

# Spam Filter Machine Learning Project

## Documentation

### 1. Importing Required Libraries

```
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.naive_bayes import MultinomialNB
from sklearn.metrics import classification_report
from sklearn.feature_extraction.text import ENGLISH_STOP_WORDS
import pandas as pd
import numpy as np
import string
import re
```

In this first part, you import all the necessary libraries. These include libraries for machine learning model creation and evaluation (sklearn), data manipulation (pandas, numpy), and text processing (string, re).

### 2. Text Preprocessing Functions

```
def to_lower(word):
    return word.lower()

def remove_special_characters(word):
    return word.translate(str.maketrans(dict.fromkeys(string.punctuation)))

def remove_stop_words(words):
    return ' '.join([i for i in words.split() if i not in ENGLISH_STOP_WORDS])

def remove_hyperlink(word):
    return re.sub(r"http\S+|www\S+", "", word)

def preprocess_text(text):
    text = to_lower(text)
    text = remove_special_characters(text)
    text = remove_stop_words(text)
    text = remove_hyperlink(text)
    return text
```

These functions perform preprocessing steps on the text data. The steps include converting text to lowercase, removing special characters and hyperlinks, and filtering out English stop words.

### 3. Loading and Preprocessing the Data

```
df = pd.read_csv('emails.csv')
df.replace([np.inf, -np.inf], np.nan)
df = df.dropna()
df['text'] = df['text'].apply(preprocess_text)
```

Here, you load the data from a CSV file, handle missing or infinite values, and apply the preprocessing functions to the 'text' column of the DataFrame.

### 4. Splitting the Data

```
X_train, X_test, y_train, y_test = train_test_split(df['text'], df['spam'],
                                                    test_size=0.2, random_state=42)
```

The dataset is split into training and testing sets. The 'text' column is used as the input feature, and 'spam' as the output label.

## 5. Transforming Text Data

```
vectorizer = TfidfVectorizer()  
X_train = vectorizer.fit_transform(X_train)  
X_test = vectorizer.transform(X_test)
```

The text data is transformed into numerical form using TF-IDF vectorization.

## 6. Training the Classifier

```
classifier = MultinomialNB()  
classifier.fit(X_train, y_train)
```

A Naive Bayes classifier is trained on the training data.

## 7. Evaluating the Model

```
predictions = classifier.predict(X_test)
```

The trained model is evaluated on the test data.

## 8. Classifying a New Email

```
new_email = input("\nEnter the content of the email you want to classify: ")  
new_email = preprocess_text(new_email)  
new_email_vector = vectorizer.transform([new_email])  
spam_probability = classifier.predict_proba(new_email_vector)[0][1]  
  
if spam_probability > threshold:  
    print("Likely SPAM.\n")  
else:  
    print("Likely NOT SPAM.\n")
```

Lastly, the model is used to classify a new email input by the user. The spam probability is calculated, and based on a defined threshold, the email is classified as spam or not spam.