5. Text Field 5

We can safely say that the amount of data in the Unnamed columns are negligible and can be dropped without any alterations to the remaining data.

Also, fortunately, we've no null values in v1 and v2

```
# Incase the package is unavailable
# pip install nltk

import nltk
nltk.download('stopwords')
```

```
[nltk_data] Downloading package stopwords to /root/nltk_data...
[nltk_data]   Unzipping corpora/stopwords.zip.
True
```

```
# Incase the package is unavailable
# import nltk
# nltk.download('stopwords')

# We can now move further to data processing

import string
from nltk.corpus import stopwords
from nltk.stem import SnowballStemmer

stemmer = SnowballStemmer("english")

def simplify_data(data):
    # Create new tables named "Spam" and "Text"
    # Convert ham/spam to 0/1, 1 indicating Spam and fill them under Spam
    # Clean text by removing all special characters
    # Drop unwanted columns

    data = pd.read_csv("spam.csv")          # Refreshing data, just in-case the code is ran after running further
    data["Spam"] = data.v1.map({'ham':0, 'spam':1})
```

```
    data["Text"] = data.v2.str.lower()
    data.Text = data.Text.str.replace(r'[.,\\&;!:-?(|)#@$^%*0-9/\'\"+={|}~`_[|]]*', '')
    data = data.drop(["v1", "v2", "Unnamed: 2", "Unnamed: 3", "Unnamed: 4"], axis=1)
    return data

def remove_stopwords(message):
    # Remove stop words from the text

    stop_words = set(stopwords.words('english'))
    message = message.translate(str.maketrans('', '', string.punctuation))
    text = [word for word in message.split() if word not in stop_words and len(word) > 2]
    return " ".join(text)

def text_length(text):
    return len(text)

def format_length(data):
    data["Length"] = data.Text.apply(text_length)
    data.Length = pd.cut(data.Length, [-1, 10, 20, 30, 50, 75, 100, 999], labels=[10,20,30,50,75,100,200])
    return data

def apply_transformations(data):
    data = simplify_data(data)
    data.Text = data.Text.apply(remove_stopwords)
    data = format_length(data)
    return data

data = apply_transformations(data)
```

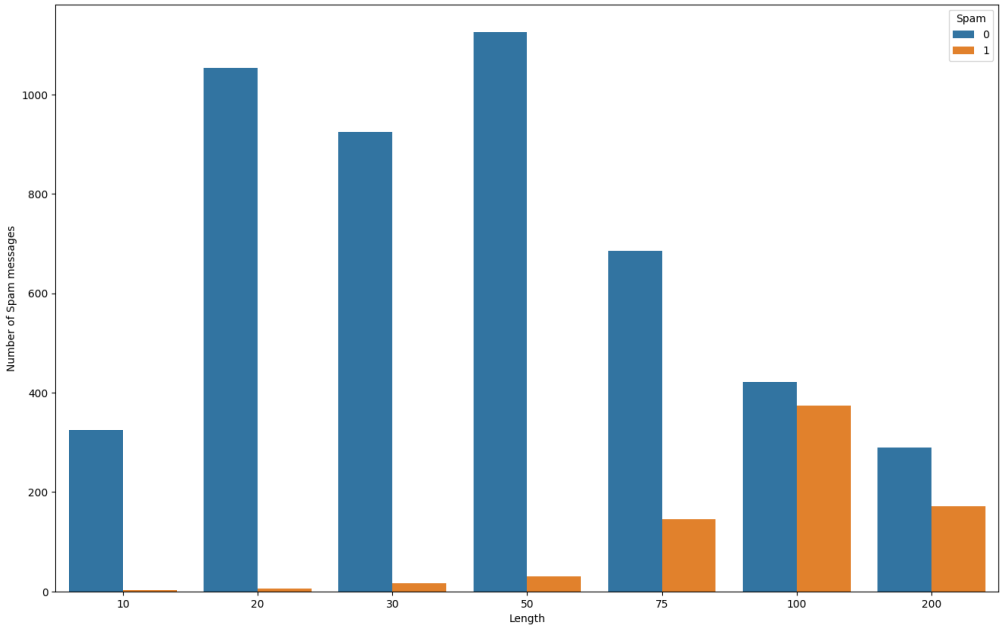
```
<ipython-input-14-ca624ba48d38>:22: FutureWarning: The default value of regex will
  data.Text = data.Text.str.replace(r'[.,\\&;!:-?(|)#@$^%*0-9/\'\"+={|}~`_[|]]*',
```

	Spam	Text	Length
0	0	jurong point crazy available bugis great world...	75
1	0	lar joking wif oni	20
2	1	free entry wkly comp win cup final tkts may te...	100
3	0	dun say early hor already say	30
4	0	nah dont think goes usf lives around though	50

Next steps: Generate code with `data` View recommended plots

```
plt.figure(figsize=(16,10))
plt.xlabel("Length")
plt.ylabel("Number of Spam messages")
sns.countplot(x=data.Length, hue=data.Spam)
```

```
<Axes: xlabel='Length', ylabel='Number of Spam messages'>
```



We can see that most messages with less length were mostly Ham messages and that the spam messages have a comparatively very small area. We can use this data further for classification. We also binned the lengths due to the broad spread it had previously.

```
# For the first model, we will try to create a feature of our own
# We can calculate number of spam words and the number of ham word
# These numbers can be compared to make out whether a message has
# more ham features or more spam features

# Calculating the number of Spam/Ham words in a message and Storin
# the diff Spam-Ham(0 if Ham>Spam, 1 if Spam>Ham))


# Create a list of all words occuring in Spam/Ham
spam_words = []
ham_words = []
```

```
def getSpam(text):
    global spam_words, spam_messages
    messages = text.split()
    words = [x for x in messages]
    spam_words += words

def getHam(text):
    global ham_words, ham_messages
    messages = text.split()
    words = [x for x in messages]
    ham_words += words

# Separate spam and ham messages
spam_messages = data[data["Spam"] == 1]["Text"]
ham_messages = data[data["Spam"] == 0]["Text"]

# Store common words in Spam/Ham
spam_messages.apply(getSpam)
ham_messages.apply(getHam)


def countSpam(text):
    count = 0
    for x in text.split():
        if x in spam_words:
            count += spam_words.count(x)
    return count

def countHam(text):
    count = 0
    for x in text.split():
        if x in ham_words:
            count += ham_words.count(x)
    return count

def getCounts(data):
    SpamCount = data.Text.apply(countSpam)
    HamCount = data.Text.apply(countHam)
    data["Diff"] = SpamCount - HamCount
    return data

def categorize(diff):
    if diff <= 0:
        return 0
    else:
        return 1

def apply_calc(data):
    data = getCounts(data)
    data.Diff = data.Diff.apply(categorize)
    return data

data = apply_calc(data)
data.head()
```

	Spam	Text	Length	Diff
0	0	jurong point crazy available bugis great world...	75	0
1	0	lar joking wif oni	20	0
2	1	free entry wkly comp win cup final tkts may te...	100	1
3	0	dun say early hor already say	30	0
4	0	nah dont think goes usf lives around though	50	0

Next steps: Generate code with `data` View recommended plots

```
spam_words.count("free")
```

```
219
```

```
ham_words.count("free")
```

```
59
```

Now that we've the algorithm to generate the required data(diff), we can try our model.

```
from sklearn.model_selection import train_test_split, GridSearchCV

X = data.drop(["Spam"], axis=1)
X_train, X_test, y_train, y_test = train_test_split(X, data.Spam, test_size=0.2, random_state=23)
```

Since we already have aur generated outputs in Diff column, we can now check the accuracy of the model on the training data

```
from sklearn.metrics import accuracy_score, make_scorer
print("Accuracy on train data: ", accuracy_score(X_train.Diff, y_train))
print("Accuracy on test data: ", accuracy_score(X_test.Diff, y_test))
```

```
Accuracy on train data:  0.9524343728965672
Accuracy on test data:  0.9434977578475336
```

A 94-95% accuracy sounds good for using only one parameter! However, we can further try using different models and try to include length as a parameter.

```
from sklearn.ensemble import RandomForestClassifier
from sklearn.svm import SVC
from sklearn.naive_bayes import GaussianNB

X_train = X_train[["Length", "Diff"]]
X_test = X_test[["Length", "Diff"]]


# RandomForestModel
# Trying different parameters and selecting the best one's to run
clf = RandomForestClassifier()
parameters = {'n_estimators': [4, 6, 9],
              'max_features': ['log2', 'sqrt','auto'],
              'criterion': ['entropy', 'gini'],
              'max_depth': [2, 3, 5, 10],
              'min_samples_split': [2, 3, 5],
              'min_samples_leaf': [1,5,8]
```

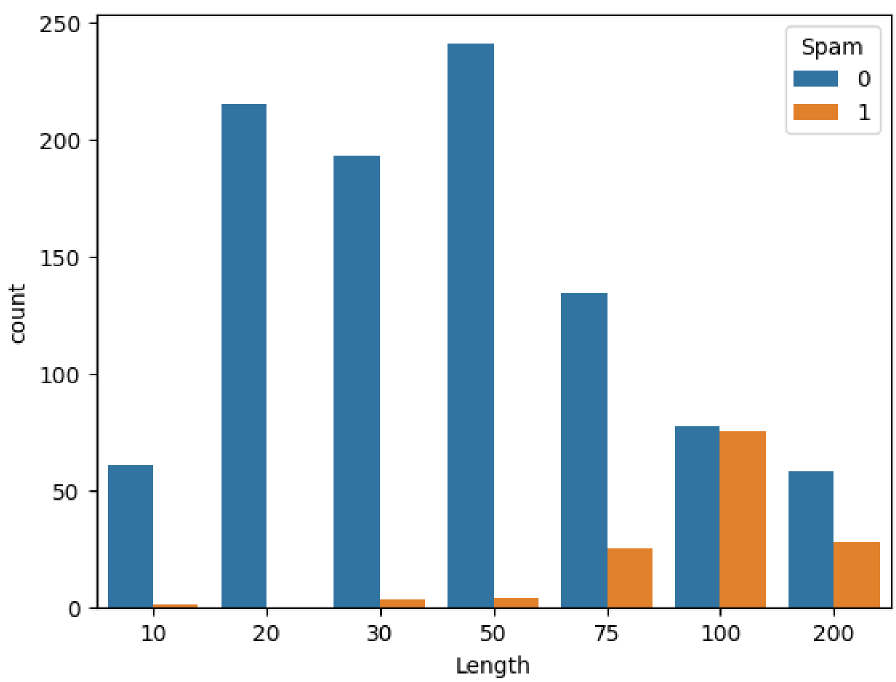
```
            }
acc_scorer = make_scorer(accuracy_score)
grid_obj = GridSearchCV(clf, parameters, scoring=acc_scorer, cv=3)
grid_obj = grid_obj.fit(X_train, y_train)
clf = grid_obj.best_estimator_

clf.fit(X_train, y_train)

# Predicting the reuslts and calculating the accuracy

preds = clf.predict(X_test)

clf_acc = nb_acc = accuracy_score(y_test, preds)
print("Accuracy with RandomForestClassifier: ", accuracy_score(y_test, preds)

# SVC model
svc_clf = SVC(gamma='scale')
svc_clf.fit(X_train,y_train)
svc_preds = svc_clf.predict(X_test)

svc_acc = accuracy_score(y_test, svc_preds)
print("Accuracy with SVC: ", accuracy_score(y_test, svc_preds))

nb = GaussianNB()
nb.fit(X_train, y_train)
nb_preds = nb.predict(X_test)

nb_acc = accuracy_score(y_test, nb_preds)
```

```
  warn(
/usr/local/lib/python3.10/dist-packages/sklearn/ensemble/_forest.py:424: FutureWarning: `max_features='auto'`
  warn(
/usr/local/lib/python3.10/dist-packages/sklearn/ensemble/_forest.py:424: FutureWarning: `max_features='auto'`
  warn(
/usr/local/lib/python3.10/dist-packages/sklearn/ensemble/_forest.py:424: FutureWarning: `max_features='auto'`
  warn(
/usr/local/lib/python3.10/dist-packages/sklearn/ensemble/_forest.py:424: FutureWarning: `max_features='auto'`
  warn(
/usr/local/lib/python3.10/dist-packages/sklearn/ensemble/_forest.py:424: FutureWarning: `max_features='auto'`
  warn(
/usr/local/lib/python3.10/dist-packages/sklearn/ensemble/_forest.py:424: FutureWarning: `max_features='auto'`
  warn(
/usr/local/lib/python3.10/dist-packages/sklearn/ensemble/_forest.py:424: FutureWarning: `max_features='auto'`
  warn(
Accuracy with RandomForestClassifier:  0.957847533632287
Accuracy with SVC:  0.8780269058295964
Accuracy with NaiveBayesian:  0.9434977578475336
```

We got a great accuracy with all models, including the programming approach! Our models are proving to be really great in detecting spam messages!

```
sns.countplot(x=X_test.Length, hue=y_test)
```

```
<Axes: xlabel='Length', ylabel='count'>
```



The model would be useless if we can't test custom inputs! Finally we create a function to interact with front-end for predicting spam category for manual input.

Since we had the most accuracy with RandomForestClassifier, we'll use it for our predictions.

```
# Interface for the manual messages

def manual_entry():
    global clf
    temp = pd.DataFrame(columns=["Text"])
    temp = temp.append({"Text": input("Enter message: ")}, ignore_index=True

    temp = format_length(temp)
    temp = apply_calc(temp)
```

```
    temp = temp.drop(["Text"], axis=1)

    if temp.Diff.loc[0] == 1:
        print("Spam")
    else:
        print("Ham")

manual_entry()
```

```
Enter message: Spam
Ham
<ipython-input-23-ccd7272d620d>:6: FutureWarning: The frame.append method is deprecated and will be removed from
  temp = temp.append({"Text": input("Enter message: ")}, ignore_index=True)
```

```
from sklearn.metrics import confusion_matrix
confusion_matrix(data.Spam, data.Diff)
```