Web Mining Theory Digital Assignment

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Group:4

Q1:

Importing Libraries

In [1]:

```
import numpy as np
import pandas as pd
import nltk
import re
import os
import codecs
from sklearn import feature_extraction
from nltk.stem.snowball import SnowballStemmer
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.metrics.pairwise import cosine_similarity
import matplotlib.pyplot as plt
from scipy.cluster.hierarchy import ward, dendrogram
from sklearn.cluster import AgglomerativeClustering
from sklearn.mixture import GaussianMixture
import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d import Axes3D
```

Importing Files

In [3]:

```
titles = []
data = []
#Please specify path according to the system
for i in os.listdir('.\Health-Tweets'):
    if i.endswith('.txt'):
        titles.append(i)
        with open(".\Health-Tweets\\" + str(i), 'r+',encoding='utf-8',errors='ignore') as t
            data.append(text.read())
```

Stop word Removal and Lemmatization

In [4]:

```
stopwords = nltk.corpus.stopwords.words('english')
stemmer = SnowballStemmer('english')
```

In [5]:

```
def tokenize_and_stem(text):
    tokens = [word for sent in nltk.sent_tokenize(text) for word in nltk.word_tokenize(sent
    filtered_tokens = []
    for token in tokens:
        if re.search('[a-zA-Z]', token):
            filtered_tokens.append(token)
    stems = [stemmer.stem(t) for t in filtered_tokens]
    return stems
```

In [6]:

```
def tokenize(text):
    tokens = [word.lower() for sent in nltk.sent_tokenize(text) for word in nltk.word_token
    filtered_tokens = []
    for token in tokens:
        if re.search('[a-zA-Z]', token):
            filtered_tokens.append(token)
    return filtered_tokens
```

In [7]:

```
totalvocab_stemmed = []
totalvocab_tokenized = []

for i in data:
    allwords_stemmed = tokenize_and_stem(i)
    totalvocab_stemmed.extend(allwords_stemmed)

    allwords_tokenized = tokenize(i)
    totalvocab_tokenized.extend(allwords_tokenized)

vocab = pd.DataFrame({'words': totalvocab_tokenized}, index = totalvocab_stemmed)
vocab.iloc[3]
```

Out[7]:

```
words    cancer
Name: cancer, dtype: object
```

TF-IDF

In [8]:

```
tfidf_vectorizer = TfidfVectorizer(max_df=0.8, max_features=200000,min_df=0.2, stop_words='
%time tfidf_matrix = tfidf_vectorizer.fit_transform(data)
```

```
C:\ProgramData\Anaconda3\envs\dev\lib\site-packages\sklearn\feature_extracti
on\text.py:386: UserWarning: Your stop_words may be inconsistent with your p
reprocessing. Tokenizing the stop words generated tokens ['abov', 'afterwar
d', 'alon', 'alreadi', 'alway', 'ani', 'anoth', 'anyon', 'anyth', 'anywher',
'becam', 'becaus', 'becom', 'befor', 'besid', 'cri', 'describ', 'dure', 'el
s', 'elsewher', 'empti', 'everi', 'everyon', 'everyth', 'everywher', 'fift
i', 'forti', 'henc', 'hereaft', 'herebi', 'howev', 'hundr', 'inde', 'mani',
'meanwhil', 'moreov', 'nobodi', 'noon', 'noth', 'nowher', 'onc', 'onli', 'ot
herwis', 'ourselv', 'perhap', 'pleas', 'sever', 'sinc', 'sincer', 'sixti',
'someon', 'someth', 'sometim', 'somewher', 'themselv', 'thenc', 'thereaft',
'therebi', 'therefor', 'togeth', 'twelv', 'twenti', 'veri', 'whatev', 'when
c', 'whenev', 'wherea', 'whereaft', 'wherebi', 'wherev', 'whi', 'yourselv']
not in stop_words.
  'stop_words.' % sorted(inconsistent))

Wall time: 42 s
```

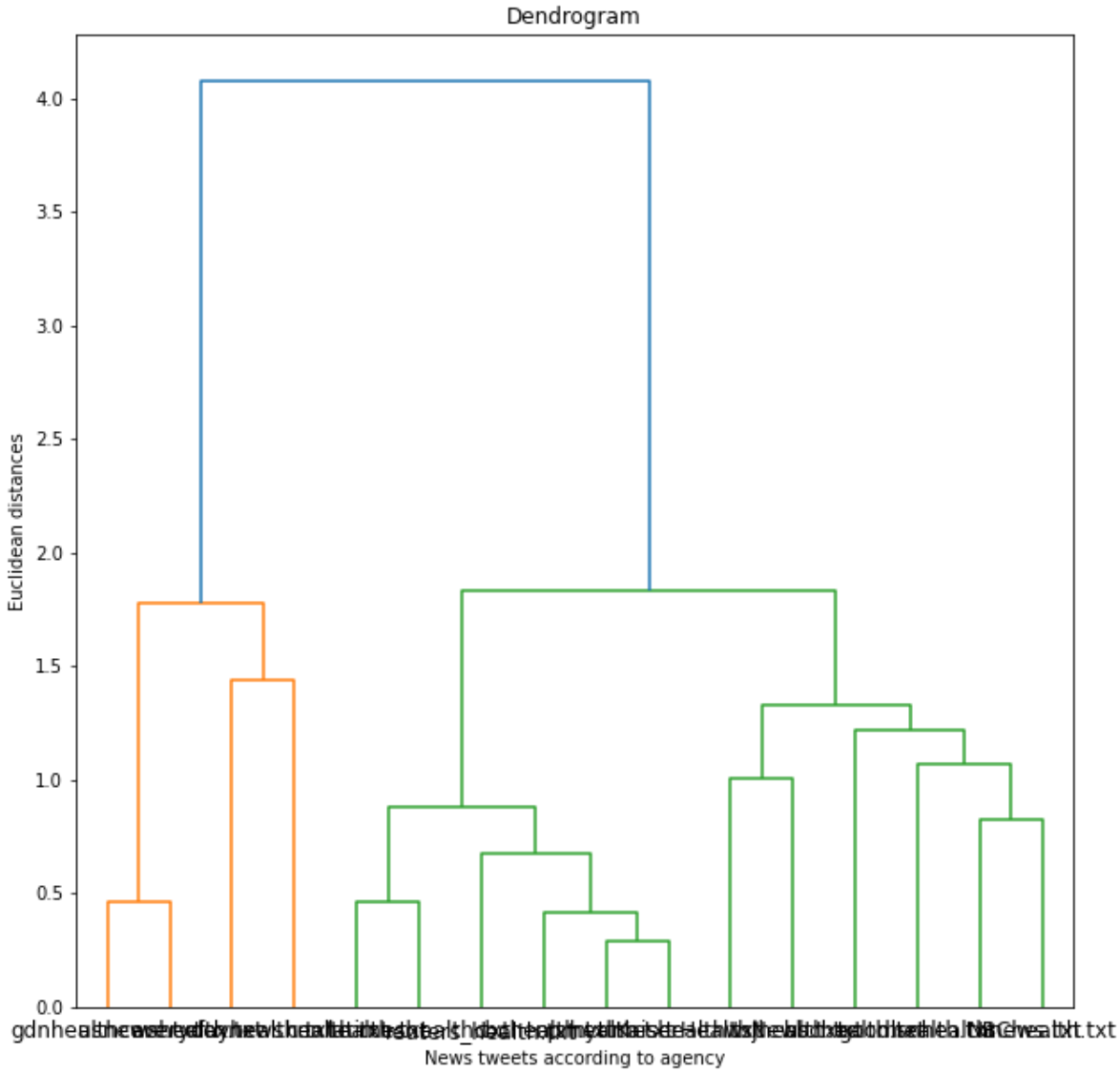
In [9]:

```
terms = tfidf_vectorizer.get_feature_names()
dist = 1 - cosine_similarity(tfidf_matrix)
```

1) Hierarchical Clustering

In [14]:

```
X = ward(dist)
fig, ax = plt.subplots(figsize=(10, 10)) # set size
ax = dendrogram(X,labels=titles);
plt.title('Dendrogram')
plt.xlabel('News tweets according to agency')
plt.ylabel('Euclidean distances')
plt.show()
plt.tight_layout()
```



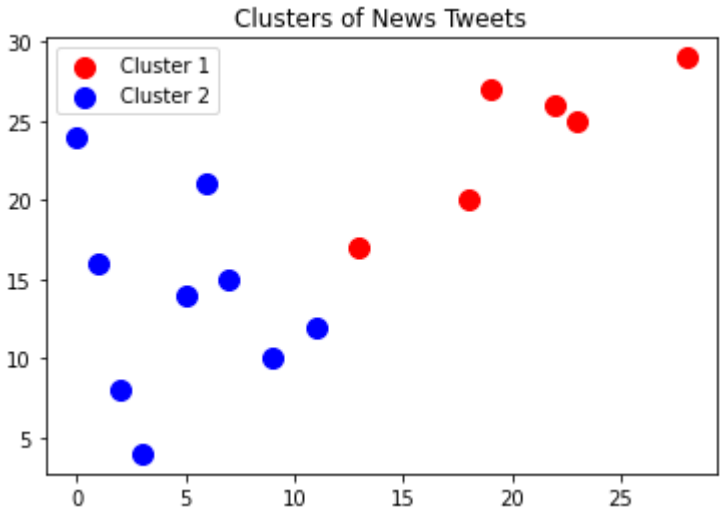
```
<Figure size 432x288 with 0 Axes>
```

We can observe from the dendogram that we can make 2 cluster (as the longest vertical line without intersection is blue)

In [15]:

```
hc = AgglomerativeClustering(n_clusters = 2, affinity = 'euclidean', linkage = 'ward')
y_hc = hc.fit_predict(X)

# Visualising the clusters
plt.scatter(X[y_hc == 0, 0], X[y_hc == 0, 1], s = 100, c = 'red', label = 'Cluster 1')
plt.scatter(X[y_hc == 1, 0], X[y_hc == 1, 1], s = 100, c = 'blue', label = 'Cluster 2')
plt.title('Clusters of News Tweets')
plt.legend()
plt.show()
```



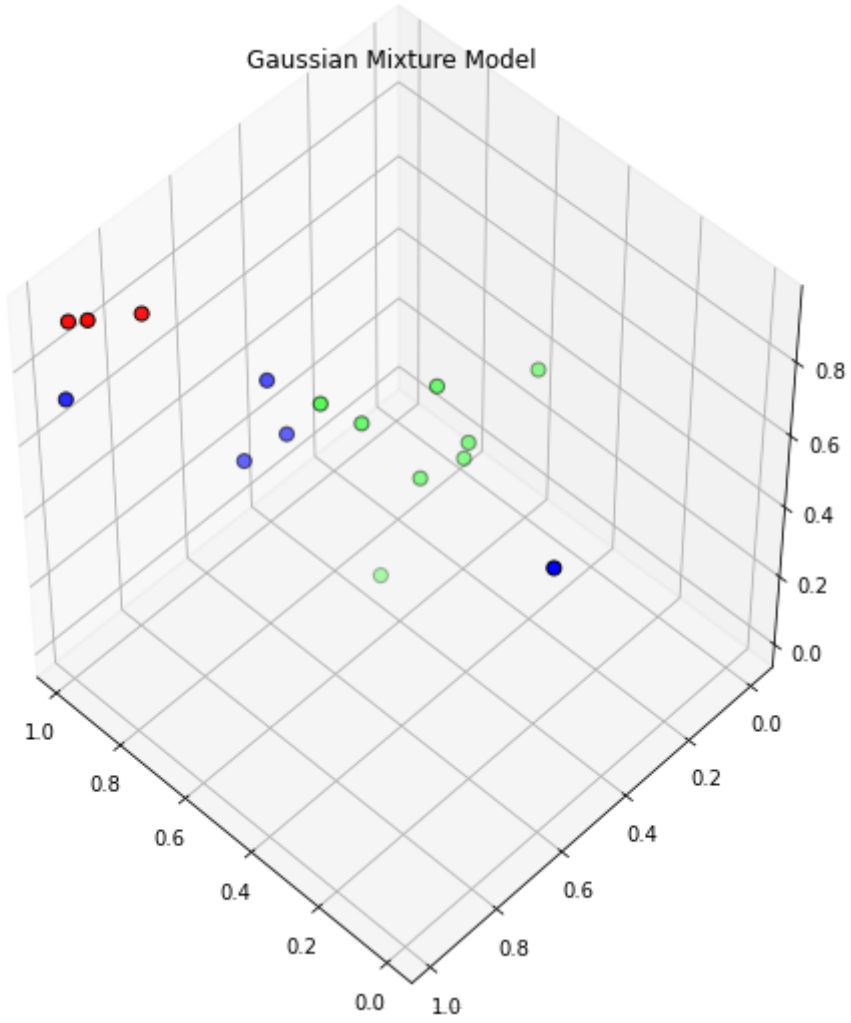
2) Expectation Maximization

In [16]:

```
# Expectation Maximization uging Gaussian Mixture Model
gmm = GaussianMixture(n_components=3)
gmm.fit(dist)
proba_lists = gmm.predict_proba(dist)
#Plotting
colored_arrays = np.matrix(proba_lists)
colored_tuples = [tuple(i.tolist()[0]) for i in colored_arrays]
fig = plt.figure(1, figsize=(7,7))
ax = Axes3D(fig, rect=[0, 0, 0.95, 1], elev=48, azim=134)
ax.scatter(dist[:, 0], dist[:, 1], dist[:, 2],c=colored_tuples, edgecolor="k", s=50)
plt.title("Gaussian Mixture Model")
```

Out[16]:

```
Text(0.5, 0.92, 'Gaussian Mixture Model')
```



In [ ]:

```
```

Q2

In [17]:

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

In [18]:

```
dataset=pd.read_csv("diabetes_simplied.csv")
```

In [19]:

```
dataset.head()
```

Out[19]:

	Glucose	BloodPressure	Insulin	BMI	Age	Outcome
0	148	72	0	33.6	50	1
1	85	66	0	26.6	31	0
2	183	64	0	23.3	32	1
3	89	66	94	28.1	21	0
4	137	40	168	43.1	33	1

In [21]:

```
X=dataset.iloc[:,0:4].values
X
```

Out[21]:

```
array([[148. ,  72. ,   0. ,  33.6],
       [ 85. ,  66. ,   0. ,  26.6],
       [183. ,  64. ,   0. ,  23.3],
       ...,
       [121. ,  72. , 112. ,  26.2],
       [126. ,  60. ,   0. ,  30.1],
       [ 93. ,  70. ,   0. ,  30.4]])
```

In [22]:

```
y=dataset.iloc[:,5].values
```

In [23]:

```
from sklearn.model_selection import train_test_split
X_train,X_test,y_train,y_test = train_test_split(X,y,test_size=0.33, random_state=42)
```

1) Decision Tree

In [24]:

```
from sklearn.tree import DecisionTreeClassifier
classifier = DecisionTreeClassifier(criterion = 'entropy')
classifier.fit(X_train, y_train)
```

Out[24]:

```
DecisionTreeClassifier(criterion='entropy')
```

In [25]:

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

In [26]:

```
from sklearn.metrics import f1_score, r2_score,accuracy_score, roc_curve, auc
```

F1-Score, R2-Score and Accuracy

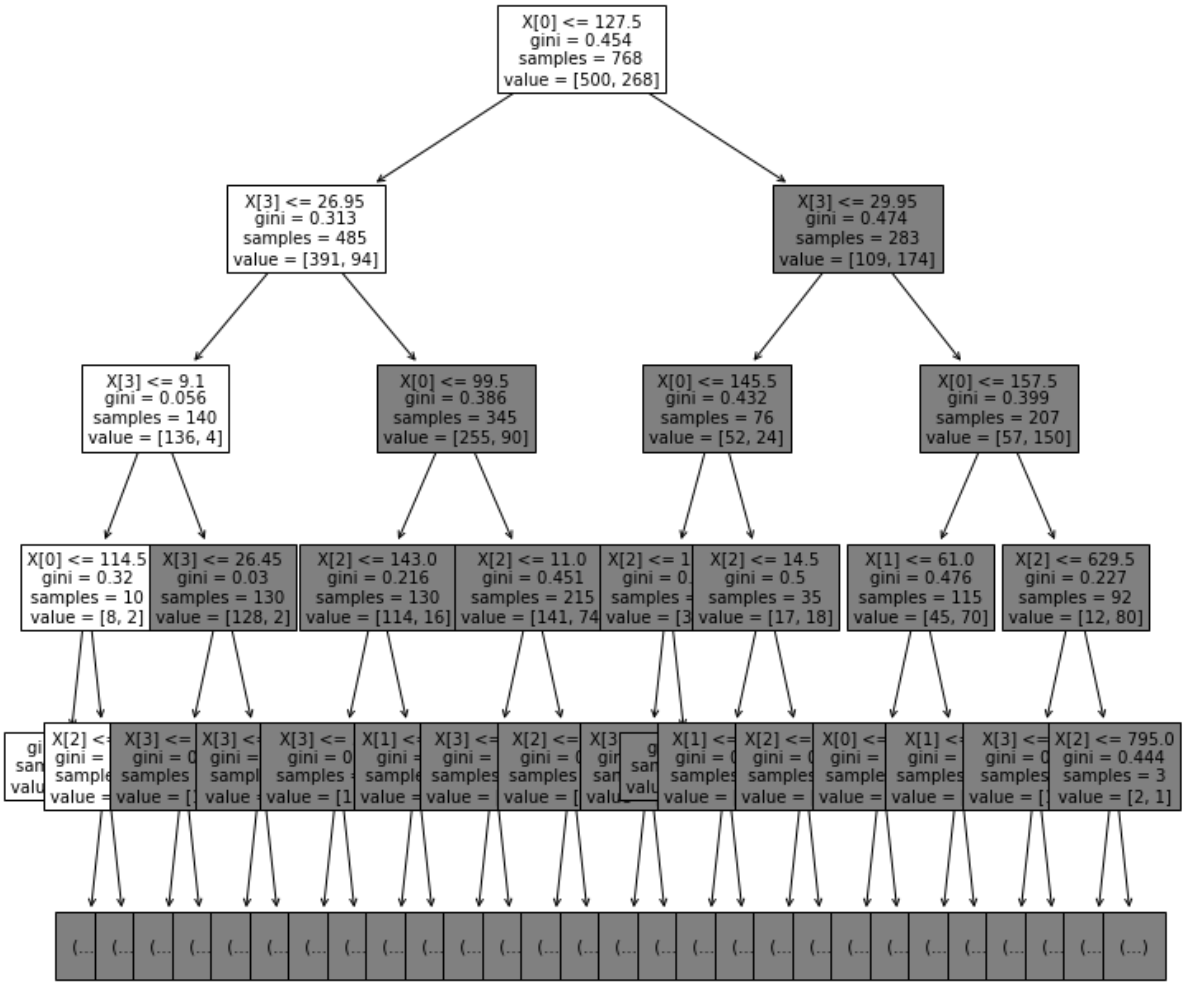
In [39]:

```
print('F1-score: ',f1_score(y_test,y_pred))
print('R2-score: ', r2_score(y_test,y_pred))
print('Accuracy score: ', accuracy_score(y_test,y_pred))
```

```
F1-score:  0.5222222222222221
R2-score:  -0.5119047619047623
Accuracy score:  0.6614173228346457
```

In [40]:

```
#Decision Tree
from sklearn import tree
clf = tree.DecisionTreeClassifier()
fig, ax = plt.subplots(figsize=(12, 12))
tree.plot_tree(clf.fit(X, y), max_depth=4, fontsize=10)
plt.show()
```



In [41]:

```
#ROC and AUC Curves
from sklearn.metrics import roc_curve
from sklearn.metrics import roc_auc_score
y_pred = classifier.predict_proba(X_test)
y_pred = y_pred[:, 1]
fpr, tpr, thresholds = roc_curve(y_test,y_pred)
auc = roc_auc_score(y_test,y_pred)
print('AUC Score: %.2f' % auc)
```

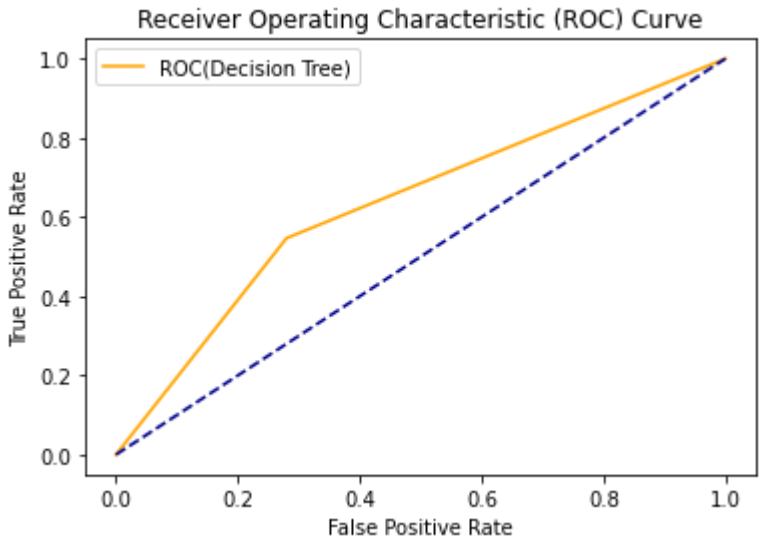
```
AUC Score: 0.63
```

In [42]:

```
def plot_roc_curve(fpr, tpr):
    plt.plot(fpr, tpr, color='orange', label='ROC(Decision Tree)')
    plt.plot([0, 1], [0, 1], color='darkblue', linestyle='--')
    plt.xlabel('False Positive Rate')
    plt.ylabel('True Positive Rate')
    plt.title('Receiver Operating Characteristic (ROC) Curve')
    plt.legend()
    plt.show()
```

In [43]:

```
plot_roc_curve(fpr, tpr)
```



2) AdaBoost

In [44]:

```
from sklearn.ensemble import AdaBoostClassifier
classifier1 = AdaBoostClassifier(n_estimators=100,random_state=0)
classifier1.fit(X_train, y_train)
```

Out[44]:

```
AdaBoostClassifier(n_estimators=100, random_state=0)
```

In [45]:

```
y_pred1=classifier1.predict(X_test)
```

F1-Score, R2-Score and Accuracy

In [46]:

```
print('F1-score: ',f1_score(y_test,y_pred1))
print('R2-score: ', r2_score(y_test,y_pred1))
print('Accuracy score: ', accuracy_score(y_test,y_pred1))
```

```
F1-score:  0.5647058823529412
R2-score:  -0.30094130675526065
Accuracy score:  0.7086614173228346
```

In [47]:

```
#ROC and AUC Curves
from sklearn.metrics import roc_curve
from sklearn.metrics import roc_auc_score
y_pred1 = classifier1.predict_proba(X_test)
y_pred1 = y_pred1[:, 1]
fpr1, tpr1, thresholds1 = roc_curve(y_test,y_pred1)
auc1 = roc_auc_score(y_test,y_pred1)
print('AUC Score: %.2f' % auc)
```

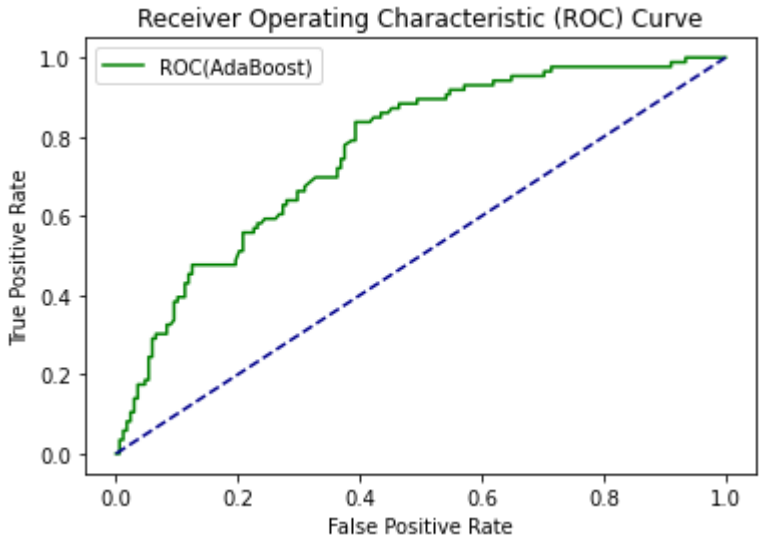
```
AUC Score: 0.63
```

In [48]:

```
def plot_roc_curve(fpr1, tpr1):
    plt.plot(fpr1, tpr1, color='green', label='ROC(AdaBoost)')
    plt.plot([0, 1], [0, 1], color='darkblue', linestyle='--')
    plt.xlabel('False Positive Rate')
    plt.ylabel('True Positive Rate')
    plt.title('Receiver Operating Characteristic (ROC) Curve')
    plt.legend()
    plt.show()
```

In [49]:

```
plot_roc_curve(fpr1, tpr1)
```



Comparision of ROC Curves of Decision Tree and AdaBoost

In [38]:

```
plt.plot(fpr1, tpr1, color='green', label='ROC(AdaBoost)')
plt.plot(fpr, tpr, color='orange', label='ROC(Decision Tree)')
plt.plot([0, 1], [0, 1], color='darkblue', linestyle='--')
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('Receiver Operating Characteristic (ROC) Curve')
plt.legend()
plt.show()
```