South Point Institute of Technology And Management

AI with Python
Practical file
(MCA201C)

Submitted to-

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MCA 2nd year

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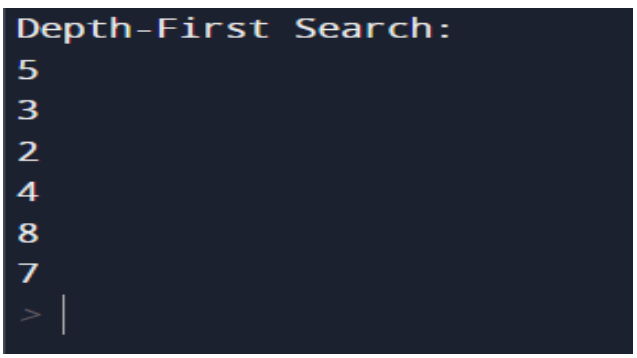
1. Depth-First Search

```
graph = {
   '5': ['3', '7'],
   '3': ['2', '4'],
   '7': ['8'],
   '2': [],
   '4': ['8'],
   '8': []
}

visited = set()

def dfs(visited, graph, node):
   if node not in visited:
      print(node)
      visited.add(node)
      for neighbour in graph[node]:
         dfs(visited, graph, neighbour)
      print("Depth-First Search:")
dfs(visited, graph, '5')
```

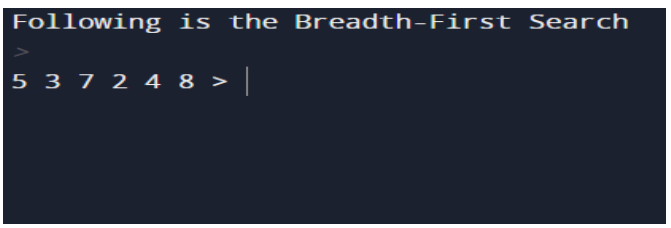
Output:



2. Breadth First Search

```
graph = {
  '5' : ['3','7'],
  '3' : ['2', '4'],
  '7' : ['8'],
  '2' : [],
  '4' : ['8'],
  '8' : []
}
visited = []
queue = []
def bfs(visited, graph, node): #function for BFS
  visited.append(node)
  queue.append(node)

  while queue:
    m = queue.pop(0)
    print (m, end = " ")
    for neighbour in graph[m]:
      if neighbour not in visited:
        visited.append(neighbour)
        queue.append(neighbour)
print("Following is the Breadth-First Search")
bfs(visited, graph, '5')
```

Output:



3. A* Algorithm

```
tree = {'S': [['A', 1], ['B', 5], ['C', 8]],
        'A': [['S', 1], ['D', 3], ['E', 7], ['G', 9]],
        'B': [['S', 5], ['G', 4]],
        'C': [['S', 8], ['G', 5]],
        'D': [['A', 3]],
        'E': [['A', 7]]}

tree2 = {'S': [['A', 1], ['B', 2]],
         'A': [['S', 1]],
         'B': [['S', 2], ['C', 3], ['D', 4]],
         'C': [['B', 2], ['E', 5], ['F', 6]],
         'D': [['B', 4], ['G', 7]],
         'E': [['C', 5]],
         'F': [['C', 6]]
         }

heuristic = {'S': 8, 'A': 8, 'B': 4, 'C': 3, 'D': 5000, 'E': 5000, 'G': 0}
heuristic2 = {'S': 0, 'A': 5000, 'B': 2, 'C': 3, 'D': 4, 'E': 5000, 'F': 5000, 'G': 0}

cost = {'S': 0}

def AStarSearch():
    global tree, heuristic
    closed = []
    opened = [['S', 8]]

    while True:
```

```
        fn = [i[1] for i in opened]
        chosen_index = fn.index(min(fn))
        node = opened[chosen_index][0]
        closed.append(opened[chosen_index])
        del opened[chosen_index]
        if closed[-1][0] == 'G':
            break
        for item in tree[node]:
            if item[0] in [closed_item[0] for closed_item in closed]:
                continue
            cost.update({item[0]: cost[node] + item[1]})
            fn_node = cost[node] + heuristic[item[0]] + item[1]
            temp = [item[0], fn_node]
            opened.append(temp)
    trace_node = 'G'
    optimal_sequence = ['G']
    for i in range(len(closed)-2, -1, -1):
        check_node = closed[i][0]
        if trace_node in [children[0] for children in tree[check_node]]:
            children_costs = [temp[1] for temp in tree[check_node]]
            children_nodes = [temp[0] for temp in tree[check_node]]

            if cost[check_node] + children_costs[children_nodes.index(trace_node)] == cost[trace_node]:
                optimal_sequence.append(check_node)
                trace_node = check_node
    optimal_sequence.reverse()
    return closed, optimal_sequence
if __name__== '__main__':
    visited_nodes, optimal_nodes = AStarSearch()
    print('visited nodes: ' + str(visited_nodes))
    print('optimal nodes sequence: ' + str(optimal_nodes))
```

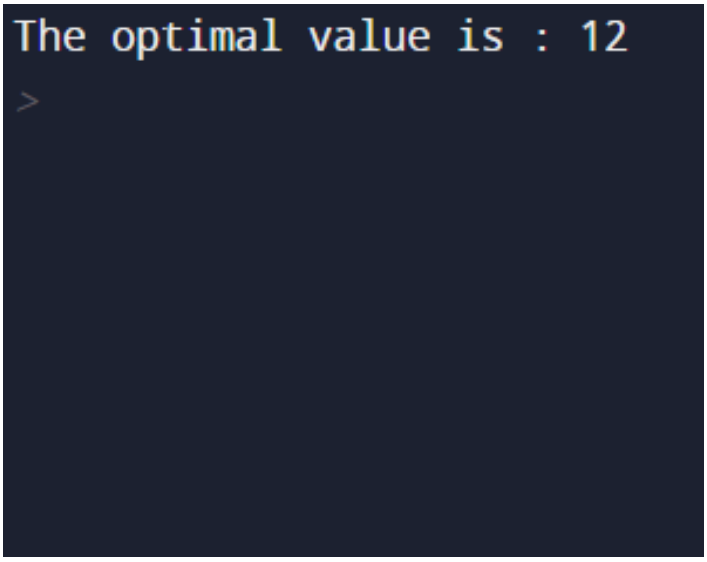
Output:

```
visited nodes: [['S', 8], ['A', 9], ['B', 9], ['G', 9]]
optimal nodes sequence: ['S', 'B', 'G']
>
```

4. Min-max algorithm of Game Theory

```
import math

def minimax (curDepth, nodeIndex,
             maxTurn, scores,
             targetDepth):

    if (curDepth == targetDepth):
        return scores[nodeIndex]

    if (maxTurn):
        return max(minimax(curDepth + 1, nodeIndex * 2,
                   False, scores, targetDepth),
                   minimax(curDepth + 1, nodeIndex * 2 + 1,
                   False, scores, targetDepth))

    else:
        return min(minimax(curDepth + 1, nodeIndex * 2,
                   True, scores, targetDepth),
                   minimax(curDepth + 1, nodeIndex * 2 + 1,
                   True, scores, targetDepth))

scores = [3, 5, 2, 9, 12, 5, 23, 23]

treeDepth = math.log(len(scores), 2)

print("The optimal value is : ", end = "")
print(minimax(0, 0, True, scores, treeDepth))
```

Output:

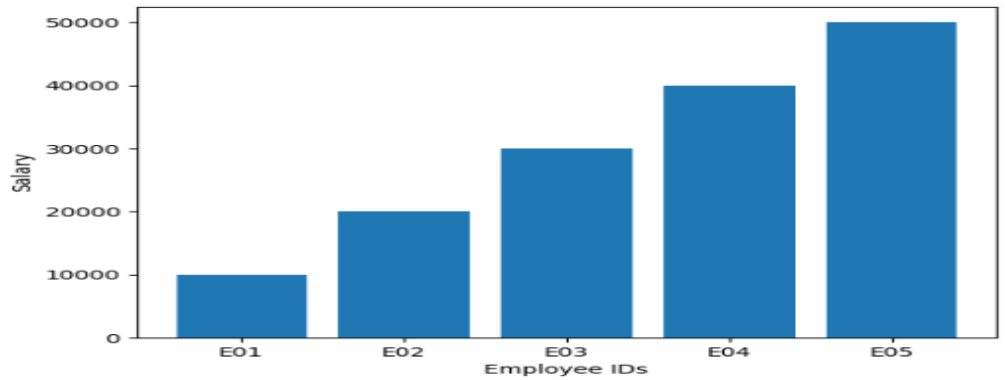


5. Write a Program to analyze data and display in the form of a bar graph for two departments of a company having employee id numbers on X-axis and their salaries on Y axis.

```
import matplotlib.pyplot as pl
import numpy as np

EmpId=['E01','E02','E03','E04','E05']
Sal = [10000,20000,30000,40000,50000]

pl.xlabel("Employee IDs")
pl.ylabel("Salary")
pl.bar(EmpId,Sal)
pl.show()
```

Output:

```
[Execution complete with exit code 0]
```

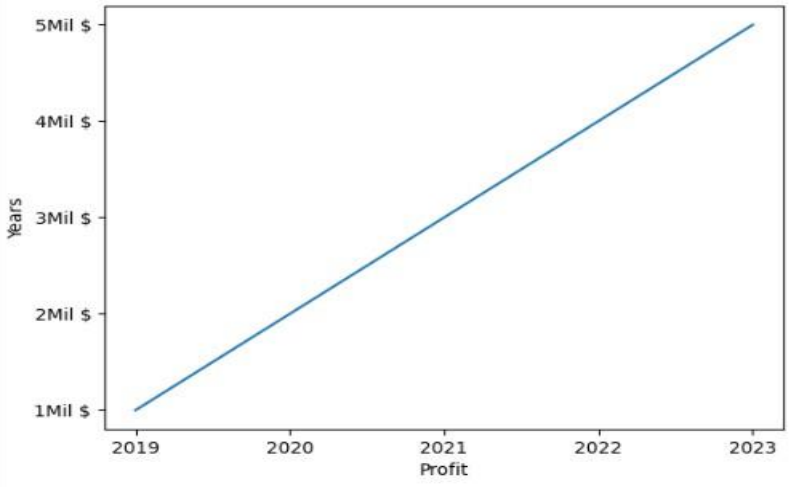


6. Write a program to analyze and draw a line graph to show the profits of a company in various years.

```
import matplotlib.pyplot as pl
import numpy as np

Yr =['2019','2020','2021','2022','2023']
Profit = ['1Mil $','2Mil $','3Mil $','4Mil $','5Mil $']

pl.xlabel("Profit")
pl.ylabel("Years")
pl.plot(Yr,Profit)
pl.show()
```

Output:

```
[Execution complete with exit code 0]
```



7. Customer segmentation project using K Means Clustering.

. Imports:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.cluster import KMeans
```

. Data Collection & Analysis:

```
# loading the data from csv file to a Pandas DataFrame
customer_data = pd.read_csv('/content/Mall_Customers.csv')
```

```
# first 5 rows in the dataframe
customer_data.head()
```

	CustomerID	Gender	Age	Annual Income (k$)	Spending Score (1-100)
0	1	Male	19	15	39
1	2	Male	21	15	81
2	3	Female	20	16	6
3	4	Female	23	16	77
4	5	Female	31	17	40

finding the number of rows and columns
customer_data.shape

```
(200, 5)
```

getting some informations about the dataset

customer_data.info()

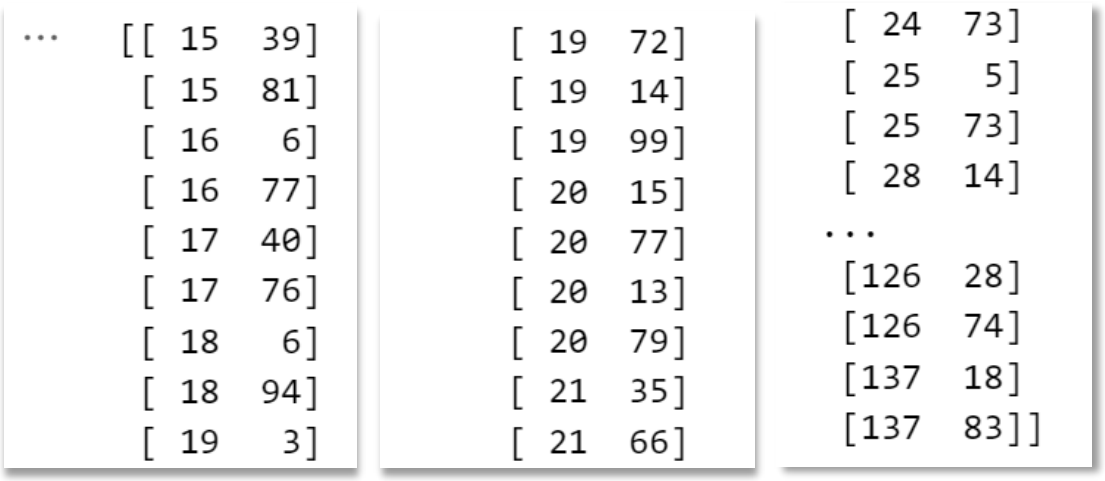
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200 entries, 0 to 199
Data columns (total 5 columns):
 #   Column                  Non-Null Count  Dtype
---  ------                  --------------  -----
 0   CustomerID              200 non-null    int64
 1   Gender                  200 non-null    object
 2   Age                     200 non-null    int64
 3   Annual Income (k$)      200 non-null    int64
 4   Spending Score (1-100)  200 non-null    int64
dtypes: int64(4), object(1)
memory usage: 7.9+ KB
```

# checking for missing values
customer_data.isnull().sum()

```
CustomerID                0
Gender                    0
Age                       0
Annual Income (k$)        0
Spending Score (1-100)    0
dtype: int64
```

. Choosing the Annual Income Column & Spending Score column:

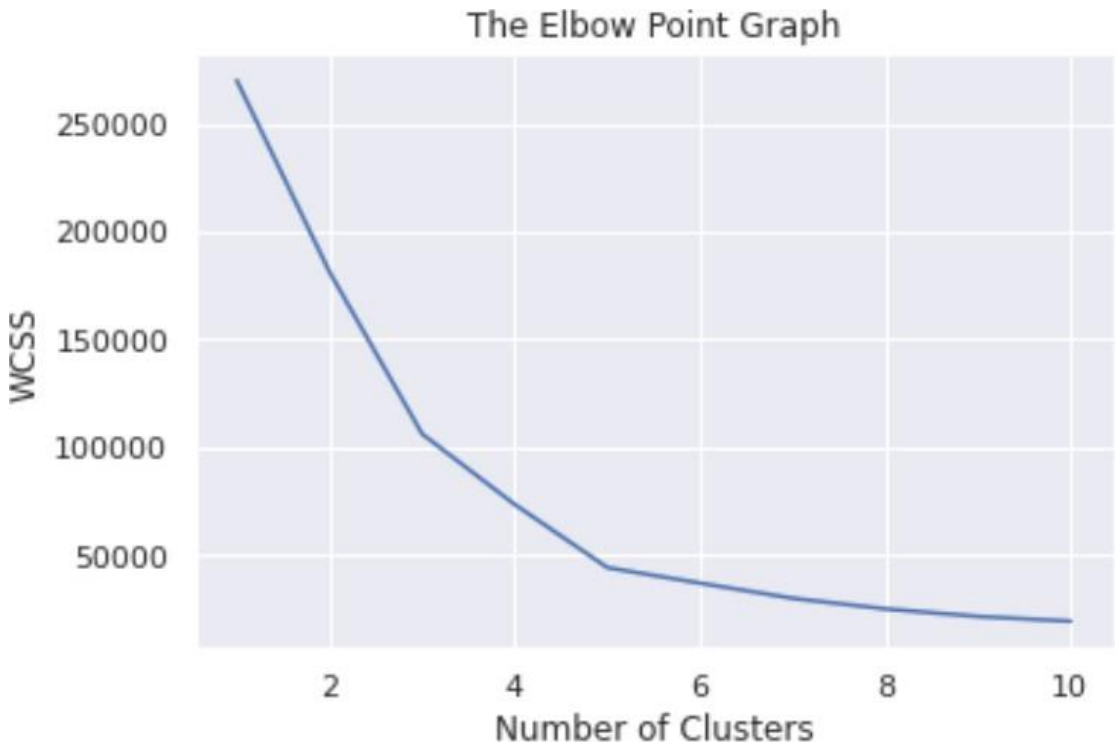
```
X = customer_data.iloc[:,[3,4]].values

print(X)
```



. Choosing the number of clusters:

. WCSS -> Within Clusters Sum of Squares

```
# finding wcss value for different number of clusters

wcss = []

for i in range(1,11):
  kmeans = KMeans(n_clusters=i, init='k-means++', random_state=42)
  kmeans.fit(X)

  wcss.append(kmeans.inertia_)

# plot an elbow graph

sns.set()
plt.plot(range(1,11), wcss)
plt.title('The Elbow Point Graph')
plt.xlabel('Number of Clusters')
plt.ylabel('WCSS')
plt.show()
```



. Optimum Number of Clusters = 5

. Training the k-Means Clustering Model:

```
kmeans = KMeans(n_clusters=5, init='k-means++', random_state=0)

# return a label for each data point based on their cluster
Y = kmeans.fit_predict(X)

print(Y)
```

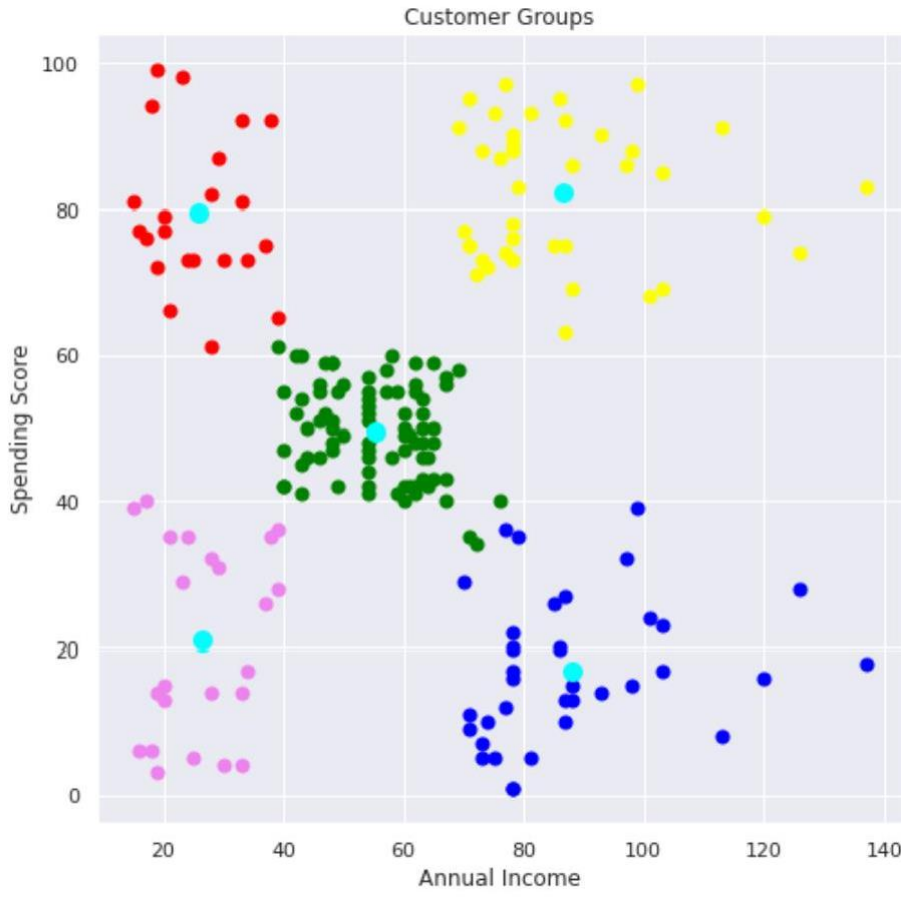
```
[3 1 3 1 3 1 3 1 3 1 3 1 3 1 3 1 3 1 3 1 3 1 3 1 3 1 3 1 3 1 3 1 3 1 3 1 3
 1 3 1 3 1 3 0 3 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 2 4 2 0 2 4 2 4 2 0 2 4 2 4 2 4 2 4 2 0 2 4 2 4 2
 4 2 4 2 4 2 4 2 4 2 4 2 4 2 4 2 4 2 4 2 4 2 4 2 4 2 4 2 4 2 4 2 4 2 4 2 4
 2 4 2 4 2 4 2 4 2 4 2 4 2 4 2]
```

. 5 Clusters - 0, 1, 2, 3, 4

. Visualizing all the Clusters:

plotting all the clusters and their Centroids

```
plt.figure(figsize=(8,8))
plt.scatter(X[Y==0,0], X[Y==0,1], s=50, c='green', label='Cluster 1')
plt.scatter(X[Y==1,0], X[Y==1,1], s=50, c='red', label='Cluster 2')
plt.scatter(X[Y==2,0], X[Y==2,1], s=50, c='yellow', label='Cluster 3')
plt.scatter(X[Y==3,0], X[Y==3,1], s=50, c='violet', label='Cluster 4')
plt.scatter(X[Y==4,0], X[Y==4,1], s=50, c='blue', label='Cluster 5')

# plot the centroids
plt.scatter(kmeans.cluster_centers_[:,0], kmeans.cluster_centers_[:,1], s=100, c='cyan',
label='Centroids')

plt.title('Customer Groups')
plt.xlabel('Annual  Income')
plt.ylabel('Spending  Score')
plt.show()
```



8. Music genre classification project.

. Imports:

```
from python_speech_features import mfcc
import scipy.io.wavfile as wav
import numpy as np

from tempfile import TemporaryFile
import os
import pickle
import random
import operator

import math
import numpy as np
```

. Define a function to get the distance between feature vectors and find neighbors:

```
def getNeighbors(trainingSet, instance, k):
    distances = []
    for x in range (len(trainingSet)):
        dist = distance(trainingSet[x], instance, k )+ distance(instance, trainingSet[x], k)
        distances.append((trainingSet[x][2], dist))
    distances.sort(key=operator.itemgetter(1))
    neighbors = []
    for x in range(k):
        neighbors.append(distances[x][0])
    return neighbors
```

. Identify the nearest neighbors:

```
def nearestClass(neighbors):
    classVote = {}

    for x in range(len(neighbors)):
        response = neighbors[x]
        if response in classVote:
            classVote[response]+=1
        else:
            classVote[response]=1

    sorter = sorted(classVote.items(), key = operator.itemgetter(1), reverse=True)
    return sorter[0][0]
```

. Define a function for model evaluation:

```
def getAccuracy(testSet, predictions):
    correct = 0
    for x in range (len(testSet)):
        if testSet[x][-1]==predictions[x]:
            correct+=1
    return 1.0*correct/len(testSet)
```

. Extract features from the dataset and dump these features into a binary .dat file “my.dat”:

```
directory = "__path_to_dataset__"
f= open("my.dat" ,'wb')
i=0

for folder in os.listdir(directory):
    i+=1
    if i==11 :
        break
    for file in os.listdir(directory+folder):
        (rate,sig) = wav.read(directory+folder+"/"+file)
        mfcc_feat = mfcc(sig,rate ,winlen=0.020, appendEnergy = False)
        covariance = np.cov(np.matrix.transpose(mfcc_feat))
        mean_matrix = mfcc_feat.mean(0)
        feature = (mean_matrix , covariance , i)
        pickle.dump(feature , f)

f.close()
```

. Train and test split on the dataset:

```
dataset = []
def loadDataset(filename , split , trSet , teSet):
    with open("my.dat" , 'rb') as f:
        while True:
            try:
                dataset.append(pickle.load(f))
            except EOFError:
                f.close()
                break

    for x in range(len(dataset)):
        if random.random() <split :
            trSet.append(dataset[x])
        else:
            teSet.append(dataset[x])

trainingSet = []
testSet = []
loadDataset("my.dat" , 0.66, trainingSet, testSet)
```

. Make prediction using k Nearest Neighbours and get the accuracy on test data:

```
leng = len(testSet)
predictions = []
for x in range (leng):
   predictions.append(nearestClass(getNeighbors(trainingSet ,testSet[x] , 5)))

accuracy1 = getAccuracy(testSet , predictions)
print(accuracy1)
```

```
accuracy
0.6943620178041543
```

. Test the classifier with new audio file

```
from python_speech_features import mfcc
import scipy.io.wavfile as wav
import numpy as np
from tempfile import TemporaryFile
import os
import pickle
import random
import operator

import math
import numpy as np
from collections import defaultdict

dataset = []
def loadDataset(filename):
   with open("my.dat" , 'rb') as f:
      while True:
         try:
            dataset.append(pickle.load(f))
         except EOFError:
            f.close()
            break

loadDataset("my.dat")

def distance(instance1 , instance2 , k ):
   distance =0
   mm1 = instance1[0]
   cm1 = instance1[1]
   mm2 = instance2[0]
   cm2 = instance2[1]
   distance = np.trace(np.dot(np.linalg.inv(cm2), cm1))
   distance+=(np.dot(np.dot((mm2-mm1).transpose() , np.linalg.inv(cm2)) , mm2-mm1 ))
   distance+= np.log(np.linalg.det(cm2)) - np.log(np.linalg.det(cm1))
```

```
    distance-= k
    return distance

def getNeighbors(trainingSet , instance , k):
    distances =[]
    for x in range (len(trainingSet)):
        dist = distance(trainingSet[x], instance, k )+ distance(instance, trainingSet[x], k)
        distances.append((trainingSet[x][2], dist))
    distances.sort(key=operator.itemgetter(1))
    neighbors = []
    for x in range(k):
        neighbors.append(distances[x][0])
    return neighbors

def nearestClass(neighbors):
    classVote ={}
    for x in range(len(neighbors)):
        response = neighbors[x]
        if response in classVote:
            classVote[response]+=1
        else:
            classVote[response]=1
    sorter = sorted(classVote.items(), key = operator.itemgetter(1), reverse=True)
    return sorter[0][0]


results=defaultdict(int)

i=1
for folder in os.listdir("./musics/wav_genres/"):
    results[i]=folder
    i+=1

(rate,sig)=wav.read("sample_test.wav")
mfcc_feat=mfcc(sig,rate,winlen=0.020,appendEnergy=False)
covariance = np.cov(np.matrix.transpose(mfcc_feat))
mean_matrix = mfcc_feat.mean(0)
feature=(mean_matrix,covariance,0)

pred=nearestClass(getNeighbors(dataset ,feature , 5))

print(results[pred])
```

```
In [27]: (rate,sig)=wav.read("sample_test.wav")
         mfcc_feat=mfcc(sig,rate,winlen=0.020,appendEnergy=False)
         covariance = np.cov(np.matrix.transpose(mfcc_feat))
         mean_matrix = mfcc_feat.mean(0)
         feature=(mean_matrix,covariance,0)

In [28]: pred=nearestClass(getNeighbors(trainingSet ,testSet[x] , 5))

In [29]: print(results[pred])
         pop
```

9. Stock price prediction project using LSTM (Long short-term memory).

. Imports:

```
import pandas as pd
import numpy as np

import matplotlib.pyplot as plt
%matplotlib inline

from matplotlib.pylab import rcParams
rcParams['figure.figsize']=20,10
from keras.models import Sequential
from keras.layers import LSTM,Dropout,Dense


from sklearn.preprocessing import MinMaxScaler
```

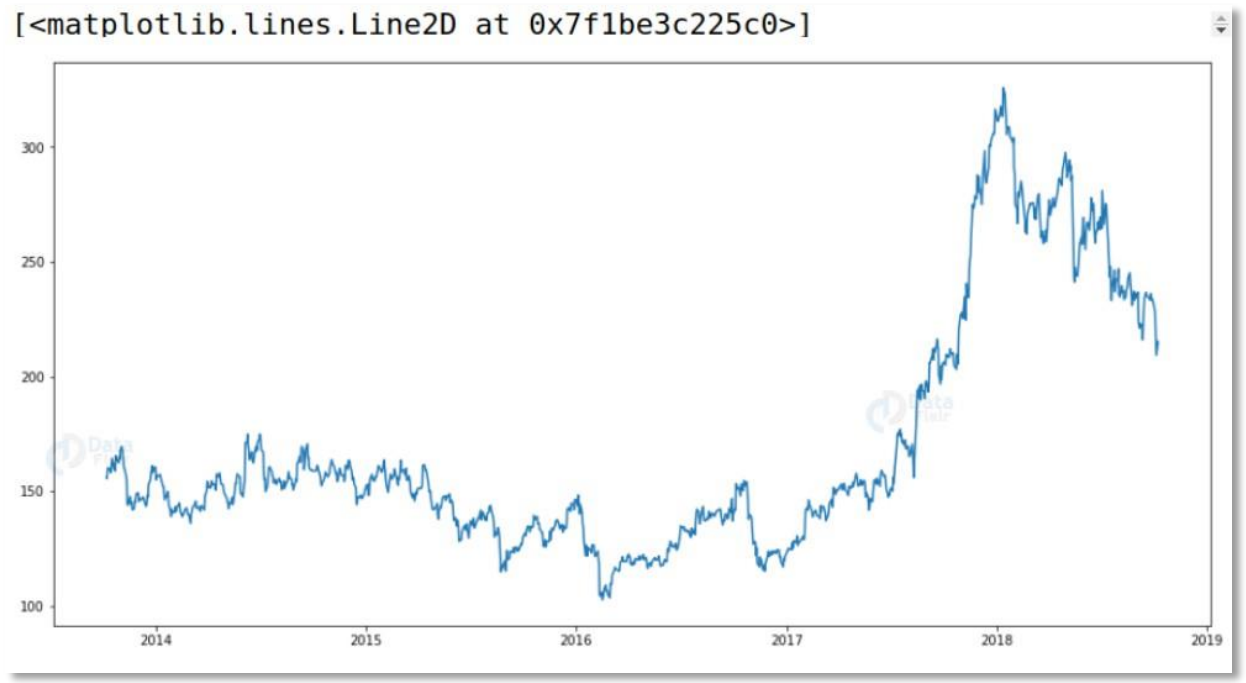
. Read the dataset:

```
df=pd.read_csv("NSE-TATA.csv")
df.head()
```

	Date	Open	High	Low	Last	Close	Total Trade Quantity	Turnover (Lacs)
0	2018-10-08	208.00	222.25	206.85	216.00	215.15	4642146.0	10062.83
1	2018-10-05	217.00	218.60	205.90	210.25	209.20	3519515.0	7407.06
2	2018-10-04	223.50	227.80	216.15	217.25	218.20	1728786.0	3815.79
3	2018-10-03	230.00	237.50	225.75	226.45	227.60	1708590.0	3960.27
4	2018-10-01	234.55	234.60	221.05	230.30	230.90	1534749.0	3486.05

. Analyze the closing prices from dataframe:

```
df["Date"]=pd.to_datetime(df.Date,format="%Y-%m-%d")
df.index=df['Date']

plt.figure(figsize=(16,8))
plt.plot(df["Close"],label='Close Price history')
```



. Sort the dataset on date time and filter “Date” and “Close” columns:

```
data=df.sort_index(ascending=True,axis=0)
new_dataset=pd.DataFrame(index=range(0,len(df)),columns=['Date','Close'])

for i in range(0,len(data)):
    new_dataset["Date"][i]=data['Date'][i]
    new_dataset["Close"][i]=data["Close"][i]
```

. Normalize the new filtered dataset:

```
scaler=MinMaxScaler(feature_range=(0,1))
final_dataset=new_dataset.values

train_data=final_dataset[0:987,:]
valid_data=final_dataset[987:,:]

new_dataset.index=new_dataset.Date
new_dataset.drop("Date",axis=1,inplace=True)
scaler=MinMaxScaler(feature_range=(0,1))
scaled_data=scaler.fit_transform(final_dataset)

x_train_data,y_train_data=[],[]

for i in range(60,len(train_data)):
    x_train_data.append(scaled_data[i-60:i,0])
    y_train_data.append(scaled_data[i,0])

x_train_data,y_train_data=np.array(x_train_data),np.array(y_train_data)

x_train_data=np.reshape(x_train_data,(x_train_data.shape[0],x_train_data.shape[1],1))
```

. Build and train the LSTM model:

```
lstm_model=Sequential()
lstm_model.add(LSTM(units=50,return_sequences=True,input_shape=(x_train_data.shape[1],1)))
lstm_model.add(LSTM(units=50))
lstm_model.add(Dense(1))

inputs_data=new_dataset[len(new_dataset)-len(valid_data)-60:].values
inputs_data=inputs_data.reshape(-1,1)
inputs_data=scaler.transform(inputs_data)

lstm_model.compile(loss='mean_squared_error',optimizer='adam')
lstm_model.fit(x_train_data,y_train_data,epochs=1,batch_size=1,verbose=2)
```

. Take a sample of a dataset to make stock price predictions using the LSTM model:

```
X_test=[]
for i in range(60,inputs_data.shape[0]):
    X_test.append(inputs_data[i-60:i,0])
X_test=np.array(X_test)

X_test=np.reshape(X_test,(X_test.shape[0],X_test.shape[1],1))
predicted_closing_price=lstm_model.predict(X_test)
predicted_closing_price=scaler.inverse_transform(predicted_closing_price)
```

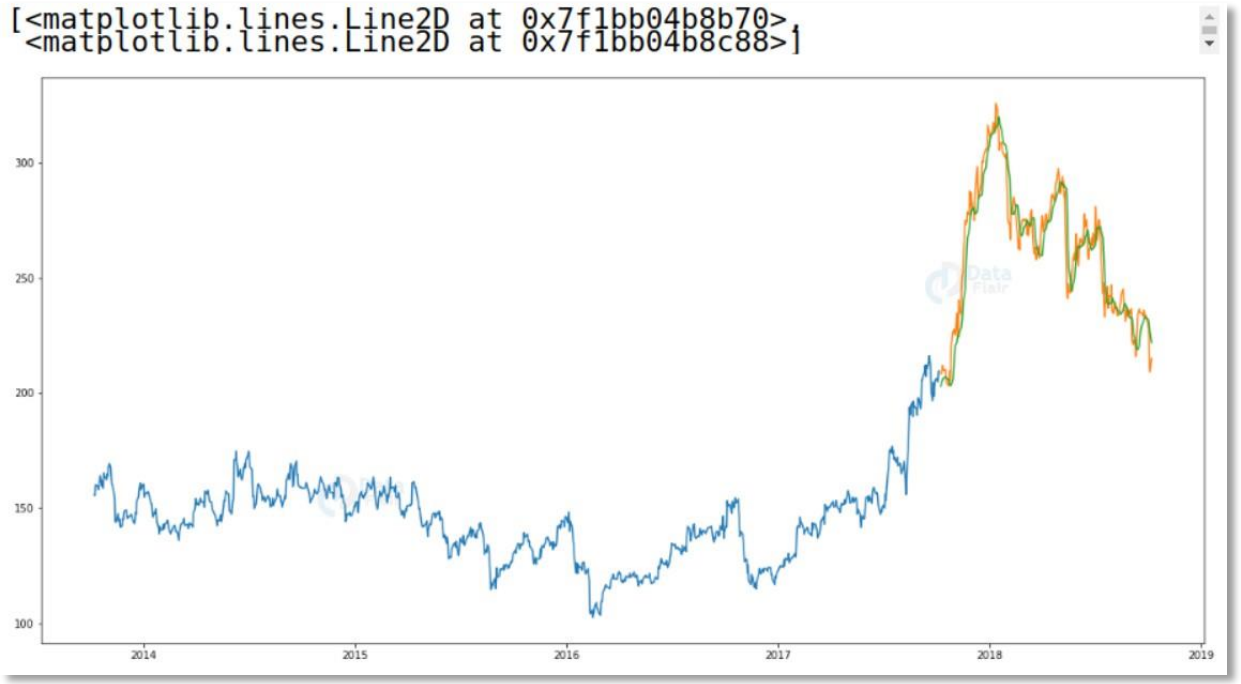
. Save the LSTM model:

```
lstm_model.save("saved_model.h5")
```

. Visualize the predicted stock costs with actual stock costs:

```
train_data=new_dataset[:987]
valid_data=new_dataset[987:]
valid_data['Predictions']=predicted_closing_price
plt.plot(train_data["Close"])
plt.plot(valid_data[['Close',"Predictions"]])
```

```
[<matplotlib.lines.Line2D at 0x7f1bb04b8b70>,
 <matplotlib.lines.Line2D at 0x7f1bb04b8c88>]
```



10. Fake news detection project:

. Imports:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.feature_extraction.text import TfidfTransformer
from sklearn import feature_extraction, linear_model, model_selection, preprocessing
from sklearn.metrics import accuracy_score
from sklearn.model_selection import train_test_split
from sklearn.pipeline import Pipeline
```

. Read datasets:

```
fake = pd.read_csv("data/Fake.csv")
true = pd.read_csv("data/True.csv")
```

```
fake.shape
```

```
(23481, 4)
```

```
true.shape
```

```
(21417, 4)
```

. Data cleaning and preparation:

```
# Add flag to track fake and real
fake['target'] = 'fake'
true['target'] = 'true'


# Concatenate dataframes
data = pd.concat([fake, true]).reset_index(drop = True)
data.shape
```

```
(44898, 5)
```

```
# Shuffle the data
from sklearn.utils import shuffle
data = shuffle(data)
data = data.reset_index(drop=True)


# Check the data
data.head()
```

	title	text	subject	date	target
0	EU Commission says all sides should stick to I...	BRUSSELS (Reuters) - The European Commission s...	worldnews	October 6, 2017	true
1	PRESIDENT TRUMP Looking at Executive Action on...	Remember during the effort to get Obamacare pa...	politics	Aug 1, 2017	fake
2	EU official says no sign Trump plans to ease R...	WASHINGTON (Reuters) - A senior European Union...	politicsNews	April 4, 2017	true
3	Subdued by Harvey, Congress reconvenes facing ...	WASHINGTON (Reuters) - Hurricane Harvey devast...	politicsNews	September 4, 2017	true
4	EVIL HILLARY SUPPORTERS Yell "F*ck Trump"... Burn...	These people are sick and evil. They will stop...	politics	Nov 6, 2016	fake

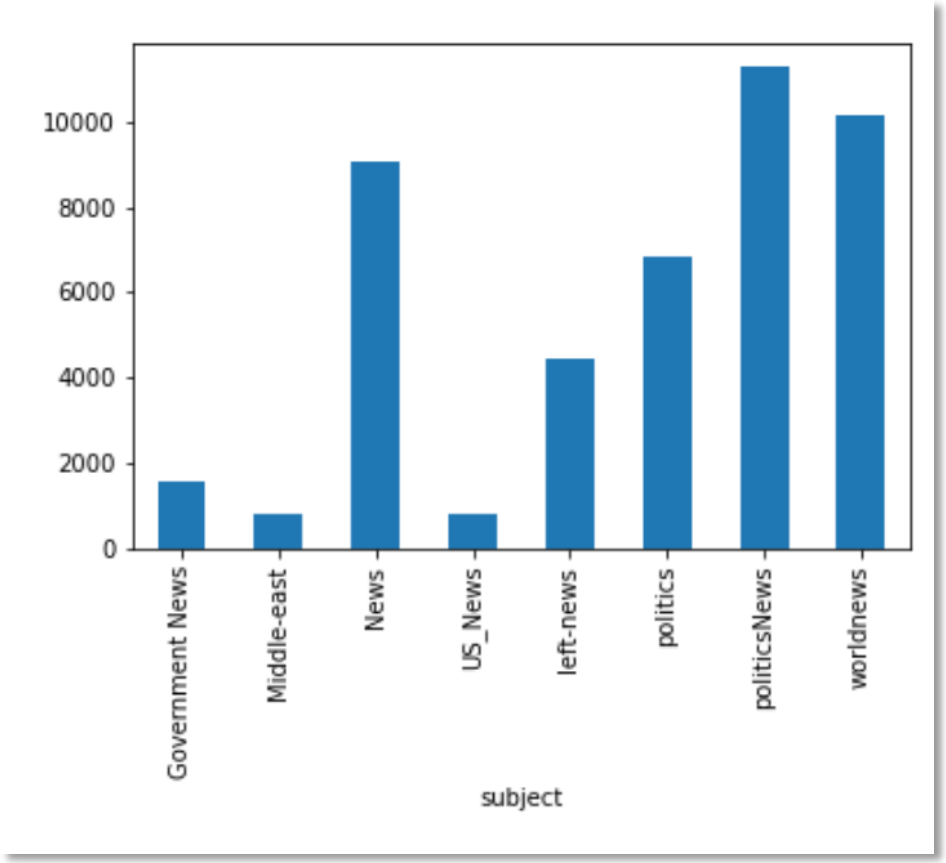
```
# Removing the title (we will only use the text)
data.drop(["title"],axis=1,inplace=True)


# Convert to lowercase
data['text'] = data['text'].apply(lambda x: x.lower())

# Remove punctuation
import string

def punctuation_removal(text):
    all_list = [char for char in text if char not in string.punctuation]
    clean_str = ''.join(all_list)
    return clean_str

data['text'] = data['text'].apply(punctuation_removal)

# Removing stopwords
import nltk
nltk.download('stopwords')
from nltk.corpus import stopwords
stop = stopwords.words('english')

data['text'] = data['text'].apply(lambda x: ' '.join([word for word in x.split() if word not in (stop)]))

data.head()
```

	text	subject	target
0	brussels reuters european commission said frid...	worldnews	true
1	remember effort get obamacare passed nancy pel...	politics	fake
2	washington reuters senior european union offic...	politicsNews	true
3	washington reuters hurricane harvey devastated...	politicsNews	true
4	people sick evil stop nothing get way laws mea...	politics	fake

. Basic data exploration:

```
# How many articles per subject?
print(data.groupby(['subject'])['text'].count())
data.groupby(['subject'])['text'].count().plot(kind="bar")
plt.show()
```

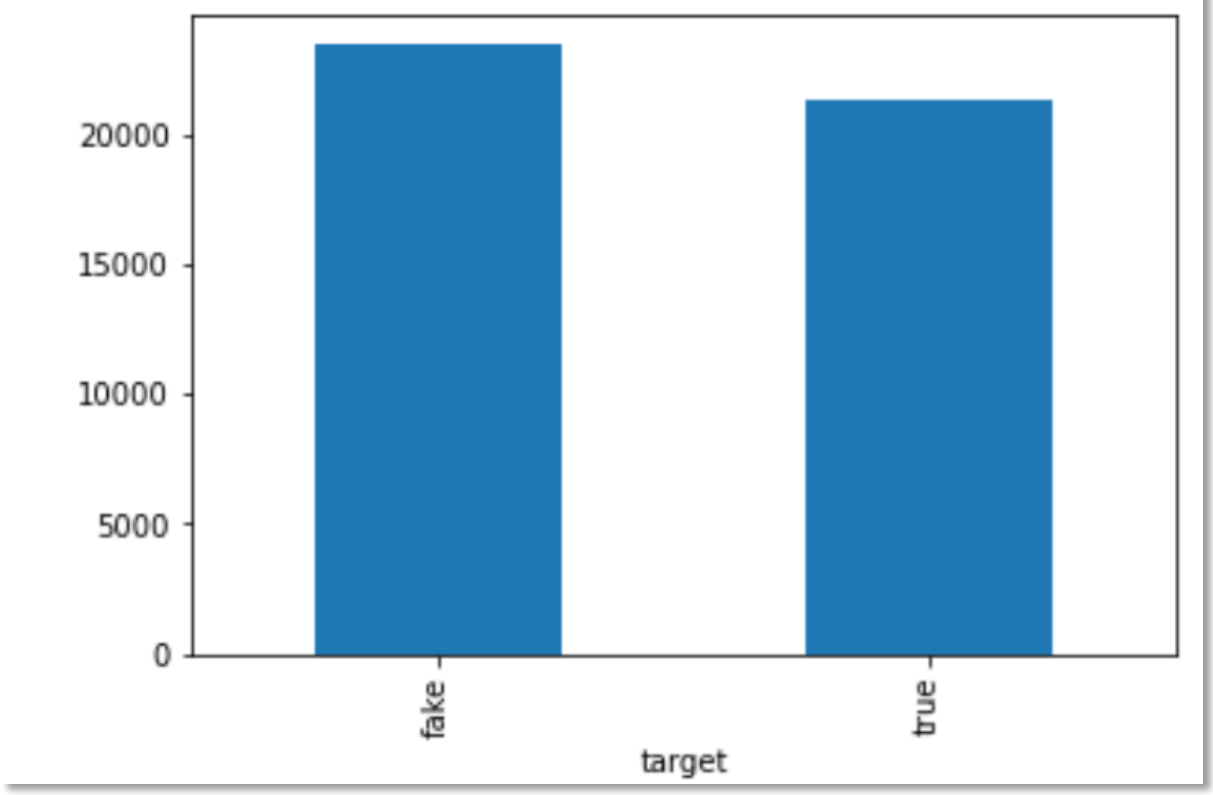
```
subject
Government News     1570
Middle-east          778
News                9050
US_News              783
left-news           4459
politics            6841
politicsNews       11272
worldnews          10145
Name: text, dtype: int64
```



How many fake and real articles?

```
print(data.groupby(['target'])['text'].count())
data.groupby(['target'])['text'].count().plot(kind="bar")
plt.show()
```

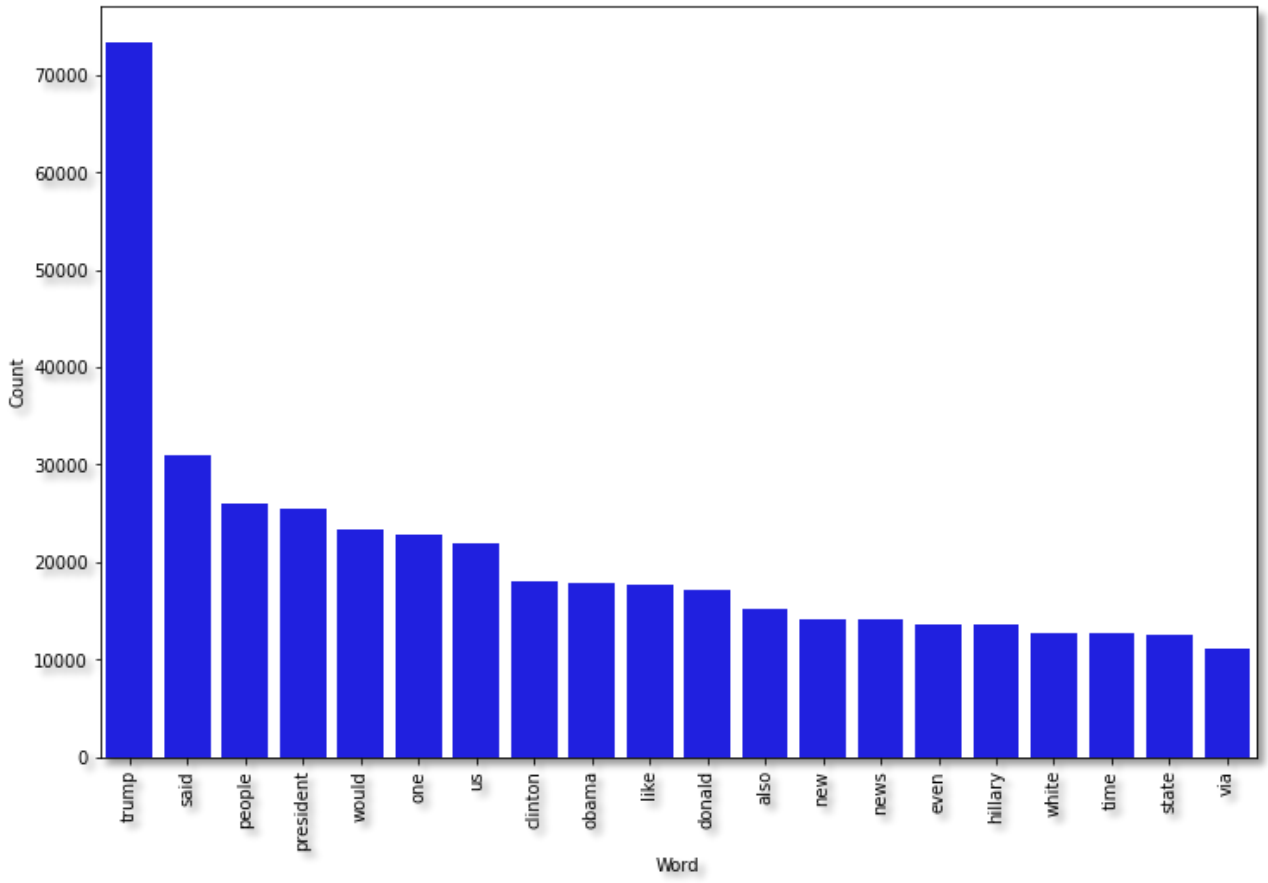
```
target
fake    23481
true    21417
Name: text, dtype: int64
```



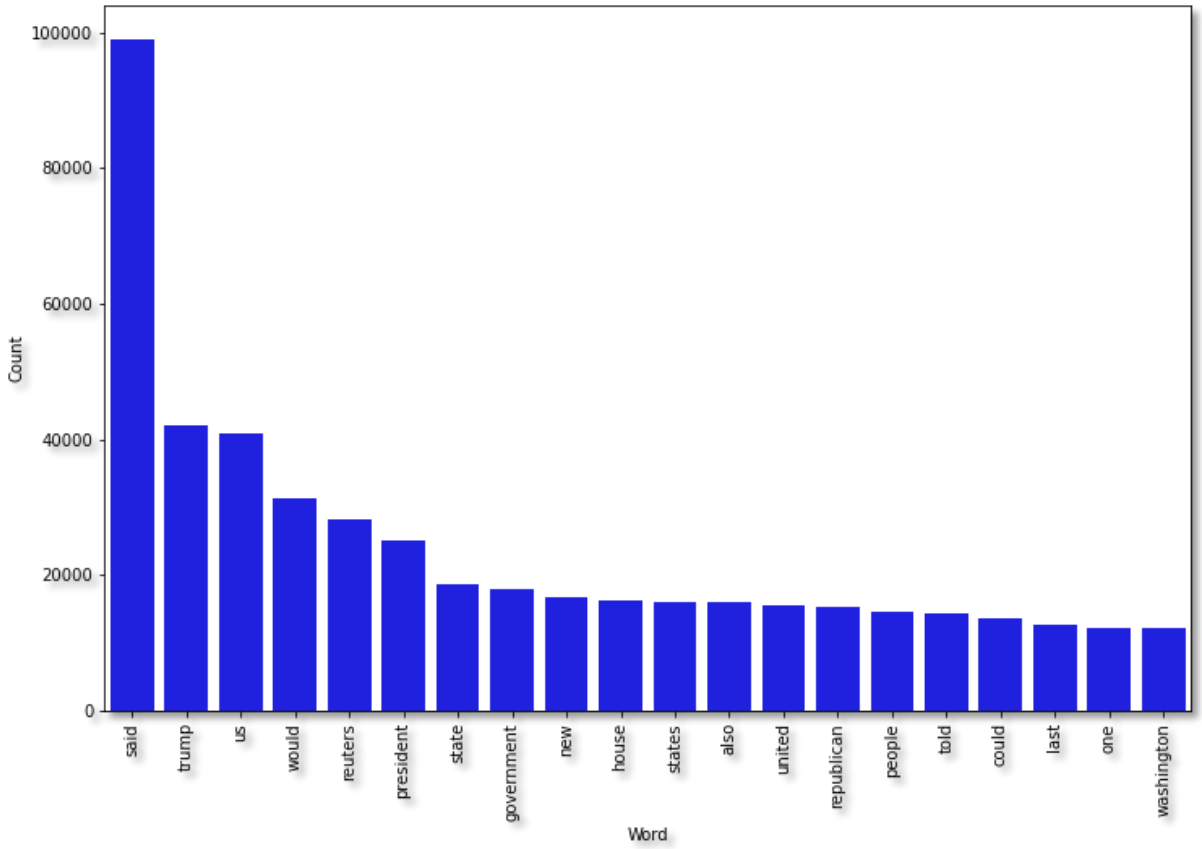

```
# Most frequent words counter
from nltk import tokenize

token_space = tokenize.WhitespaceTokenizer()

def counter(text, column_text, quantity):
    all_words = ' '.join([text for text in text[column_text]])
    token_phrase = token_space.tokenize(all_words)
```

```
    frequency = nltk.FreqDist(token_phrase)
    df_frequency = pd.DataFrame({"Word": list(frequency.keys()),
                                 "Frequency": list(frequency.values())})
    df_frequency = df_frequency.nlargest(columns = "Frequency", n = quantity)
    plt.figure(figsize=(12,8))
    ax = sns.barplot(data = df_frequency, x = "Word", y = "Frequency", color = 'blue')
    ax.set(ylabel = "Count")
    plt.xticks(rotation='vertical')
    plt.show()
```

```
# Most frequent words in fake news
counter(data[data["target"] == "fake"], "text", 20)
```




```
# Most frequent words in real news
counter(data[data["target"] == "true"], "text", 20)
```


100000
80000
60000
40000
20000
0
Count
said
trump
us
would
reuters
president
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new
house
states
also
united
republican
people
told
could
last
one
washington
Word