

South Point Institute of Technology And Management



AI with Python Practical file (MCA201C)

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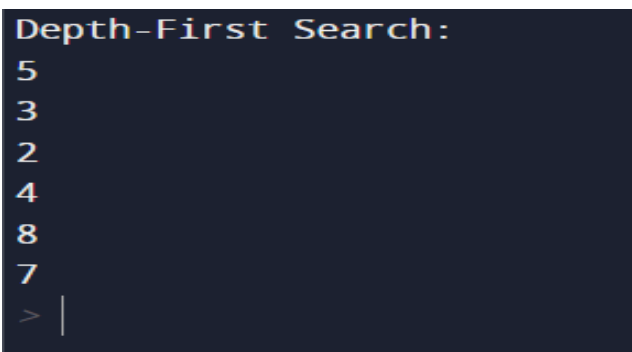
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1. Depth-First Search

```
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:



```
Depth-First Search:  
5  
3  
2  
4  
8  
7  
> |
```

2. Breadth First Search

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

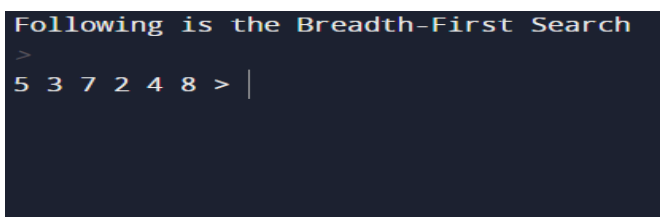
visited = []
queue = []

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:

A terminal window with a dark background. The first line shows the text "Following is the Breadth-First Search" in a light green color. The second line shows a prompt character ">" followed by the sequence of nodes visited: "5 3 7 2 4 8 > |". The cursor is positioned at the end of the sequence.

```
Following is the Breadth-First Search
>
5 3 7 2 4 8 > |
```

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:

```
The optimal value is : 12
```

```
>
```

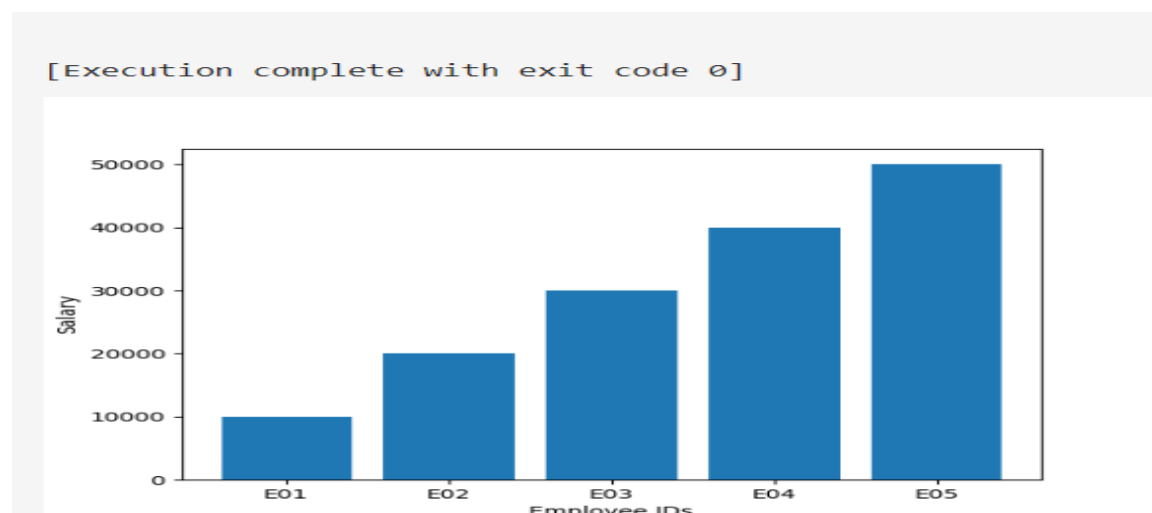
5. Write a Program to analyze data and display in the form of a bar graph for two departments of a company having employee id numbers on X-axis and their salaries on Y axis.

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

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

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

Output:



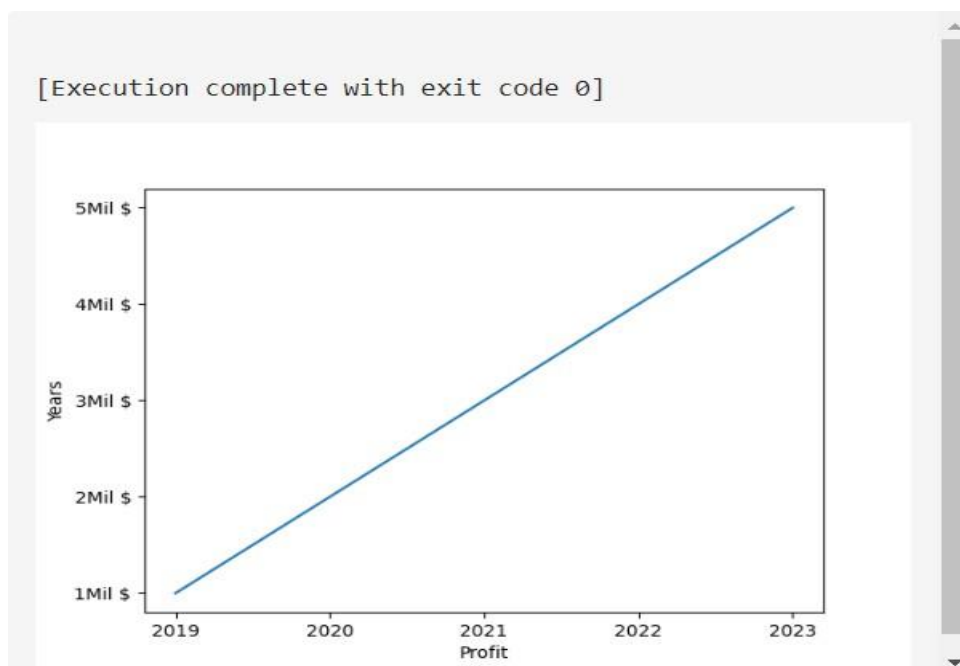
6. Write a program to analyze and draw a line graph to show the profits of a company in various years.

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

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

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

Output:



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)
```

```
... [[ 15  39] [ 19  72] [ 24  73]
      [ 15  81] [ 19  14] [ 25   5]
      [ 16   6] [ 19  99] [ 25  73]
      [ 16  77] [ 20  15] [ 28  14]
      [ 17  40] [ 20  77] ...
      [ 17  76] [ 20  13] [126  28]
      [ 18   6] [ 20  79] [126  74]
      [ 18  94] [ 21  35] [137  18]
      [ 19   3] [ 21  66] [137  83]]
```

. 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()
```

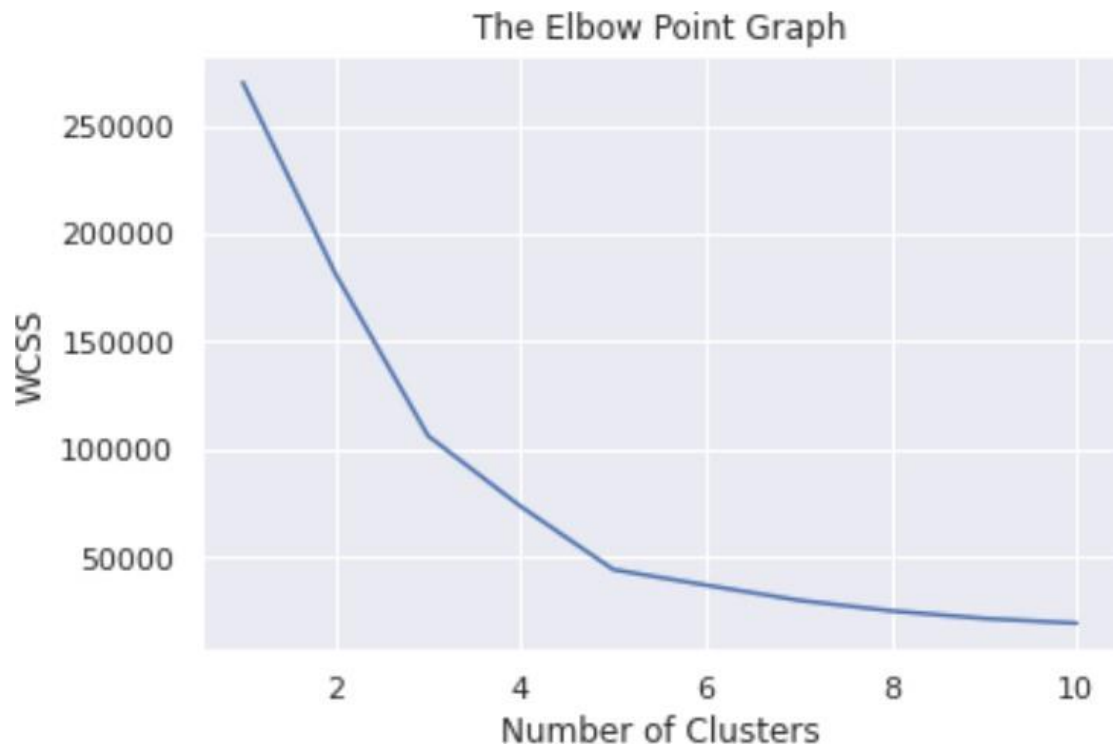
```
plt.plot(range(1,11), wcss)
```

```
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)
```

[illegible]

. 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_[0,0], kmeans.cluster_centers_[0,1], 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()
```

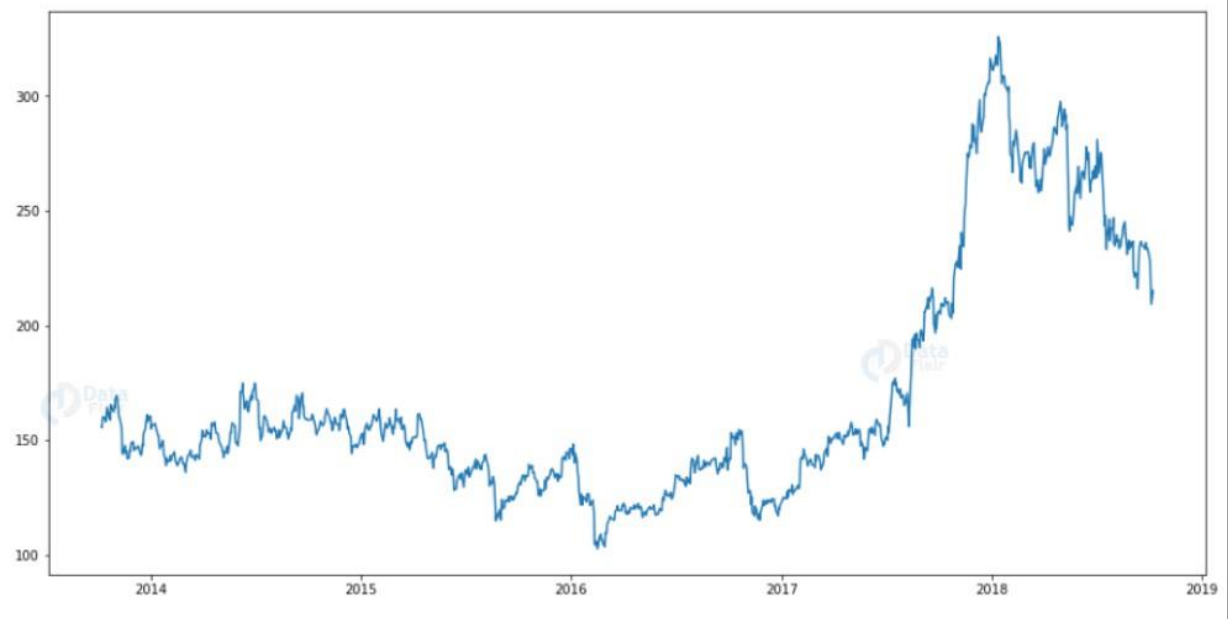
	Date	Open	High	Low	Last	Close	Total Trade Quantity	Turnover (Lacs)
0	2018-10-08	208.00	222.25	206.85	216.00	215.15	4642146.0	10062.83
1	2018-10-05	217.00	218.60	205.90	210.25	209.20	3519515.0	7407.06
2	2018-10-04	223.50	227.80	216.15	217.25	218.20	1728786.0	3815.79
3	2018-10-03	230.00	237.50	225.75	226.45	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')
```

[<matplotlib.lines.Line2D at 0x7f1be3c225c0>]



. 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)
```

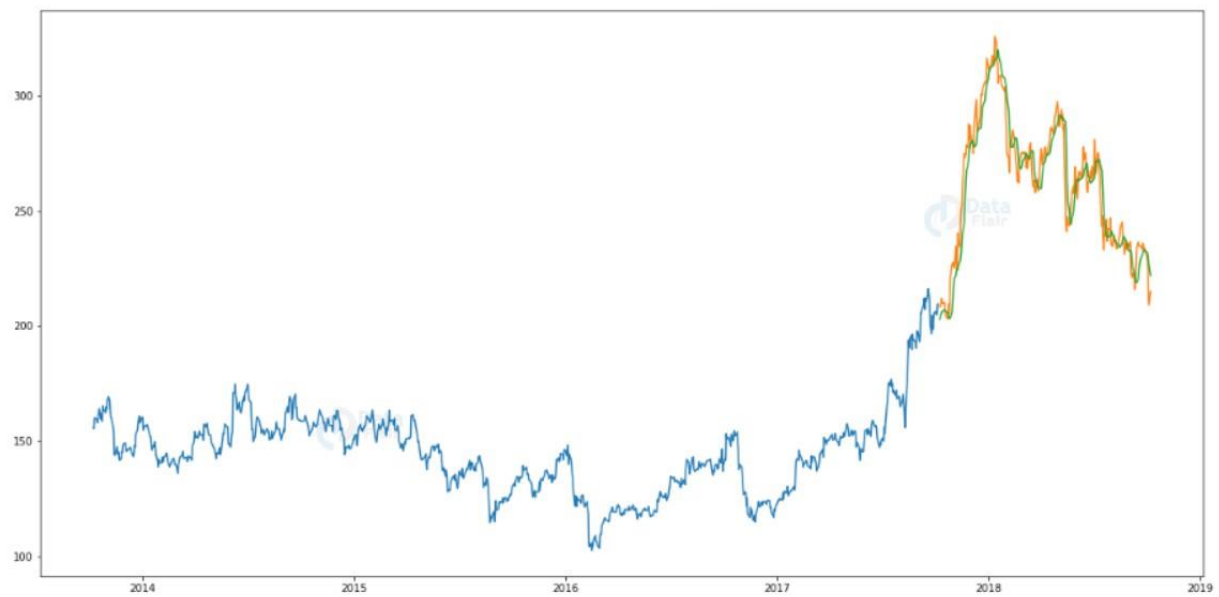
. Save the LSTM model:

```
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

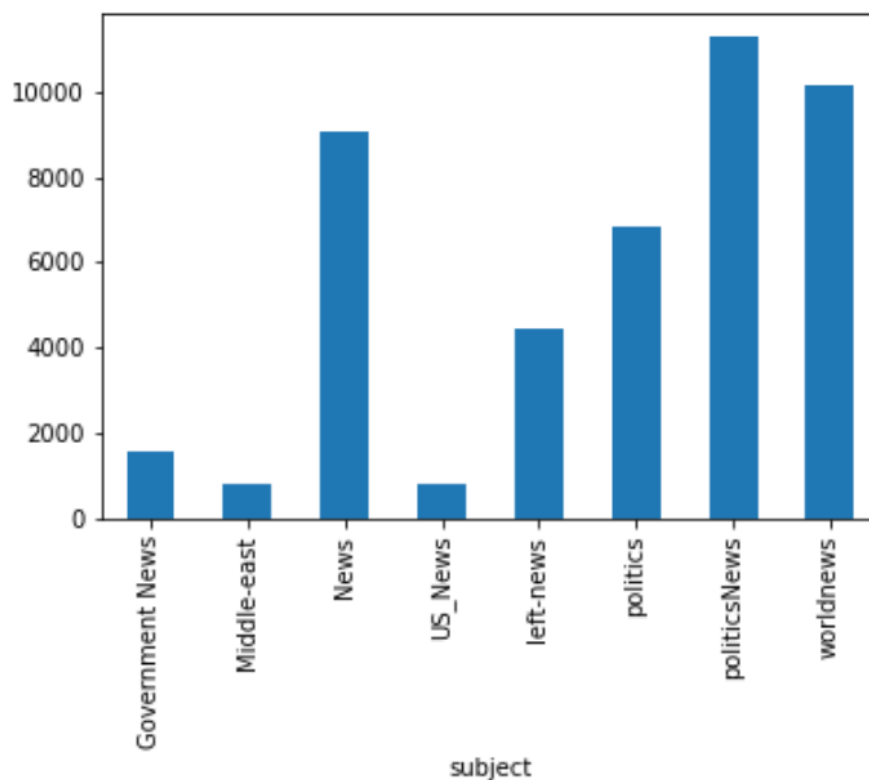
. Basic data exploration:

```

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

```

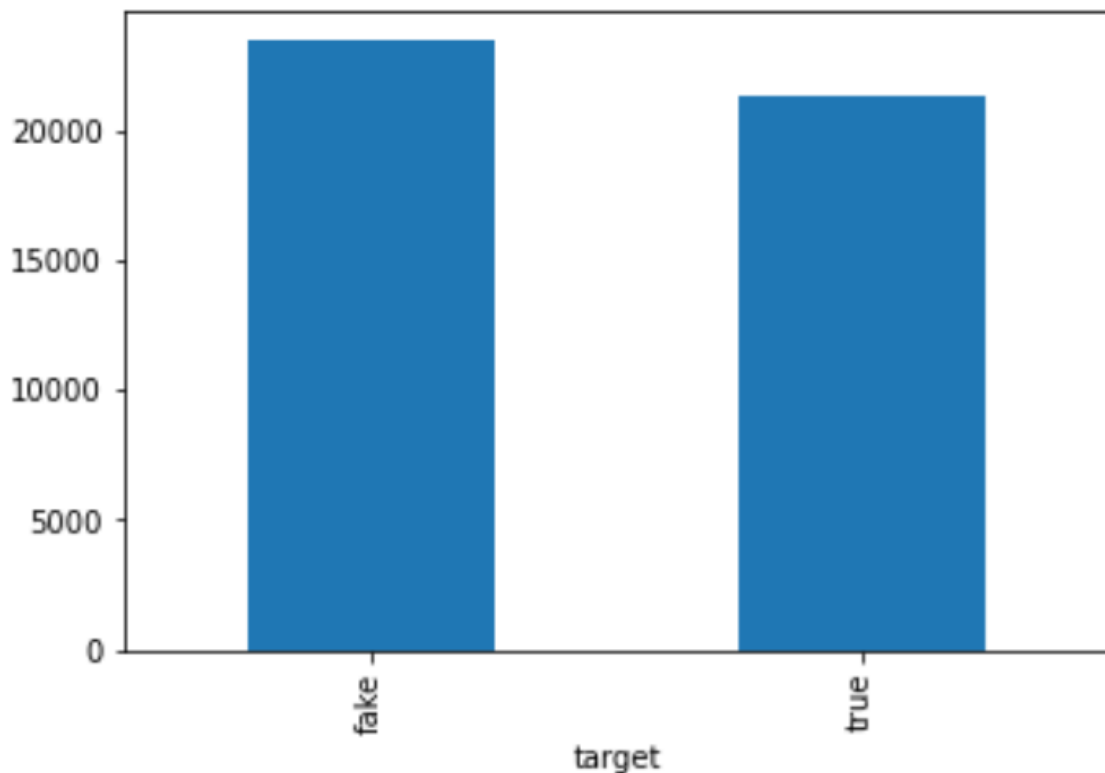
```
subject
Government News    1570
Middle-east        778
News               9050
US_News            783
left-news          4459
politics           6841
politicsNews       11272
worldnews          10145
Name: text, dtype: int64
```



```
# 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)
```

```

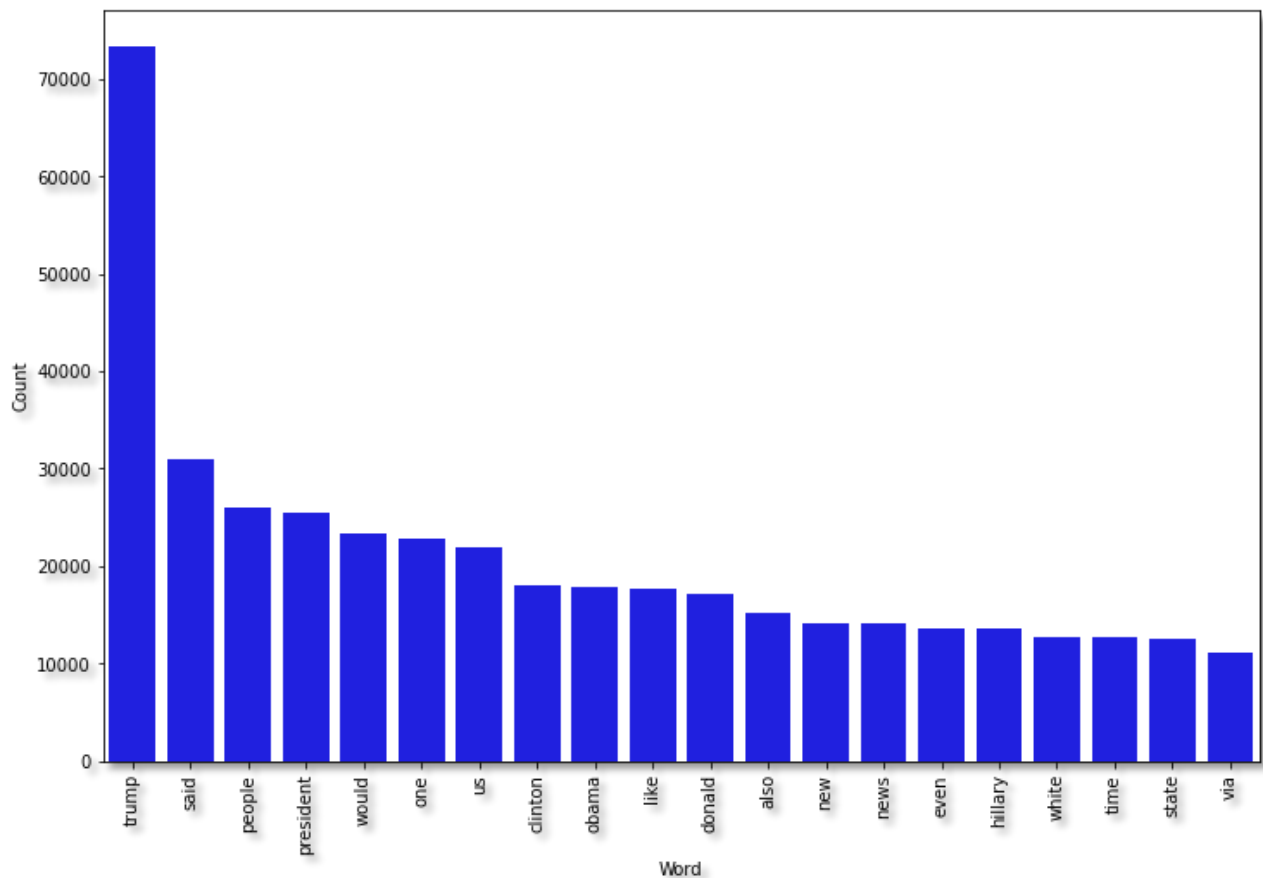
frequency = nltk.FreqDist(token_phrase)
df_frequency = pd.DataFrame({"Word": list(frequency.keys()),
                             "Frequency": list(frequency.values())})
df_frequency = df_frequency.nlargest(columns = "Frequency", n = quantity)
plt.figure(figsize=(12,8))
ax = sns.barplot(data = df_frequency, 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)

```

