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

%matplotlib inline

from sklearn.linear_model import LogisticRegression
from sklearn.naive_bayes import BernoulliNB, MultinomialNB
from sklearn.feature_extraction.text import CountVectorizer, TfidfVectorizer
from sklearn.model_selection import train_test_split
from sklearn.pipeline import make_pipeline, Pipeline
from sklearn.metrics import f1_score
from sklearn.metrics import classification_report, confusion_matrix, accuracy_score
```

Data Preprocessing

In [ ]:
```
# Data set was already split into training and testing sets

df_train = pd.read_csv('train.csv')
df_test = pd.read_csv('test.csv')
```

In [ ]:
```
# Shape of training data
df_train.shape
```

Out[ ]:
```
(7613, 5)
```

In [ ]:
```
# Shape of testing data
df_test.shape
```

Out[ ]:
```
(3263, 4)
```

In [ ]:
```
# Describing training dataset
df_train.describe()
```

Out[ ]:

	id	target
count	7613.000000	7613.00000
mean	5441.934848	0.42966
std	3137.116090	0.49506
min	1.000000	0.00000
25%	2734.000000	0.00000
50%	5408.000000	0.00000
75%	8146.000000	1.00000
max	10873.000000	1.00000

In [ ]:
```
# Describing testing dataset
df_test.describe()
```

Out[ ]:

	id
count	3263.000000
mean	5427.152927
std	3146.427221
min	0.000000
25%	2683.000000
50%	5500.000000
75%	8176.000000
max	10875.000000

In [ ]:
```
# Top 5 of training set
df_train.head()
```

Out[ ]:

	id	keyword	location	text	target
0	1	NaN	NaN	Our Deeds are the Reason of this #earthquake M...	1
1	4	NaN	NaN	Forest fire near La Ronge Sask. Canada	1
2	5	NaN	NaN	All residents asked to 'shelter in place' are ...	1
3	6	NaN	NaN	13,000 people receive #wildfires evacuation or...	1
4	7	NaN	NaN	Just got sent this photo from Ruby #Alaska as ...	1

In [ ]:
```
#  Function to calculate total of missing values in dataset
def missing_values(df):
    print("Number of records with missing location:",df.location.isna().sum())
    print("Number of records with missing keywords:",df.keyword.isna().sum())
```

In [ ]:
```
# Checking missing values of training set
missing_values(df_train)
```

```
Number of records with missing location: 2533
Number of records with missing keywords: 61
```

In [ ]:
```
# Missing values of testing set
missing_values(df_test)
```

```
Number of records with missing location: 1105
Number of records with missing keywords: 26
```

In [ ]:
```
# Check for keywords count
keywords = df_train['keyword'].value_counts()
print(keywords.head())
```

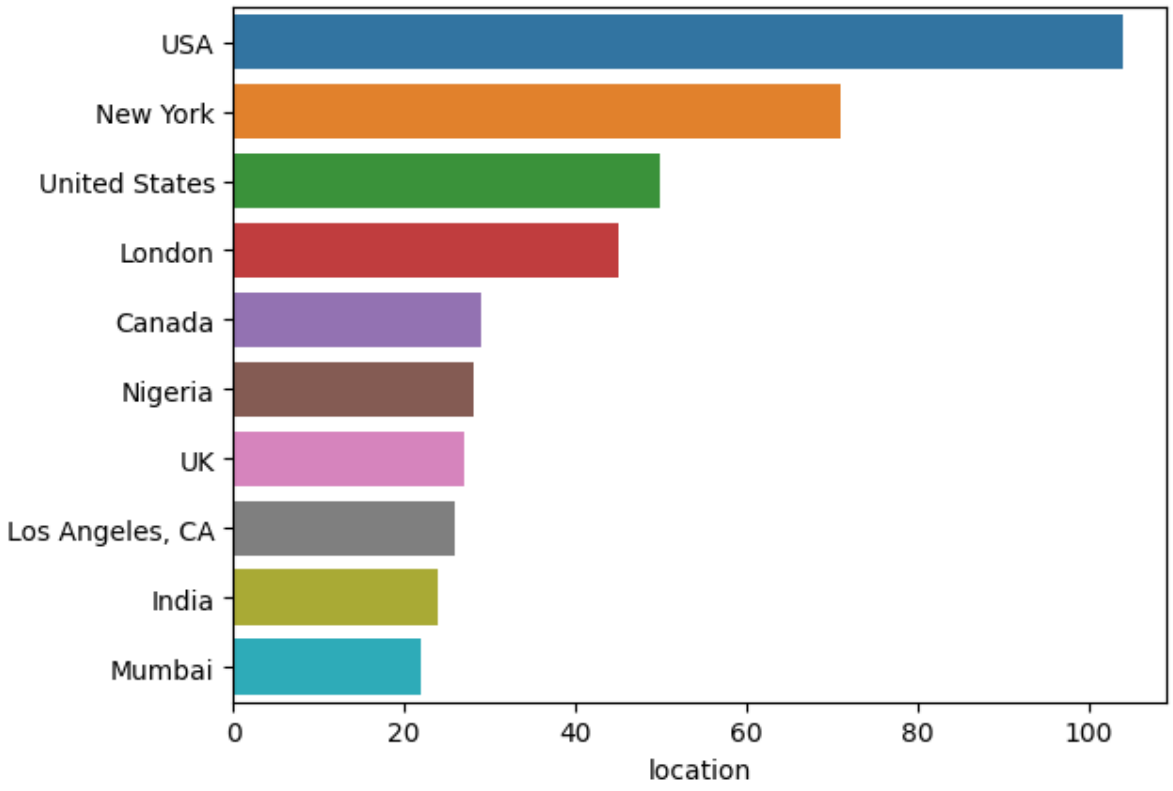
```
fatalities    45
deluge        42
armageddon    42
sinking       41
damage        41
Name: keyword, dtype: int64
```

In [ ]:
```
# Check location counts
locations = df_train['location'].value_counts()
print(locations.head())
```

```
USA              104
New York          71
United States     50
London            45
Canada            29
Name: location, dtype: int64
```

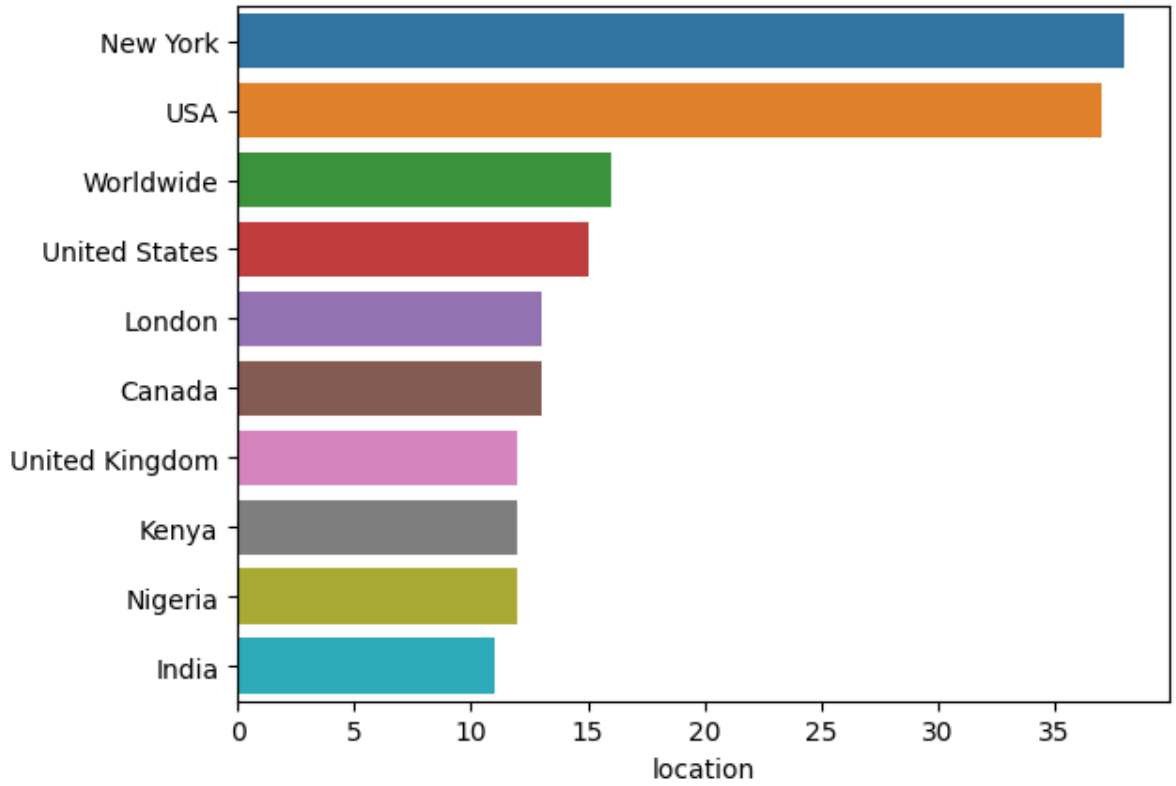
In [ ]:
```
#Create barchart for locations in train set using seaborn
sns.barplot(y=df_train['location'].value_counts()[:10].index,x=df_train['location']
            orient='h')
```

Out[ ]: <AxesSubplot: xlabel='location'>



In [ ]:
```
#Create barchart for locations in test set using seaborn
sns.barplot(y=df_test['location'].value_counts()[:10].index,x=df_test['location'].v
            orient='h')
```

Out[ ]: <AxesSubplot: xlabel='location'>



Group By

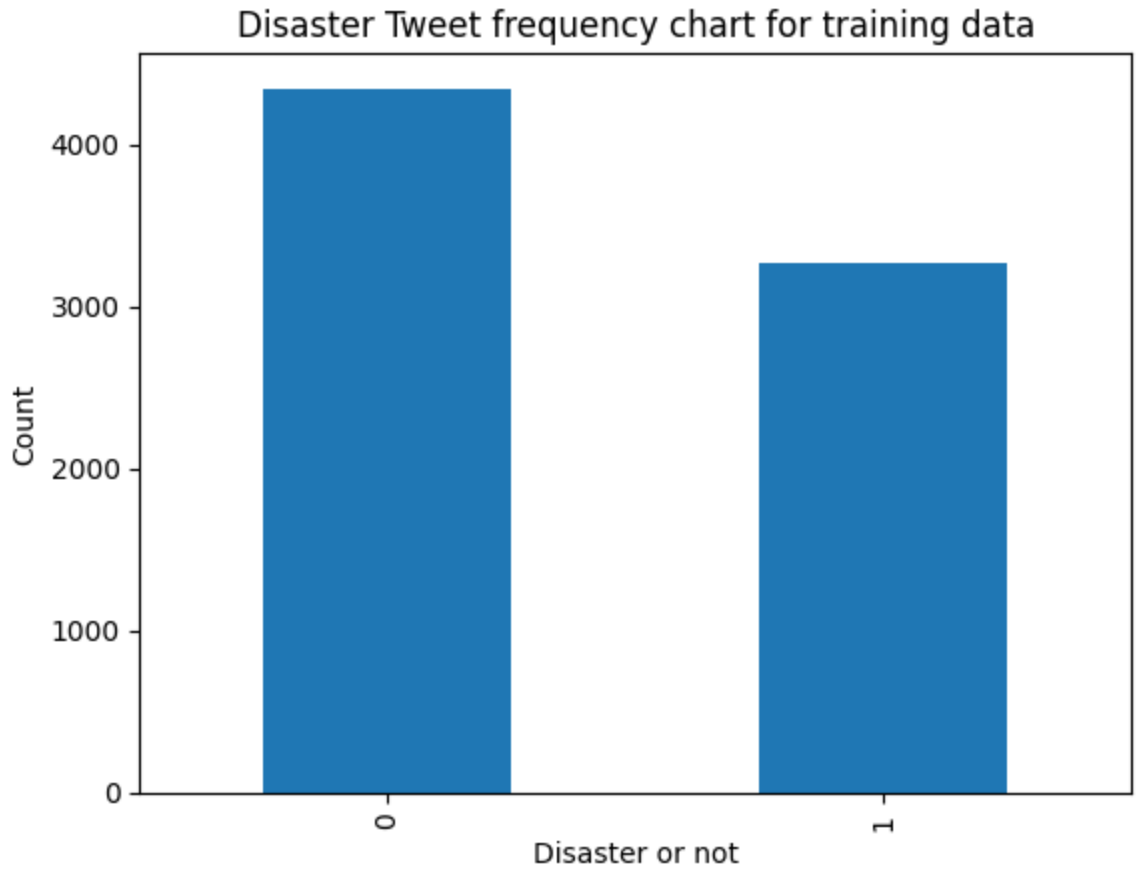
In [ ]:
```
# Groupby
df_train.groupby('target').count()
```

Out[ ]:

target	id	keyword	location	text
0	4342	4323	2884	4342
1	3271	3229	2196	3271

In [ ]:
```
# Group the tweets by disaster or not for the training data
grouped = df_train.groupby(['target'])['text'].count()

# plot the same as bar chart
grouped.plot(kind='bar')
plt.title('Disaster Tweet frequency chart for training data')
plt.xlabel('Disaster or not')
plt.ylabel('Count')
plt.show()
```



Tweet Lengths

In [ ]:
```
# Calculate tweet lengths
df_train['length'] = df_train['text'].apply(lambda x : len(x))
df_train.head() # Check new columns
```

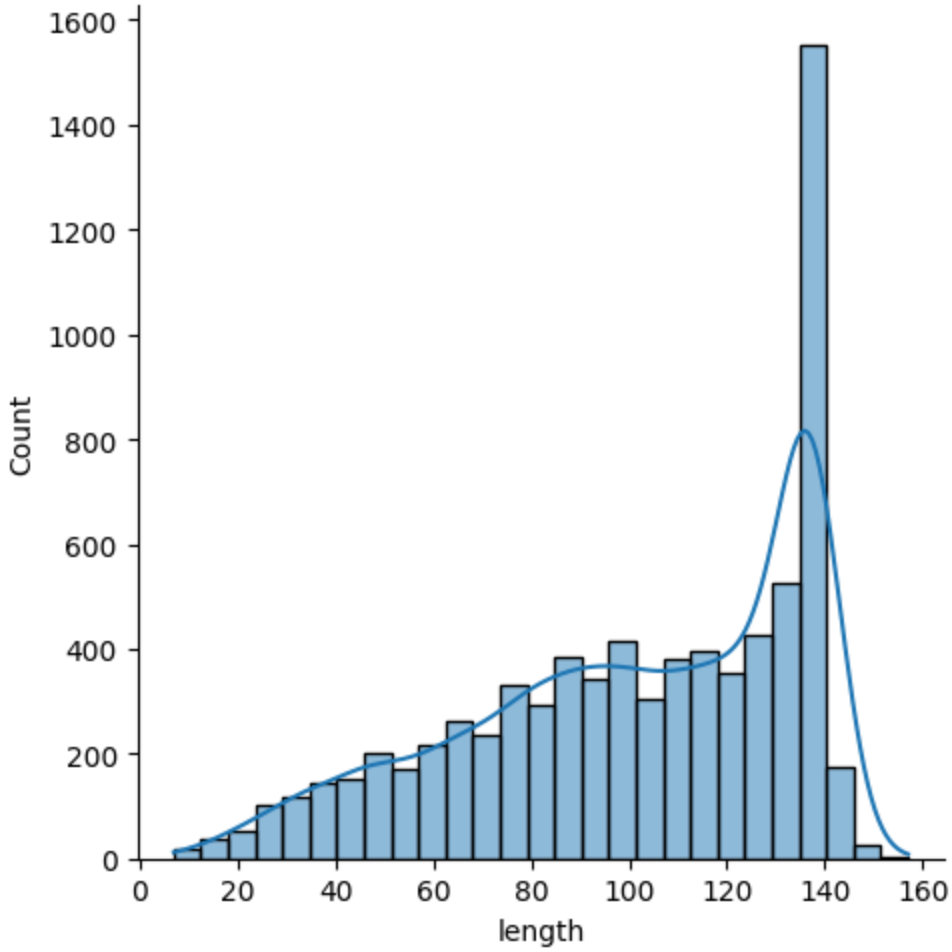
Out[ ]:

	id	keyword	location	text	target	length
0	1	NaN	NaN	Our Deeds are the Reason of this #earthquake M...	1	69
1	4	NaN	NaN	Forest fire near La Ronge Sask. Canada	1	38
2	5	NaN	NaN	All residents asked to 'shelter in place' are ...	1	133
3	6	NaN	NaN	13,000 people receive #wildfires evacuation or...	1	65
4	7	NaN	NaN	Just got sent this photo from Ruby #Alaska as ...	1	88

In [ ]:
```
# Visualization of Tweet Lengths in training data
# Code source: https://seaborn.pydata.org/generated/seaborn.displot.html

sns.displot(data=df_train['length'], kde=True)
```

Out[ ]:
```
<seaborn.axisgrid.FacetGrid at 0x26af4ff51d0>
```



In [ ]:
```
# Dropping unnecessary columns
df_train = df_train.drop(columns=['keyword', 'location', 'length'])
```

Text Vectorization

In [ ]:
```
# Import string
import string

# Import nltk (Natural Language Toolkit)
import nltk
nltk.download('stopwords')

# NLTK packages
from nltk.corpus import stopwords
from nltk import PorterStemmer as Stemmer

# Code source for text preprocessing:
# https://www.analyticsvidhya.com/blog/2021/06/text-preprocessing-in-nlp-with-pytho

def preprocess(text):
    # lowercase
    text = text.lower()

    # Remove punctuation
```

```
    text = ''.join([t for t in text if t not in string.punctuation])

    # Removing stopwords since they do not add value to this analysis
    # Code source: https://pythonprogramming.net/stop-words-nltk-tutorial/
    text = [t for t in text.split() if t not in stopwords.words('english')]

    # Stemming is used to reducing words to their root
    # Code source: https://www.kaggle.com/code/sudalairajkumar/getting-started-with
    stemmer = Stemmer()
    text = [stemmer.stem(t) for t in text]

    # return text
    return text

# The function above is used to normalize and tokenize
# texts that were found in the 'Text' column.
# we cleaned the 'Text' column as much as we could by
# using the NLTK (Natural Language Toolkit) library
# that we found in their documentation (https://www.nltk.org/).
# By cleaning this up, we are able reduce
# the size of the vocab when we input into our machine learning model.
```

```
[nltk_data] Downloading package stopwords to
[nltk_data]     C:\Users\khuyn\AppData\Roaming\nltk_data...
[nltk_data]   Package stopwords is already up-to-date!
```

In [ ]:
```
# Test with dataset, the first 20 rows
df_train['text'][:20].apply(preprocess)
```

Out[ ]:
```
0     [deed, reason, earthquak, may, allah, forgiv, us]
1          [forest, fire, near, la, rong, sask, canada]
2     [resid, ask, shelter, place, notifi, offic, ev...
3     [13000, peopl, receiv, wildfir, evacu, order, ...
4     [got, sent, photo, rubi, alaska, smoke, wildfi...
5     [rockyfir, updat, california, hwi, 20, close, ...
6     [flood, disast, heavi, rain, caus, flash, floo...
7                       [im, top, hill, see, fire, wood]
8     [there, emerg, evacu, happen, build, across, s...
9                     [im, afraid, tornado, come, area]
10                [three, peopl, die, heat, wave, far]
11    [haha, south, tampa, get, flood, hah, wait, se...
12    [rain, flood, florida, tampabay, tampa, 18, 19...
13                 [flood, bago, myanmar, arriv, bago]
14    [damag, school, bu, 80, multi, car, crash, break]
15                                        [what, man]
16                                     [love, fruit]
17                                   [summer, love]
18                                      [car, fast]
19                                 [goooooooaaaaaal]
Name: text, dtype: object
```

In [ ]:
```
# Test with dataset, the first 20 rows
df_test['text'][:20].apply(preprocess)
```

Out[ ]:
```
0                          [happen, terribl, car, crash]
1     [heard, earthquak, differ, citi, stay, safe, e...
2     [forest, fire, spot, pond, gees, flee, across,...
3                   [apocalyps, light, spokan, wildfir]
4          [typhoon, soudelor, kill, 28, china, taiwan]
5                                [shakingit, earthquak]
6     [theyd, probabl, still, show, life, arsen, yes...
7                                                [hey]
8                                          [nice, hat]
9                                               [fuck]
10                                  [dont, like, cold]
11                                  [noooooooooo, dont]
12                                       [dont, tell]
13                                                 []
14                                           [awesom]
15    [birmingham, wholesal, market, ablaz, bbc, new...
16           [sunkxssedharri, wear, short, race, ablaz]
17    [previouslyondoyintv, toke, makinwa ûª, marria...
18    [check, httptcoroi2nsmejj, httptco3tj8zjin21, ...
19    [psa, i ûªm, split, person, techi, follow, abl...
Name: text, dtype: object
```

In [ ]:
```
# Fit transform
TFID = TfidfVectorizer(analyzer=preprocess)
fit = TFID.fit_transform(df_train['text'])
fits = TFID.fit_transform(df_test['text'])
```

In [ ]:
```
# Checking values
content = df_train.iloc[50]['text'] # Randomly chose 50th index
print(content) # Print message
```

```
Deputies: Man shot before Brighton home set ablaze http://t.co/gWNRhMSO8k
```

In [ ]:
```
# Assigning texts to vectors

# Code source:
# https://github.com/scikit-learn/scikit-learn/blob/8c9c1f27b/sklearn/feature_extra

# Code source 2:
# https://www.kaggle.com/code/jeffysonar/spam-filter-using-naive-bayes-classifier/n

# Inputing "content" into transform function and adding to an array
tfid = TFID.transform(['text']).toarray()[0]

print('index\tidf\ttfidf\tterm') # Print in this order

# Loop function to assign different values to its term.
for i in range(len(tfid)):
    if tfid[i] != 0:
        print(i, format(TFID
                        .idf_[i], '.5f'), format(tfid[i],
                                                 '.5f'),
                        TFID.get_feature_names_out()[i],sep='\t')
```

```
index   idf     tfidf   term
9747    6.69281 1.00000 text
```

Logistic Regression

In [ ]:
```
# Check size of text column
training_texts = df_train['text']

vectorizer = TfidfVectorizer()
X_train = vectorizer.fit_transform(training_texts)
y_train = df_train['target']
X_test = vectorizer.transform(df_test['text'])

print(X_train.size)
print(y_train.size)
```

```
111497
7613

7613
```

In [ ]:
```
# Splitting the data
X_train, X_test, y_train, y_test = train_test_split(X_train, y_train, test_size=0.2
```

In [ ]:
```
# Logistic regression model for predicting diaster in tweets
log = LogisticRegression()

# Train the model on the training data
log.fit(X_train, y_train)

# Make predictions on the test data
log_pred = log.predict(X_test)
print(classification_report(y_test, log_pred))
```

```
              precision    recall  f1-score   support

           0       0.78      0.90      0.84       874
           1       0.83      0.67      0.74       649

    accuracy                           0.80      1523
   macro avg       0.81      0.78      0.79      1523
weighted avg       0.80      0.80      0.80      1523
```

Multinomial NB

In [ ]:
```
mnb = MultinomialNB()

# Fitting the model
mnb.fit(X_train, y_train)

# Evaluate the Multinomial NB model on the testing set
nb_pred = mnb.predict(X_test)
print(classification_report(y_test, nb_pred))
```

	precision	recall	f1-score	support
0	0.77	0.93	0.84	874
1	0.86	0.63	0.73	649
accuracy			0.80	1523
macro avg	0.82	0.78	0.78	1523
weighted avg	0.81	0.80	0.79	1523

SVM

In [ ]:
```
from sklearn.svm import SVC
from sklearn.metrics import silhouette_score, accuracy_score, classification_report

# Building and training SVM model
svm = SVC()

# Fitting the model
svm.fit(X_train, y_train)

# Evaluate the SVM model on the testing set
svm_pred = svm.predict(X_test)
print(classification_report(y_test, svm_pred))
```

	precision	recall	f1-score	support
0	0.78	0.93	0.85	874
1	0.87	0.65	0.75	649
accuracy			0.81	1523
macro avg	0.83	0.79	0.80	1523
weighted avg	0.82	0.81	0.81	1523

Random Forest

In [ ]:
```
from sklearn.ensemble import RandomForestClassifier

# Building Random Forest model
rf = RandomForestClassifier(n_estimators=100, random_state=42)
rf.fit(X_train, y_train)

# Evaluate the classifier
rf_pred = rf.predict(X_test)
print(classification_report(y_test, rf_pred))
```

	precision	recall	f1-score	support
0	0.75	0.93	0.83	874
1	0.86	0.57	0.69	649
accuracy			0.78	1523
macro avg	0.80	0.75	0.76	1523
weighted avg	0.80	0.78	0.77	1523

Neural Networks

In [ ]:
```
from sklearn.preprocessing import StandardScaler

# Standardize the  dataset
scaler = StandardScaler(with_mean=False)
X_train = scaler.fit_transform(X_train)
X_test = scaler.transform(X_test)
```

In [ ]:
```
import tensorflow as tf
from tensorflow import keras
from tensorflow.keras.preprocessing.text import Tokenizer
from tensorflow.keras.preprocessing.sequence import pad_sequences
from tensorflow.keras import layers
from tensorflow.keras.layers import Dense, Embedding, Flatten, Dropout
from keras.models import Sequential
```

In [ ]:
```
# Tokenizer documentation: https://www.tensorflow.org/api_docs/python/tf/keras/prep
# pad_sequences documentation: https://www.tensorflow.org/api_docs/python/tf/keras/
# Sequential model documentation: https://www.tensorflow.org/api_docs/python/tf/ker
# Embedding layer documentation: https://www.tensorflow.org/api_docs/python/tf/kera
# Dense layer documentation: https://www.tensorflow.org/api_docs/python/tf/keras/la
# Flatten layer documentation: https://www.tensorflow.org/api_docs/python/tf/keras/
# Dropout layer documentation: https://www.tensorflow.org/api_docs/python/tf/keras/

# Preprocess the text data
tokenizer = Tokenizer(num_words=10000, oov_token='<OOV>')
tokenizer.fit_on_texts(df_train['text'])
tokenizer.fit_on_texts(df_test['text'])
train_sequences = tokenizer.texts_to_sequences(df_train['text'])
train_padded = pad_sequences(train_sequences, padding='post', truncating='post')
test_sequences = tokenizer.texts_to_sequences(df_test['text'])
test_padded = pad_sequences(test_sequences, padding='post', truncating='post')
```

In [ ]:
```
# create model
model = Sequential()
model.add(Dense(256, activation='relu'))
model.add(Dense(128, activation='relu'))
model.add(Dense(1, activation='sigmoid'))

# Build model
model.build(input_shape=(None, 21637))
```

```
 # Compile model
model.compile(loss='binary_crossentropy', optimizer='adam', metrics=['accuracy'])
model.summary()
```

```
Model: "sequential_41"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 dense_97 (Dense)            (None, 256)               5539328

 dense_98 (Dense)            (None, 128)               32896

 dense_99 (Dense)            (None, 1)                 129

=================================================================
Total params: 5,572,353
Trainable params: 5,572,353
Non-trainable params: 0
_________________________________________________________________
```


```
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 dense_97 (Dense)            (None, 256)               5539328

 dense_98 (Dense)            (None, 128)               32896

 dense_99 (Dense)            (None, 1)                 129

=================================================================
Total params: 5,572,353
Trainable params: 5,572,353
Non-trainable params: 0
_________________________________________________________________
```


In [ ]:
```
# Converting to  numpy arras to be compatible with keras
X_test = np.array(X_test)
y_test = np.array(y_test)

# Evaluate the model
accuracy = model.evaluate(X_test, y_test)
print('Test loss:', accuracy[0])
print('Test accuracy:', accuracy[1])
```

```
48/48 [==============================] - 0s 9ms/step - loss: 0.8140 - accuracy: 0.
4347
Test loss: 0.8139750361442566
Test accuracy: 0.4346684217453003
```