In [68]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import matplotlib as mpl
import seaborn as sns
import warnings
!pip install --upgrade scikit-learn
warnings.filterwarnings("ignore")
%matplotlib inline
import xgboost as xgb
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score, roc_curve, auc,classification_report
```

```
Requirement already satisfied: scikit-learn in c:\users\sanjeevan\anaconda
3\lib\site-packages (1.1.3)
Collecting scikit-learn
  Downloading scikit_learn-1.3.0-cp38-cp38-win_amd64.whl (9.2 MB)
     ---------------------------------------- 9.2/9.2 MB 3.3 MB/s eta 0:0
0:00
Collecting joblib>=1.1.1
  Using cached joblib-1.3.1-py3-none-any.whl (301 kB)
Requirement already satisfied: scipy>=1.5.0 in c:\users\sanjeevan\anaconda
3\lib\site-packages (from scikit-learn) (1.10.1)
Requirement already satisfied: numpy>=1.17.3 in c:\users\sanjeevan\anacond
a3\lib\site-packages (from scikit-learn) (1.24.2)
Requirement already satisfied: threadpoolctl>=2.0.0 in c:\users\sanjeevan
\anaconda3\lib\site-packages (from scikit-learn) (2.1.0)
Installing collected packages: joblib, scikit-learn
  Attempting uninstall: joblib
    Found existing installation: joblib 1.0.1
    Uninstalling joblib-1.0.1:
      Successfully uninstalled joblib-1.0.1
  Attempting uninstall: scikit-learn
    Found existing installation: scikit-learn 1.1.3
    Uninstalling scikit-learn-1.1.3:
      Successfully uninstalled scikit-learn-1.1.3
Successfully installed joblib-1.3.1 scikit-learn-1.3.0
```

In [69]:

```
df = pd.read_csv('finaldata1.csv')
bots = df[df.bot==1]
nonbots = df[df.bot==0]
```

In [70]:

```
df.head()
```

Out[70]:

	id	id_str	screen_name	location	description	
0	8.160000e+17	"815745789754417152"	"HoustonPokeMap"	"Houston, TX"	"Rare and strong PokŽmon in Houston, TX. See m...	"https://t.cc
1	4.843621e+09	4843621225	kernyeahx	Templeville town, MD, USA	From late 2014 Socium Marketplace will make sh...	
2	4.303727e+09	4303727112	mattlieberisbot	NaN	Inspired by the smart, funny folks at @replyal...	https://t.cc
3	3.063139e+09	3063139353	sc_papers	NaN	NaN	
4	2.955142e+09	2955142070	lucarivera16	Dublin, United States	Inspiring cooks everywhere since 1956.	

5 rows × 21 columns

In [71]:

```
df = pd.read_csv('finaldata1.csv')
bag_of_words_bot = r'bot|b0t|cannabis|tweet me|mishear|follow me|updates every|gorilla|y
                    r'expos|kill|clit|bbb|butt|fuck|XXX|sex|truthe|fake|anony|free|virus
                    r'nerd|swag|jack|bang|bonsai|chick|prison|paper|pokem|xx|freak|ffd|d
                    r'ffd|onlyman|emoji|joke|troll|droop|free|every|wow|cheese|yeah|bio|

df['screen_name_binary'] = df.screen_name.str.contains(bag_of_words_bot, case=False, na=
df['name_binary'] = df.name.str.contains(bag_of_words_bot, case=False, na=False)
df['description_binary'] = df.description.str.contains(bag_of_words_bot, case=False, na=
df['status_binary'] = df.status.str.contains(bag_of_words_bot, case=False, na=False)
#df['tweet_binary'] = df.tweet.str.contains(bag_of_words_bot, case=False, na=False)
```

In [72]:

```
features = ['screen_name_binary', 'name_binary', 'description_binary', 'status_binary',
```

In [73]:

```
features
```

Out[73]:

```
['screen_name_binary',
 'name_binary',
 'description_binary',
 'status_binary',
 'verified',
 'followers_count',
 'friends_count',
 'statuses_count',
 'tweet',
 'bot']
```

In [74]:

```
X = df[features].iloc[:,5:-1]
```

In [75]:

```
X
```

Out[75]:

	followers_count	friends_count	statuses_count	tweet
0	1291	0	78554	there are some truly sick ppl out there.
1	1	349	31	bihday pressie from my mummy and my granny #mi...
2	1086	0	713	Matt Lieber is a little bit of hot supper afte...
3	33	0	676	Construction of human anti-tetanus single-chai...
4	11	745	185	@user stuck in athens instead of santorini be...
...	...	...	...	...
2193	51314111	392225	5126	RT @lukester: Springing forward should happen ...
2194	46	54	194	Data Science is a team sport. I'm _□ for all o...
2195	45	146	36	Sitting at home and im very bored keep hearing...
2196	1336587	512	17125	RT @CNN: School apologizes after fifth-graders...
2197	25253	152	36172	Fed bokkie too many birthday treats-sicko

2198 rows × 4 columns

In [76]:

```
y = df[features].iloc[:,-1]
```

In [77]:

```
y
```

Out[77]:

```
0       1
1       1
2       1
3       1
4       1
       ..
2193    0
2194    0
2195    0
2196    0
2197    0
Name: bot, Length: 2198, dtype: int64
```

In [78]:

```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=10
```

Preprocessing on Tweets

In [79]:

```
#!pip install nltk
import re
import nltk
"""
nltk.download('punkt')
nltk.download('stopwords')
nltk.download('wordnet')"""

from nltk.stem import PorterStemmer
from nltk.corpus import stopwords
from nltk.stem import WordNetLemmatizer
```

In [80]:

```
stemmer = PorterStemmer()
lemmatizer=WordNetLemmatizer()
import re
corpus = []
for i in range(0, len(df)):
    if isinstance(df['tweet'][i], str):
        review = re.sub('[^a-zA-Z@#0-9 ]' ,' ', df['tweet'][i])
        review = review.lower()
        review = review.split()
        review = [lemmatizer.lemmatize(word) for word in review if not word in stopwords
        review = ' '.join(review)
        corpus.append(review)
print(corpus)
```

```
['truly sick ppl', 'bihday pressie mummy granny #michaelkors #luckygirl
#bihday #liverpool', 'matt lieber little bit hot supper afterwards', 'c
onstruction human anti tetanus single chain variable fragment applying
symplex technology http co 5wjzdutkou', '@user stuck athens instead san
torini @user said windy land shocking service every level since', 'anyo
ne ever tried throwing water kellyanne conway', 'u mostly admire', 'cou
ple fat naked japanese girl', 'feeding schedule proteolysis regulate au
tophagic clearance mutant huntingtin http co zlqdliy2vb', 'functional s
electivity cytokine signaling revealed pathogenic epo mutation http co
u4vr9z9ec9 http co rkdtigzdkz', 'daughter riding bike around driveway s
on playing guitar u enjoy campfire #summeime #memories', 'large scale c
hromosome folding versus genomic dna sequence', '@user happy folk first
#freakshake launch #freaks #yum #dalston @user', 'huge crowd trump', 't
hankful saturday #thankful #positive', 'hard bag four item', 'omg lovin
g station way jam work #memories @user rock refurbishing', 'good god so
n riding bike around driveway son playing guitar u campfire #summeime #
memories', 'maurabot nice daughter riding bike around driveway enjoy ca
mpfire #summeime #memories', '@jonathanddownie daniel gile sure dad',
'hillary giveaway pose entering job #imwithyou #americans lie', 'loving
```

CountVectorizer

In [81]:

```
from sklearn.feature_extraction.text import CountVectorizer
cv = CountVectorizer(max_features = 3500)
X = cv.fit_transform(corpus).toarray()
X
```

Out[81]:

```
array([[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]], dtype=int64)
```

Feature Selection

In [82]:

```
y = df[features].iloc[:,-1]
```

In [83]:

```
y
```

Out[83]:

```
0       1
1       1
2       1
3       1
4       1
       ..
2193    0
2194    0
2195    0
2196    0
2197    0
Name: bot, Length: 2198, dtype: int64
```

In [84]:

```
import pickle
# Creating a pickle file for the CountVectorizer
pickle.dump(cv, open('cv-transform.pkl', 'wb'))
```

Split Data into Test and Train

In [85]:

```
X = df[features].iloc[:,5:-1]
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.24, random_state
```

Multinomial Navie Bayes

In [86]:

```python
import numpy as np
from sklearn.naive_bayes import MultinomialNB
from sklearn.metrics import accuracy_score, classification_report
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import CountVectorizer

# Assuming your data is in a DataFrame called df
X = np.concatenate((df[['followers_count', 'friends_count', 'statuses_count']].values, c
y = df['bot'].values

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.25, random_state=4

# Train Naive Bayes model
mnb = MultinomialNB(alpha=0.8)
mnb.fit(X_train, y_train)

y_pred_mnb=mnb.predict(X_test)
mnb_accuracy = accuracy_score(y_test,y_pred_mnb)
print("Training accuracy Score    : ",mnb.score(X_train,y_train))
print("Validation accuracy Score : ",mnb_accuracy )
print(classification_report(y_pred_mnb,y_test))
```

```
Training accuracy Score    :  0.8015776699029126
Validation accuracy Score :  0.7963636363636364
              precision    recall  f1-score   support

           0       0.47      0.88      0.61       100
           1       0.97      0.78      0.86       450

    accuracy                           0.80       550
   macro avg       0.72      0.83      0.74       550
weighted avg       0.88      0.80      0.82       550
```

In [87]:

```
"""# Get user input
followers_count = int(input("Enter number of followers: "))
friends_count = int(input("Enter number of friends: "))
statuses_count = int(input("Enter number of statuses: "))
tweet = input("Enter the tweet text: ")

# Preprocess user input
user_input = np.concatenate((np.array([followers_count, friends_count, statuses_count]).

# Make prediction on user input
prediction = mnb.predict(user_input)

if(prediction==1):
    print("Bot")
else:
    print("Human")
#print("Prediction: ", prediction)"""
```

Out[87]:

```
'# Get user input\nfollowers_count = int(input("Enter number of followers:
"))\nfriends_count = int(input("Enter number of friends: "))\nstatuses_cou
nt = int(input("Enter number of statuses: "))\ntweet = input("Enter the tw
eet text: ")\n\n# Preprocess user input\nuser_input = np.concatenate((np.a
rray([followers_count, friends_count, statuses_count]).reshape(1, -1), cv.
transform([tweet]).toarray()), axis=1)\n\n# Make prediction on user input
\nprediction = mnb.predict(user_input)\n\nif(prediction==1):\n    print("B
ot")\nelse:\n    print("Human")\n#print("Prediction: ", prediction)'
```

Bernoulli Navie Bayes

In [88]:

```
from sklearn.naive_bayes import BernoulliNB

from sklearn.metrics import accuracy_score, classification_report
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import CountVectorizer

# Assuming your data is in a DataFrame called df
X = np.concatenate((df[['followers_count', 'friends_count', 'statuses_count']].values, c
y = df['bot'].values

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.25, random_state=4

bnb = BernoulliNB(alpha=0.5)
bnb.fit(X_train,y_train)
y_pred_bnb=mnb.predict(X_test)
bnb_accuracy = accuracy_score(y_test,y_pred_bnb)
print("Training accuracy Score    : ",bnb.score(X_train,y_train))
print("Validation accuracy Score : ",bnb_accuracy )
print(classification_report(y_pred_bnb,y_test))
```

```
Training accuracy Score    :  0.9205097087378641
Validation accuracy Score :  0.7963636363636364
              precision    recall  f1-score   support

           0       0.47      0.88      0.61       100
           1       0.97      0.78      0.86       450

    accuracy                           0.80       550
   macro avg       0.72      0.83      0.74       550
weighted avg       0.88      0.80      0.82       550
```

In [89]:

```
"""# Get user input
followers_count = int(input("Enter number of followers: "))
friends_count = int(input("Enter number of friends: "))
statuses_count = int(input("Enter number of statuses: "))
tweet = input("Enter the tweet text: ")

# Preprocess user input
user_input = np.concatenate((np.array([followers_count, friends_count, statuses_count]).

# Make prediction on user input
prediction = bnb.predict(user_input)

if(prediction==1):
    print("Bot")
else:
    print("Human")
#print("Prediction: ", prediction)
"""
```

Out[89]:

```
'# Get user input\nfollowers_count = int(input("Enter number of followers:
"))\nfriends_count = int(input("Enter number of friends: "))\nstatuses_cou
nt = int(input("Enter number of statuses: "))\ntweet = input("Enter the tw
eet text: ")\n\n# Preprocess user input\nuser_input = np.concatenate((np.a
rray([followers_count, friends_count, statuses_count]).reshape(1, -1), cv.
transform([tweet]).toarray()), axis=1)\n\n# Make prediction on user input
\nprediction = bnb.predict(user_input)\n\nif(prediction==1):\n    print("B
ot")\nelse:\n    print("Human")\n#print("Prediction: ", prediction)\n'
```

RandomForestClassifier

In [90]:

```
#multinomial Navie Bayes model
filename = 'bot-model.pkl'
pickle.dump(mnb, open(filename, 'wb'))
```

In [91]:

```
from sklearn.ensemble import RandomForestClassifier

from sklearn.metrics import accuracy_score, classification_report
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import CountVectorizer

# Assuming your data is in a DataFrame called df
X = np.concatenate((df[['followers_count', 'friends_count', 'statuses_count']].values, c
y = df['bot'].values

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.25, random_state=4

rf_clf = RandomForestClassifier()
rf_clf.fit(X_train,y_train)
rf_prediction = rf_clf.predict(X_test)
rf_accuracy = accuracy_score(y_test,rf_prediction)
print("Training accuracy Score    : ",rf_clf.score(X_train,y_train))
print("Validation accuracy Score : ",rf_accuracy )
print(classification_report(rf_prediction,y_test))
```

```
Training accuracy Score    :  1.0
Validation accuracy Score :  0.8527272727272728
              precision    recall  f1-score   support

           0       0.67      0.87      0.76       145
           1       0.95      0.85      0.89       405

    accuracy                           0.85       550
   macro avg       0.81      0.86      0.83       550
weighted avg       0.87      0.85      0.86       550
```

In [92]:

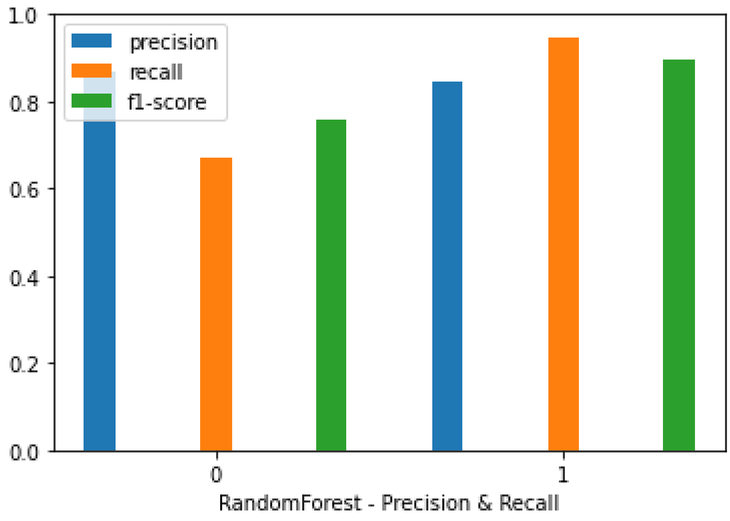
```
"""
# Get user input
followers_count = int(input("Enter number of followers: "))
friends_count = int(input("Enter number of friends: "))
statuses_count = int(input("Enter number of statuses: "))
tweet = input("Enter the tweet text: ")

# Preprocess user input
user_input = np.concatenate((np.array([followers_count, friends_count, statuses_count]).

# Make prediction on user input
prediction = rf_clf.predict(user_input)

if(prediction==1):
    print("Bot")
else:
    print("Human")
#print("Prediction: ", prediction)
"""
```

Out[92]:

```
'\n# Get user input\nfollowers_count = int(input("Enter number of follower
s: "))\nfriends_count = int(input("Enter number of friends: "))\nstatuses_
count = int(input("Enter number of statuses: "))\ntweet = input("Enter the
tweet text: ")\n\n# Preprocess user input\nuser_input = np.concatenate((n
p.array([followers_count, friends_count, statuses_count]).reshape(1, -1),
cv.transform([tweet]).toarray()), axis=1)\n\n# Make prediction on user inp
ut\nprediction = rf_clf.predict(user_input)\n\nif(prediction==1):\n    pri
nt("Bot")\nelse:\n    print("Human")\n#print("Prediction: ", prediction)
\n'
```

In [93]:

```
from sklearn.metrics import classification_report
import matplotlib.pyplot as plt
import numpy as np

# Create the classification report
report = classification_report(y_test, rf_prediction, output_dict=True)

# Extract the precision, recall, and F1-score for each class
classes = list(report.keys())[:-3]
metrics = ["precision", "recall", "f1-score"]
scores = np.zeros((len(classes), len(metrics)))
for i, c in enumerate(classes):
    for j, m in enumerate(metrics):
        scores[i, j] = report[c][m]

# Create the bar chart
x = np.arange(len(classes)) * 3
fig, ax = plt.subplots()
for j, m in enumerate(metrics):
    ax.bar(x - 1 + j, scores[:, j], width=0.8/len(metrics), label=m)
ax.set_xticks(x)
ax.set_xticklabels(classes)
ax.set_xlabel("RandomForest - Precision & Recall")
ax.set_ylim([0, 1])
ax.legend()
plt.show()
```



In [94]:

```
import joblib
joblib.dump(rf_clf, 'RFC-20%.pkl')
RFCjoblib = joblib.load('RFC-20%.pkl')
RFCjoblib.predict(X_test)
```

Out[94]:

```
array([1, 1, 1, 0, 1, 0, 1, 1, 1, 1, 0, 1, 0, 1, 1, 1, 1, 1, 0, 1, 0, 1,
       1, 1, 1, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 1, 1, 0, 1, 1, 1, 1, 1,
       1, 0, 1, 0, 0, 1, 1, 0, 1, 1, 1, 0, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 0, 1, 1, 0, 0, 1, 1, 1,
       1, 1, 1, 1, 0, 1, 1, 0, 1, 1, 1, 1, 1, 1, 0, 1, 0, 1, 1, 1, 1, 0,
       1, 0, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1, 0, 0, 1, 1, 1, 1, 1, 1, 1, 1,
       0, 1, 1, 1, 1, 1, 0, 0, 1, 0, 0, 1, 1, 1, 1, 0, 1, 1, 0, 0, 1, 1,
       1, 0, 1, 0, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1,
       1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 0, 0, 1, 0, 0, 1, 0, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 0, 1,
       1, 1, 1, 1, 1, 0, 0, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 0, 0, 1,
       1, 0, 1, 0, 0, 0, 1, 1, 0, 0, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 0, 1, 0, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1,
       1, 1, 1, 0, 1, 1, 1, 0, 1, 0, 0, 1, 1, 1, 0, 0, 1, 1, 1, 1, 0, 1,
       1, 0, 1, 0, 0, 1, 0, 1, 0, 0, 0, 1, 1, 0, 1, 0, 1, 1, 0, 1, 1, 1,
       1, 1, 1, 0, 1, 0, 0, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 0, 0, 1, 0,
       0, 1, 0, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 0, 1, 1, 0, 1, 1, 0,
       1, 1, 1, 1, 1, 1, 0, 1, 0, 0, 1, 1, 0, 1, 0, 1, 1, 1, 0, 1, 0, 1,
       1, 0, 1, 0, 1, 1, 1, 1, 0, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 0, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 0,
       1, 1, 1, 1, 0, 0, 1, 1, 1, 0, 1, 0, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 0, 0, 1, 0, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 0, 1,
       1, 0, 0, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 0,
       0, 1, 1, 1, 0, 0, 0, 1, 1, 1, 1, 0, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 0, 1, 1, 1, 0, 1],
      dtype=int64)
```

LogisticRegression

In [95]:

```
from sklearn.linear_model import LogisticRegression
```

In [96]:

```
from sklearn.metrics import accuracy_score, classification_report
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import CountVectorizer

# Assuming your data is in a DataFrame called df
X = np.concatenate((df[['followers_count', 'friends_count', 'statuses_count']].values, c
y = df['bot'].values

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.25, random_state=4

LR_clf = LogisticRegression()
LR_clf.fit(X_train,y_train)

LR_pred = LR_clf.predict(X_test)
LR_accuracy = accuracy_score(y_test,LR_pred)
print("Training accuracy Score    : ",LR_clf.score(X_train,y_train))
print("Validation accuracy Score : ",LR_accuracy )
print(classification_report(LR_pred,y_test))
```

```
Training accuracy Score    :  0.7942961165048543
Validation accuracy Score :  0.7872727272727272
              precision    recall  f1-score   support

           0       0.43      0.89      0.58        91
           1       0.97      0.77      0.86       459

    accuracy                           0.79       550
   macro avg       0.70      0.83      0.72       550
weighted avg       0.88      0.79      0.81       550
```

In [97]:

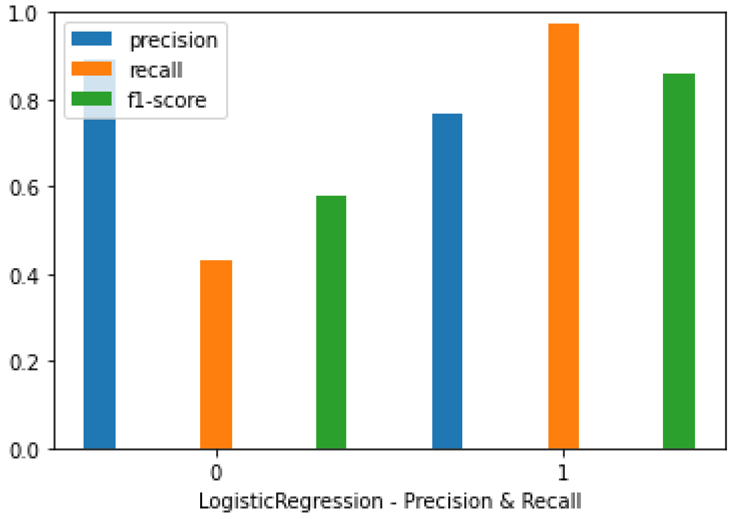
```
"""
# Get user input
followers_count = int(input("Enter number of followers: "))
friends_count = int(input("Enter number of friends: "))
statuses_count = int(input("Enter number of statuses: "))
tweet = input("Enter the tweet text: ")

# Preprocess user input
user_input = np.concatenate((np.array([followers_count, friends_count, statuses_count]).

# Make prediction on user input
prediction = LR_clf.predict(user_input)

if(prediction==1):
    print("Bot")
else:
    print("Human")
#print("Prediction: ", prediction)
"""
```

Out[97]:

```
'\n# Get user input\nfollowers_count = int(input("Enter number of follower
s: "))\nfriends_count = int(input("Enter number of friends: "))\nstatuses_
count = int(input("Enter number of statuses: "))\ntweet = input("Enter the
tweet text: ")\n\n# Preprocess user input\nuser_input = np.concatenate((n
p.array([followers_count, friends_count, statuses_count]).reshape(1, -1),
cv.transform([tweet]).toarray()), axis=1)\n\n# Make prediction on user inp
ut\nprediction = LR_clf.predict(user_input)\n\nif(prediction==1):\n    pri
nt("Bot")\nelse:\n    print("Human")\n#print("Prediction: ", prediction)
\n'
```

In [98]:

```
from sklearn.metrics import classification_report
import matplotlib.pyplot as plt
import numpy as np

# Create the classification report
report = classification_report(y_test, LR_pred, output_dict=True)

# Extract the precision, recall, and F1-score for each class
classes = list(report.keys())[:-3]
metrics = ["precision", "recall", "f1-score"]
scores = np.zeros((len(classes), len(metrics)))
for i, c in enumerate(classes):
    for j, m in enumerate(metrics):
        scores[i, j] = report[c][m]

# Create the bar chart
x = np.arange(len(classes)) * 3
fig, ax = plt.subplots()
for j, m in enumerate(metrics):
    ax.bar(x - 1 + j, scores[:, j], width=0.8/len(metrics), label=m)
ax.set_xticks(x)
ax.set_xticklabels(classes)
ax.set_xlabel("LogisticRegression - Precision & Recall")
ax.set_ylim([0, 1])
ax.legend()
plt.show()
```



In [99]:

```
import joblib
joblib.dump(rf_clf, 'LR-30%.pkl')
LRjoblib = joblib.load('LR-30%.pkl')
LRjoblib.predict(X_test)
```

Out[99]:

```
array([1, 1, 1, 0, 1, 0, 1, 1, 1, 1, 0, 1, 0, 1, 1, 1, 1, 1, 0, 1, 0, 1,
       1, 1, 1, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 1, 1, 0, 1, 1, 1, 1, 1,
       1, 0, 1, 0, 0, 1, 1, 0, 1, 1, 1, 0, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 0, 1, 1, 0, 0, 1, 1, 1,
       1, 1, 1, 1, 0, 1, 1, 0, 1, 1, 1, 1, 1, 1, 0, 1, 0, 1, 1, 1, 1, 0,
       1, 0, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1, 0, 0, 1, 1, 1, 1, 1, 1, 1, 1,
       0, 1, 1, 1, 1, 1, 0, 0, 1, 0, 0, 1, 1, 1, 1, 0, 1, 1, 0, 0, 1, 1,
       1, 0, 1, 0, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1,
       1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 0, 0, 1, 0, 0, 1, 0, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 0, 1,
       1, 1, 1, 1, 1, 0, 0, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 0, 0, 1,
       1, 0, 1, 0, 0, 0, 1, 1, 0, 0, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 0, 1, 0, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1,
       1, 1, 1, 0, 1, 1, 1, 0, 1, 0, 0, 1, 1, 1, 0, 0, 1, 1, 1, 1, 0, 1,
       1, 0, 1, 0, 0, 1, 0, 1, 0, 0, 0, 1, 1, 0, 1, 0, 1, 1, 0, 1, 1, 1,
       1, 1, 1, 0, 1, 0, 0, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 0, 0, 1, 0,
       0, 1, 0, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 0, 1, 1, 0, 1, 1, 0,
       1, 1, 1, 1, 1, 1, 0, 1, 0, 0, 1, 1, 0, 1, 0, 1, 1, 1, 0, 1, 0, 1,
       1, 0, 1, 0, 1, 1, 1, 1, 0, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 0, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 0,
       1, 1, 1, 1, 0, 0, 1, 1, 1, 0, 1, 0, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 0, 0, 1, 0, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 0, 1,
       1, 0, 0, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 0,
       0, 1, 1, 1, 0, 0, 0, 1, 1, 1, 1, 0, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 0, 1, 1, 1, 0, 1],
      dtype=int64)
```

DecisionTreeClassifier

In [100]:

```
from sklearn.tree import DecisionTreeClassifier
```

In [101]:

```
from sklearn.metrics import accuracy_score, classification_report
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import CountVectorizer

# Assuming your data is in a DataFrame called df
X = np.concatenate((df[['followers_count', 'friends_count', 'statuses_count']].values, c
y = df['bot'].values

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.25, random_state=4


DT_clf = DecisionTreeClassifier()
DT_clf.fit(X_train,y_train)
DT_pred = DT_clf.predict(X_test)
DT_accuracy = accuracy_score(y_test,DT_pred)
print("Training accuracy Score    : ",DT_clf.score(X_train,y_train))
print("Validation accuracy Score : ",DT_accuracy )
print(classification_report(DT_pred,y_test))
```

```
Training accuracy Score    :  1.0
Validation accuracy Score :  0.8327272727272728
              precision    recall  f1-score   support

           0       0.75      0.76      0.75       186
           1       0.88      0.87      0.87       364

    accuracy                           0.83       550
   macro avg       0.81      0.81      0.81       550
weighted avg       0.83      0.83      0.83       550
```

In [102]:

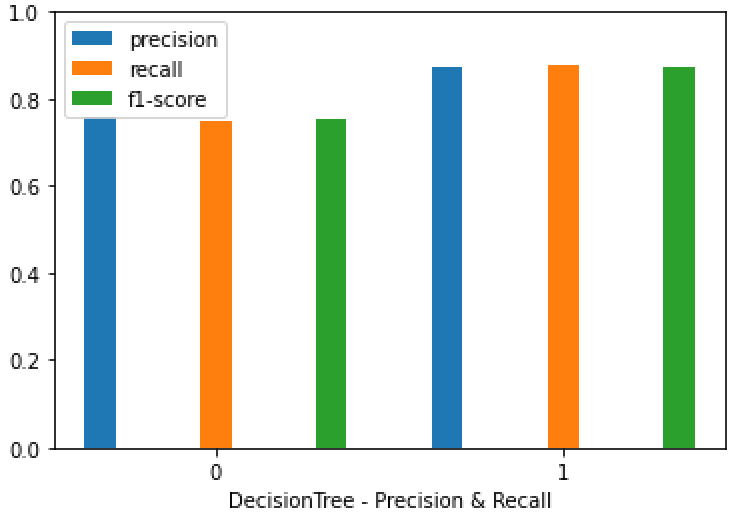
```
"""
# Get user input
followers_count = int(input("Enter number of followers: "))
friends_count = int(input("Enter number of friends: "))
statuses_count = int(input("Enter number of statuses: "))
tweet = input("Enter the tweet text: ")

# Preprocess user input
user_input = np.concatenate((np.array([followers_count, friends_count, statuses_count]).

# Make prediction on user input
prediction = DT_clf.predict(user_input)

if(prediction==1):
    print("Bot")
else:
    print("Human")
#print("Prediction: ", prediction)
"""
```

Out[102]:

```
'\n# Get user input\nfollowers_count = int(input("Enter number of follower
s: "))\nfriends_count = int(input("Enter number of friends: "))\nstatuses_
count = int(input("Enter number of statuses: "))\ntweet = input("Enter the
tweet text: ")\n\n# Preprocess user input\nuser_input = np.concatenate((n
p.array([followers_count, friends_count, statuses_count]).reshape(1, -1),
cv.transform([tweet]).toarray()), axis=1)\n\n# Make prediction on user inp
ut\nprediction = DT_clf.predict(user_input)\n\nif(prediction==1):\n    pri
nt("Bot")\nelse:\n    print("Human")\n#print("Prediction: ", prediction)
\n'
```

In [103]:

```python
from sklearn.metrics import classification_report
import matplotlib.pyplot as plt
import numpy as np

# Create the classification report
report = classification_report(y_test, DT_pred, output_dict=True)

# Extract the precision, recall, and F1-score for each class
classes = list(report.keys())[:-3]
metrics = ["precision", "recall", "f1-score"]
scores = np.zeros((len(classes), len(metrics)))
for i, c in enumerate(classes):
    for j, m in enumerate(metrics):
        scores[i, j] = report[c][m]

# Create the bar chart
x = np.arange(len(classes)) * 3
fig, ax = plt.subplots()
for j, m in enumerate(metrics):
    ax.bar(x - 1 + j, scores[:, j], width=0.8/len(metrics), label=m)
ax.set_xticks(x)
ax.set_xticklabels(classes)
ax.set_xlabel("DecisionTree - Precision & Recall")
ax.set_ylim([0, 1])
ax.legend()
plt.show()
```



In [104]:

```
import joblib
joblib.dump(DT_clf, 'DT-30%.pkl')
dtjoblib = joblib.load('DT-30%.pkl')
dtjoblib.predict(X_test)
```

Out[104]:

```
array([1, 0, 0, 1, 1, 0, 1, 1, 1, 1, 0, 0, 1, 1, 1, 1, 1, 1, 0, 1, 0, 1,
       1, 1, 1, 1, 0, 1, 0, 1, 1, 1, 0, 0, 0, 1, 1, 1, 0, 1, 1, 1, 1, 1,
       1, 1, 0, 0, 1, 1, 1, 0, 1, 1, 1, 0, 1, 0, 1, 1, 1, 0, 0, 1, 0, 0,
       1, 1, 1, 1, 0, 1, 0, 1, 1, 1, 0, 0, 1, 1, 0, 1, 1, 0, 0, 1, 1, 1,
       1, 1, 1, 1, 0, 1, 1, 0, 0, 0, 1, 1, 0, 1, 0, 1, 0, 0, 1, 1, 1, 0,
       1, 0, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1, 0, 1, 1, 1, 1,
       0, 1, 0, 1, 1, 1, 0, 0, 1, 0, 0, 1, 1, 1, 1, 0, 1, 1, 0, 1, 1, 1,
       1, 1, 1, 0, 1, 1, 1, 1, 0, 0, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1,
       0, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 0, 0, 1, 0, 0, 1, 0, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 0, 1,
       0, 0, 1, 0, 0, 0, 0, 1, 1, 0, 1, 1, 0, 1, 1, 1, 1, 1, 1, 0, 1, 1,
       1, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 1, 1, 1, 0, 1, 1, 0, 0, 1,
       1, 0, 1, 0, 0, 1, 1, 1, 1, 0, 0, 0, 1, 1, 1, 0, 1, 0, 1, 1, 0, 0,
       1, 1, 1, 1, 1, 1, 1, 0, 1, 0, 1, 1, 0, 1, 0, 1, 1, 1, 1, 0, 0, 1,
       1, 0, 1, 0, 0, 1, 1, 1, 0, 0, 0, 1, 1, 0, 1, 0, 1, 1, 1, 1, 1, 1,
       1, 1, 0, 0, 1, 0, 1, 1, 1, 1, 1, 1, 1, 0, 0, 1, 1, 1, 0, 1, 1, 0,
       0, 1, 0, 1, 1, 1, 1, 1, 1, 0, 0, 1, 1, 1, 0, 0, 1, 1, 1, 1, 1, 0,
       0, 1, 1, 1, 1, 1, 0, 1, 0, 0, 1, 1, 0, 1, 1, 1, 1, 1, 0, 1, 0, 1,
       1, 0, 1, 0, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 1, 0, 0, 1, 1,
       1, 1, 0, 1, 0, 1, 1, 0, 0, 1, 1, 1, 0, 0, 1, 1, 1, 1, 0, 1, 1, 0,
       1, 1, 1, 1, 0, 0, 1, 1, 1, 0, 1, 0, 0, 1, 1, 0, 1, 1, 1, 1, 0, 0,
       0, 1, 0, 0, 0, 1, 0, 0, 1, 0, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1,
       1, 0, 0, 1, 0, 1, 1, 0, 1, 1, 1, 1, 1, 0, 1, 0, 1, 1, 0, 1, 1, 1,
       0, 0, 1, 0, 0, 0, 0, 1, 1, 1, 1, 0, 1, 1, 0, 1, 0, 1, 1, 0, 1, 1,
       0, 1, 1, 1, 1, 0, 0, 1, 1, 1, 0, 1, 1, 1, 1, 1, 0, 1, 1, 1, 0, 1],
      dtype=int64)
```

Support Vector Machine (SVM)

In [105]:

```
X_train
```

Out[105]:

```
array([[   14,     0,   129, ...,     0,     0,     0],
       [  115,    93,   126, ...,     0,     0,     0],
       [  280,    48,  4722, ...,     0,     0,     0],
       ...,
       [  236,     0,  2821, ...,     0,     0,     0],
       [  260,     0, 25155, ...,     0,     0,     0],
       [ 2339,     1,  3625, ...,     0,     0,     0]], dtype=int64)
```

In [106]:

```
y_train
```

Out[106]:

```
array([1, 0, 1, ..., 1, 1, 1], dtype=int64)
```

In [107]:

```
from sklearn.svm import SVC
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score, classification_report
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import CountVectorizer

# Assuming your data is in a DataFrame called df
X = np.concatenate((df[['followers_count', 'friends_count', 'statuses_count']].values, c
y = df['bot'].values

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.25, random_state=4

svm_clf = SVC()
svm_clf.fit(X_train,y_train)
svm_pred = svm_clf.predict(X_test)
svm_accuracy = accuracy_score(y_test,svm_pred)
print("Training accuracy Score    : ",svm_clf.score(X_train,y_train))
print("Validation accuracy Score : ",svm_accuracy )
print(classification_report(svm_pred,y_test))
```

```
Training accuracy Score    :  0.7402912621359223
Validation accuracy Score :  0.7490909090909091
              precision    recall  f1-score   support

           0       0.28      0.95      0.43        56
           1       0.99      0.73      0.84       494

    accuracy                           0.75       550
   macro avg       0.64      0.84      0.64       550
weighted avg       0.92      0.75      0.80       550
```

In [108]:

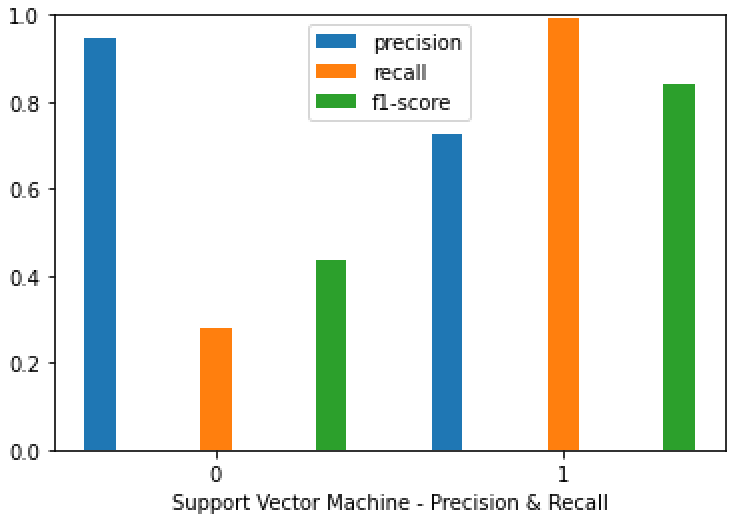
```
"""
# Get user input
followers_count = int(input("Enter number of followers: "))
friends_count = int(input("Enter number of friends: "))
statuses_count = int(input("Enter number of statuses: "))
tweet = input("Enter the tweet text: ")

# Preprocess user input
user_input = np.concatenate((np.array([followers_count, friends_count, statuses_count]).

# Make prediction on user input
prediction = svm_clf.predict(user_input)

if(prediction==1):
    print("Bot")
else:
    print("Human")
#print("Prediction: ", prediction)
"""
```

Out[108]:

```
'\n# Get user input\nfollowers_count = int(input("Enter number of follower
s: "))\nfriends_count = int(input("Enter number of friends: "))\nstatuses_
count = int(input("Enter number of statuses: "))\ntweet = input("Enter the
tweet text: ")\n\n# Preprocess user input\nuser_input = np.concatenate((n
p.array([followers_count, friends_count, statuses_count]).reshape(1, -1),
cv.transform([tweet]).toarray()), axis=1)\n\n# Make prediction on user inp
ut\nprediction = svm_clf.predict(user_input)\n\nif(prediction==1):\n    pr
int("Bot")\nelse:\n    print("Human")\n#print("Prediction: ", prediction)
\n'
```

In [109]:

```
from sklearn.metrics import classification_report
import matplotlib.pyplot as plt
import numpy as np

# Create the classification report
report = classification_report(y_test, svm_pred, output_dict=True)

# Extract the precision, recall, and F1-score for each class
classes = list(report.keys())[:-3]
metrics = ["precision", "recall", "f1-score"]
scores = np.zeros((len(classes), len(metrics)))
for i, c in enumerate(classes):
    for j, m in enumerate(metrics):
        scores[i, j] = report[c][m]

# Create the bar chart
x = np.arange(len(classes)) * 3
fig, ax = plt.subplots()
for j, m in enumerate(metrics):
    ax.bar(x - 1 + j, scores[:, j], width=0.8/len(metrics), label=m)
ax.set_xticks(x)
ax.set_xticklabels(classes)
ax.set_xlabel("Support Vector Machine - Precision & Recall")
ax.set_ylim([0, 1])
ax.legend()
plt.show()
```



In [110]:

```
import joblib
joblib.dump(svm_clf, 'SVC-20%.pkl')
svcjoblib = joblib.load('SVC-20%.pkl')
svcjoblib.predict(X_test)
```

Out[110]:

```
array([1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 0, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1,
       1, 0, 1, 0, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1,
       1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1,
       0, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 0, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1,
       1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 0, 0, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1,
       1, 1, 1, 0, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 0, 0, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1,
       1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 0,
       0, 1, 0, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0,
       1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 0, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 0, 0, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1,
       1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1],
      dtype=int64)
```

AdaBoostClassifier

In [111]:

```
from sklearn.ensemble import AdaBoostClassifier

from sklearn.metrics import accuracy_score, classification_report
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import CountVectorizer

# Assuming your data is in a DataFrame called df
X = np.concatenate((df[['followers_count', 'friends_count', 'statuses_count']].values, c
y = df['bot'].values

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.25, random_state=4

ada_clf = AdaBoostClassifier(n_estimators=100,random_state=0)
ada_clf.fit(X_train,y_train)
ada_pred = ada_clf.predict(X_test)
ada_accuracy = accuracy_score(y_test,ada_pred)
print("Training accuracy Score    : ",ada_clf.score(X_train,y_train))
print("Validation accuracy Score : ",ada_accuracy )
print(classification_report(ada_pred,y_test))
```

```
Training accuracy Score    :  0.9277912621359223
Validation accuracy Score :  0.8490909090909091
              precision    recall  f1-score   support

           0       0.76      0.79      0.77       179
           1       0.90      0.88      0.89       371

    accuracy                           0.85       550
   macro avg       0.83      0.83      0.83       550
weighted avg       0.85      0.85      0.85       550
```

In [112]:

```
"""
# Get user input
followers_count = int(input("Enter number of followers: "))
friends_count = int(input("Enter number of friends: "))
statuses_count = int(input("Enter number of statuses: "))
tweet = input("Enter the tweet text: ")

# Preprocess user input
user_input = np.concatenate((np.array([followers_count, friends_count, statuses_count]).

# Make prediction on user input
prediction = ada_clf.predict(user_input)

if(prediction==1):
    print("Bot")
else:
    print("Human")
#print("Prediction: ", prediction)
"""
```

Out[112]:

```
'\n# Get user input\nfollowers_count = int(input("Enter number of follower
s: "))\nfriends_count = int(input("Enter number of friends: "))\nstatuses_
count = int(input("Enter number of statuses: "))\ntweet = input("Enter the
tweet text: ")\n\n# Preprocess user input\nuser_input = np.concatenate((n
p.array([followers_count, friends_count, statuses_count]).reshape(1, -1),
cv.transform([tweet]).toarray()), axis=1)\n\n# Make prediction on user inp
ut\nprediction = ada_clf.predict(user_input)\n\nif(prediction==1):\n    pr
int("Bot")\nelse:\n    print("Human")\n#print("Prediction: ", prediction)
\n'
```

KNeighborsClassifier

In [113]:

```
from sklearn.neighbors import KNeighborsClassifier

from sklearn.metrics import accuracy_score, classification_report
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import CountVectorizer

# Assuming your data is in a DataFrame called df
X = np.concatenate((df[['followers_count', 'friends_count', 'statuses_count']].values, c
y = df['bot'].values

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.25, random_state=4

knn_clf = KNeighborsClassifier(n_neighbors=5)
knn_clf.fit(X_train,y_train)
knn_pred = knn_clf.predict(X_test)
knn_accuracy = accuracy_score(y_test,knn_pred)
print("Training accuracy Score    : ",knn_clf.score(X_train,y_train))
print("Validation accuracy Score : ",knn_accuracy )
print(classification_report(knn_pred,y_test))
```

```
Training accuracy Score    :  0.8847087378640777
Validation accuracy Score :  0.8327272727272728
              precision    recall  f1-score   support

           0       0.75      0.76      0.75       186
           1       0.88      0.87      0.87       364

    accuracy                           0.83       550
   macro avg       0.81      0.81      0.81       550
weighted avg       0.83      0.83      0.83       550
```

In [114]:

```
"""
# Get user input
followers_count = int(input("Enter number of followers: "))
friends_count = int(input("Enter number of friends: "))
statuses_count = int(input("Enter number of statuses: "))
tweet = input("Enter the tweet text: ")

# Preprocess user input
user_input = np.concatenate((np.array([followers_count, friends_count, statuses_count]).

# Make prediction on user input
prediction = knn_clf.predict(user_input)

if(prediction==1):
    print("Bot")
else:
    print("Human")
#print("Prediction: ", prediction)
"""
```

Out[114]:

```
'\n# Get user input\nfollowers_count = int(input("Enter number of follower
s: "))\nfriends_count = int(input("Enter number of friends: "))\nstatuses_
count = int(input("Enter number of statuses: "))\ntweet = input("Enter the
tweet text: ")\n\n# Preprocess user input\nuser_input = np.concatenate((n
p.array([followers_count, friends_count, statuses_count]).reshape(1, -1),
cv.transform([tweet]).toarray()), axis=1)\n\n# Make prediction on user inp
ut\nprediction = knn_clf.predict(user_input)\n\nif(prediction==1):\n    pr
int("Bot")\nelse:\n    print("Human")\n#print("Prediction: ", prediction)
\n'
```

OneVsRestClassifier

In [115]:

```
from sklearn.multiclass import OneVsRestClassifier
from sklearn.svm import SVC

from sklearn.metrics import accuracy_score, classification_report
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import CountVectorizer

# Assuming your data is in a DataFrame called df
X = np.concatenate((df[['followers_count', 'friends_count', 'statuses_count']].values, c
y = df['bot'].values

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.25, random_state=4

onevsrestsvm_clf = OneVsRestClassifier(SVC()).fit(X_train,y_train)
onevsrestsvm_pred = onevsrestsvm_clf.predict(X_test)
onevsrestsvm_accuracy = accuracy_score(y_test,onevsrestsvm_pred)
print("Training accuracy Score    : ",onevsrestsvm_clf.score(X_train,y_train))
print("Validation accuracy Score : ",onevsrestsvm_accuracy )
print(classification_report(onevsrestsvm_pred,y_test))
```

```
Training accuracy Score    :  0.7402912621359223
Validation accuracy Score :  0.7490909090909091
              precision    recall  f1-score   support

           0       0.28      0.95      0.43        56
           1       0.99      0.73      0.84       494

    accuracy                           0.75       550
   macro avg       0.64      0.84      0.64       550
weighted avg       0.92      0.75      0.80       550
```

In [116]:

```
"""
# Get user input
followers_count = int(input("Enter number of followers: "))
friends_count = int(input("Enter number of friends: "))
statuses_count = int(input("Enter number of statuses: "))
tweet = input("Enter the tweet text: ")

# Preprocess user input
user_input = np.concatenate((np.array([followers_count, friends_count, statuses_count]).

# Make prediction on user input
prediction = onevsrestsvm_clf.predict(user_input)

if(prediction==1):
    print("Bot")
else:
    print("Human")
#print("Prediction: ", prediction)
"""
```

Out[116]:

```
'\n# Get user input\nfollowers_count = int(input("Enter number of follower
s: "))\nfriends_count = int(input("Enter number of friends: "))\nstatuses_
count = int(input("Enter number of statuses: "))\ntweet = input("Enter the
tweet text: ")\n\n# Preprocess user input\nuser_input = np.concatenate((n
p.array([followers_count, friends_count, statuses_count]).reshape(1, -1),
cv.transform([tweet]).toarray()), axis=1)\n\n# Make prediction on user inp
ut\nprediction = onevsrestsvm_clf.predict(user_input)\n\nif(prediction==
1):\n    print("Bot")\nelse:\n    print("Human")\n#print("Prediction: ", p
rediction)\n'
```

In [117]:

```
from sklearn.multiclass import OneVsRestClassifier

from sklearn.metrics import accuracy_score, classification_report
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import CountVectorizer

# Assuming your data is in a DataFrame called df
X = np.concatenate((df[['followers_count', 'friends_count', 'statuses_count']].values, c
y = df['bot'].values

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.25, random_state=4

onevsrestxgb_clf = OneVsRestClassifier(xgb.XGBClassifier()).fit(X_train,y_train)
onevsrestxgb_pred = onevsrestxgb_clf.predict(X_test)
onevsrestxgb_accuracy = accuracy_score(y_test,onevsrestxgb_pred)
print("Training accuracy Score    : ",onevsrestxgb_clf.score(X_train,y_train))
print("Validation accuracy Score : ",onevsrestxgb_accuracy )
print(classification_report(onevsrestxgb_pred,y_test))
```

```
Training accuracy Score    :  0.9993932038834952
Validation accuracy Score :  0.8890909090909091
              precision    recall  f1-score   support

           0       0.84      0.84      0.84       189
           1       0.91      0.92      0.92       361

    accuracy                           0.89       550
   macro avg       0.88      0.88      0.88       550
weighted avg       0.89      0.89      0.89       550
```

In [118]:

```
"""
# Get user input
followers_count = int(input("Enter number of followers: "))
friends_count = int(input("Enter number of friends: "))
statuses_count = int(input("Enter number of statuses: "))
tweet = input("Enter the tweet text: ")

# Preprocess user input
user_input = np.concatenate((np.array([followers_count, friends_count, statuses_count]).

# Make prediction on user input
prediction = onevsrestxgb_clf.predict(user_input)

if(prediction==1):
    print("Bot")
else:
    print("Human")
#print("Prediction: ", prediction)
"""
```

Out[118]:

```
'\n# Get user input\nfollowers_count = int(input("Enter number of follower
s: "))\nfriends_count = int(input("Enter number of friends: "))\nstatuses_
count = int(input("Enter number of statuses: "))\ntweet = input("Enter the
tweet text: ")\n\n# Preprocess user input\nuser_input = np.concatenate((n
p.array([followers_count, friends_count, statuses_count]).reshape(1, -1),
cv.transform([tweet]).toarray()), axis=1)\n\n# Make prediction on user inp
ut\nprediction = onevsrestxgb_clf.predict(user_input)\n\nif(prediction==
1):\n    print("Bot")\nelse:\n    print("Human")\n#print("Prediction: ", p
rediction)\n'
```

In [119]:

```
from sklearn.multiclass import OneVsRestClassifier
from sklearn.neighbors import KNeighborsClassifier

from sklearn.metrics import accuracy_score, classification_report
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import CountVectorizer

# Assuming your data is in a DataFrame called df
X = np.concatenate((df[['followers_count', 'friends_count', 'statuses_count']].values, c
y = df['bot'].values

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.25, random_state=4

onevsrestknn_clf = OneVsRestClassifier(KNeighborsClassifier(n_neighbors=3)).fit(X_train,
onevsrestknn_pred = onevsrestknn_clf.predict(X_test)
onevsrestknn_accuracy = accuracy_score(y_test,onevsrestknn_pred)
print("Training accuracy Score    : ",onevsrestknn_clf.score(X_train,y_train))
print("Validation accuracy Score : ",onevsrestknn_accuracy )
print(classification_report(onevsrestknn_pred,y_test))
```

```
Training accuracy Score    :  0.9010922330097088
Validation accuracy Score :  0.8272727272727273
              precision    recall  f1-score   support

           0       0.75      0.75      0.75       189
           1       0.87      0.87      0.87       361

    accuracy                           0.83       550
   macro avg       0.81      0.81      0.81       550
weighted avg       0.83      0.83      0.83       550
```

In [120]:

```
"""
# Get user input
followers_count = int(input("Enter number of followers: "))
friends_count = int(input("Enter number of friends: "))
statuses_count = int(input("Enter number of statuses: "))
tweet = input("Enter the tweet text: ")

# Preprocess user input
user_input = np.concatenate((np.array([followers_count, friends_count, statuses_count]).

# Make prediction on user input
prediction = onevsrestknn_clf.predict(user_input)

if(prediction==1):
    print("Bot")
else:
    print("Human")
#print("Prediction: ", prediction)
"""
```

Out[120]:

```
'\n# Get user input\nfollowers_count = int(input("Enter number of follower
s: "))\nfriends_count = int(input("Enter number of friends: "))\nstatuses_
count = int(input("Enter number of statuses: "))\ntweet = input("Enter the
tweet text: ")\n\n# Preprocess user input\nuser_input = np.concatenate((n
p.array([followers_count, friends_count, statuses_count]).reshape(1, -1),
cv.transform([tweet]).toarray()), axis=1)\n\n# Make prediction on user inp
ut\nprediction = onevsrestknn_clf.predict(user_input)\n\nif(prediction==
1):\n    print("Bot")\nelse:\n    print("Human")\n#print("Prediction: ", p
rediction)\n'
```

In [121]:

```
from sklearn.multiclass import OneVsRestClassifier
from sklearn.ensemble import RandomForestClassifier

from sklearn.metrics import accuracy_score, classification_report
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import CountVectorizer

# Assuming your data is in a DataFrame called df
X = np.concatenate((df[['followers_count', 'friends_count', 'statuses_count']].values, c
y = df['bot'].values

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.25, random_state=4

onevsrestrfc_clf = OneVsRestClassifier(RandomForestClassifier()).fit(X_train,y_train)
onevsrestrfc_pred = onevsrestrfc_clf.predict(X_test)
onevsrestrfc_accuracy = accuracy_score(y_test,onevsrestrfc_pred)
print("Training accuracy Score    : ",onevsrestrfc_clf.score(X_train,y_train))
print("Validation accuracy Score : ",onevsrestrfc_accuracy )
print(classification_report(onevsrestrfc_pred,y_test))
```

```
Training accuracy Score    :  1.0
Validation accuracy Score :  0.84
              precision    recall  f1-score   support

           0       0.64      0.85      0.73       142
           1       0.94      0.84      0.89       408

    accuracy                           0.84       550
   macro avg       0.79      0.84      0.81       550
weighted avg       0.86      0.84      0.85       550
```

In [122]:

```
"""
# Get user input
followers_count = int(input("Enter number of followers: "))
friends_count = int(input("Enter number of friends: "))
statuses_count = int(input("Enter number of statuses: "))
tweet = input("Enter the tweet text: ")

# Preprocess user input
user_input = np.concatenate((np.array([followers_count, friends_count, statuses_count]).

# Make prediction on user input
prediction = onevsrestrfc_clf.predict(user_input)

if(prediction==1):
    print("Bot")
else:
    print("Human")
#print("Prediction: ", prediction)
"""
```

Out[122]:

```
'\n# Get user input\nfollowers_count = int(input("Enter number of follower
s: "))\nfriends_count = int(input("Enter number of friends: "))\nstatuses_
count = int(input("Enter number of statuses: "))\ntweet = input("Enter the
tweet text: ")\n\n# Preprocess user input\nuser_input = np.concatenate((n
p.array([followers_count, friends_count, statuses_count]).reshape(1, -1),
cv.transform([tweet]).toarray()), axis=1)\n\n# Make prediction on user inp
ut\nprediction = onevsrestrfc_clf.predict(user_input)\n\nif(prediction==
1):\n    print("Bot")\nelse:\n    print("Human")\n#print("Prediction: ", p
rediction)\n'
```

In [123]:

```
from sklearn.multiclass import OneVsRestClassifier

from sklearn.metrics import accuracy_score, classification_report
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import CountVectorizer

# Assuming your data is in a DataFrame called df
X = np.concatenate((df[['followers_count', 'friends_count', 'statuses_count']].values, c
y = df['bot'].values

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.25, random_state=4

onevsrestdt_clf = OneVsRestClassifier(DecisionTreeClassifier()).fit(X_train,y_train)
onevsrestdt_pred = onevsrestdt_clf.predict(X_test)
onevsrestdt_accuracy = accuracy_score(y_test,onevsrestdt_pred)
print("Training accuracy Score    : ",onevsrestdt_clf.score(X_train,y_train))
print("Validation accuracy Score : ",onevsrestdt_accuracy )
print(classification_report(onevsrestdt_pred,y_test))
```

```
Training accuracy Score    :  1.0
Validation accuracy Score :  0.84
              precision    recall  f1-score   support

           0       0.77      0.77      0.77       188
           1       0.88      0.88      0.88       362

    accuracy                           0.84       550
   macro avg       0.82      0.82      0.82       550
weighted avg       0.84      0.84      0.84       550
```

In [124]:

```
"""
# Get user input
followers_count = int(input("Enter number of followers: "))
friends_count = int(input("Enter number of friends: "))
statuses_count = int(input("Enter number of statuses: "))
tweet = input("Enter the tweet text: ")

# Preprocess user input
user_input = np.concatenate((np.array([followers_count, friends_count, statuses_count]).

# Make prediction on user input
prediction = onevsrestdt_clf.predict(user_input)

if(prediction==1):
    print("Bot")
else:
    print("Human")
#print("Prediction: ", prediction)
"""
```

Out[124]:

```
'\n# Get user input\nfollowers_count = int(input("Enter number of follower
s: "))\nfriends_count = int(input("Enter number of friends: "))\nstatuses_
count = int(input("Enter number of statuses: "))\ntweet = input("Enter the
tweet text: ")\n\n# Preprocess user input\nuser_input = np.concatenate((n
p.array([followers_count, friends_count, statuses_count]).reshape(1, -1),
cv.transform([tweet]).toarray()), axis=1)\n\n# Make prediction on user inp
ut\nprediction = onevsrestdt_clf.predict(user_input)\n\nif(prediction==
1):\n    print("Bot")\nelse:\n    print("Human")\n#print("Prediction: ", p
rediction)\n'
```

XGBoost - XGBClassifier

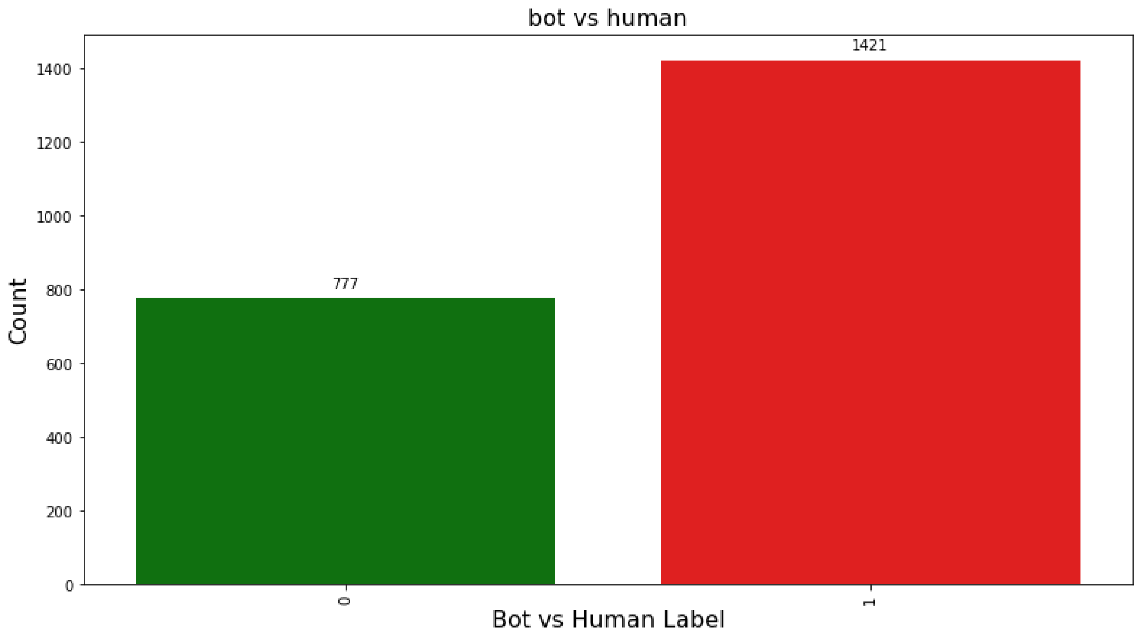
In [125]:

```
!pip install xgboost

from numpy import loadtxt
from xgboost import XGBClassifier
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

datasetxg = pd.read_csv("finaldata1.csv")
```

```
Requirement already satisfied: xgboost in c:\users\sanjeevan\anaconda3\lib
\site-packages (1.7.4)
Requirement already satisfied: scipy in c:\users\sanjeevan\anaconda3\lib\s
ite-packages (from xgboost) (1.10.1)
Requirement already satisfied: numpy in c:\users\sanjeevan\anaconda3\lib\s
ite-packages (from xgboost) (1.24.2)
```

In [126]:

```
plt.figure(figsize=(13,7))
ax = sns.countplot(x=datasetxg.bot, palette={0: 'green', 1: 'red'})
plt.title('bot vs human', fontsize=16)
plt.ylabel('Count', fontsize=16)
plt.xlabel('Bot vs Human Label', fontsize=16)
plt.xticks(rotation='vertical')

# Annotate each bar with its count
for p in ax.patches:
    ax.annotate(format(p.get_height(), '.0f'),
                (p.get_x() + p.get_width() / 2., p.get_height()),
                ha = 'center', va = 'center',
                xytext = (0, 10),
                textcoords = 'offset points')
```



In [127]:

```
#!pip install gensim

#!pip install --upgrade numpy

X = df[['followers_count','friends_count','statuses_count','tweet']]
Y = df['bot']
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, Y, test_size=0.25)
```

In [128]:

```
import nltk
#nltk.download('stopwords')
from nltk.corpus import stopwords
stop_words = set(stopwords.words('english'))#an,is,..
from sklearn.base import BaseEstimator, TransformerMixin
class TextSelector(BaseEstimator, TransformerMixin):
    def __init__(self, field):
        self.field = field
    def fit(self, X, y=None):
        return self
    def transform(self, X):
        return X[self.field]
class NumberSelector(BaseEstimator, TransformerMixin):
    def __init__(self, field):
        self.field = field
    def fit(self, X, y=None):
        return self
    def transform(self, X):
        return X[[self.field]]
```

In [129]:

```
from sklearn.pipeline import Pipeline, FeatureUnion
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.preprocessing import StandardScaler
from sklearn.decomposition import TruncatedSVD
from sklearn.ensemble import RandomForestClassifier
from sklearn.base import BaseEstimator, TransformerMixin

from xgboost import XGBClassifier

from nltk.tokenize import word_tokenize
import re
import nltk
def Tokenizer(str_input):
    words = re.sub(r"[^A-Za-z ]", " ", str_input).lower().split()
    lemmatizer = WordNetLemmatizer()
    words = [lemmatizer.lemmatize(word) for word in words if not word in stopwords.words
    return words


#from sklearn.feature_extraction.stop_words import ENGLISH_STOP_WORDS as stop_words

#Both pipelines are then combined into a FeatureUnion, which concatenates the output of
# TfidfVectorizer - Transforms text to feature vectors that can be used as input to esti

classifier = Pipeline([
    ('features', FeatureUnion([
        ('text', Pipeline([
            ('colext', TextSelector('tweet')),
            ('tfidf', TfidfVectorizer(tokenizer=Tokenizer, stop_words=stop_words,
                     min_df=.0025, max_df=0.25, ngram_range=(1,3))),
            ('svd', TruncatedSVD(algorithm='randomized', n_components=300)),
        ])),
        ('followers', Pipeline([
            ('fext', NumberSelector('followers_count')),
            ('fscaler', StandardScaler()),
        ])),
        ('friends', Pipeline([
            ('frndext', NumberSelector('friends_count')),
            ('frndscaler', StandardScaler()),
        ])),
        ('statuses', Pipeline([
            ('stext', NumberSelector('statuses_count')),
            ('stscaler', StandardScaler()),
        ]))
    ])),
    ('clf', XGBClassifier(max_depth=3, n_estimators=350, learning_rate=0.1)),
])
```

In [130]:

```
#print(y_train)
print(X_train)
```

```
      followers_count  friends_count  statuses_count  \
1955               31             39            1856   
610                29             97               3   
543              6805             88            3272   
1126                7              1             246   
1375              152              0            3301   
...               ...            ...             ...   
919                 5            474              81   
2000            89537           7950           55289   
389               275              1            1961   
832                33             38              17   
649              4956              7            2179   

                                                  tweet  
1955  Someone PLEASE take Gossip Girl away from me. ...  
610   i just caught myself eating chocolate sliced b...  
543   You can buy Twitter Followers on FollowerSale ...  
1126    I'm not lamplit but I am illuminated by a lamp.  
1375  EAT With so much fresh food available, seek ou...  
...                                                 ...  
919   For more Free VIds visit  people and to know m...  
2000  Me toooooo! I feel like I've been on the verge...  
389   how the #altright uses  &amp; insecurity to lu...  
832          girls in the world smart mature housewife   
649   519:d*NC Ant | lithograph about Antiquities ht...  

[1648 rows x 4 columns]
```

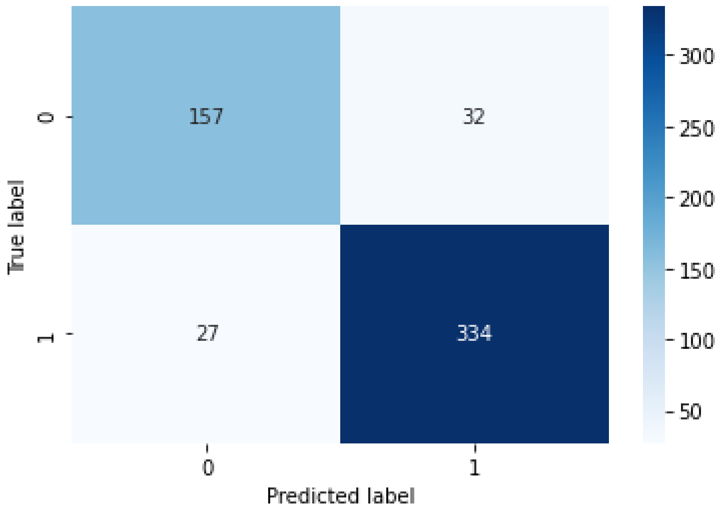
In [131]:

```
from sklearn.metrics import accuracy_score, precision_score, classification_report, conf

classifier.fit(X_train, y_train)
preds = classifier.predict(X_test)
print ("Accuracy:", classifier.score(X_train,y_train))
xgbboost_accuracy = accuracy_score(y_test,preds)
print("Validation accuracy Score : ",xgbboost_accuracy )
print(classification_report(y_test, preds))
print (confusion_matrix(y_test, preds))
```

```
Accuracy: 0.9987864077669902
Validation accuracy Score :  0.8927272727272727
              precision    recall  f1-score   support

           0       0.85      0.83      0.84       189
           1       0.91      0.93      0.92       361

    accuracy                           0.89       550
   macro avg       0.88      0.88      0.88       550
weighted avg       0.89      0.89      0.89       550

[[157  32]
 [ 27 334]]
```

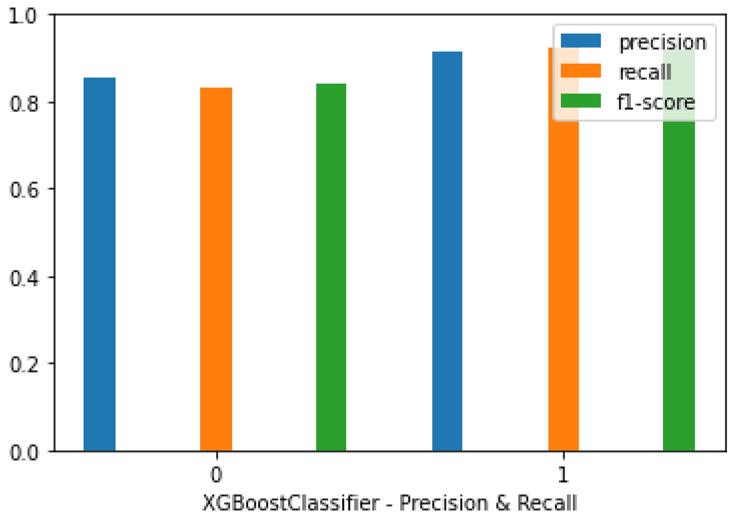
In [132]:

```
import seaborn as sns

# Create confusion matrix
cm = confusion_matrix(y_test, preds)

# Create heatmap
sns.heatmap(cm, annot=True, cmap="Blues", fmt="d")

# Set axis labels
plt.xlabel("Predicted label")
plt.ylabel("True label")

# Show plot
plt.show()
```



In [133]:

```
from sklearn.metrics import classification_report
import matplotlib.pyplot as plt
import numpy as np

# Create the classification report
report = classification_report(y_test, preds, output_dict=True)

# Extract the precision, recall, and F1-score for each class
classes = list(report.keys())[:-3]
metrics = ["precision", "recall", "f1-score"]
scores = np.zeros((len(classes), len(metrics)))
for i, c in enumerate(classes):
    for j, m in enumerate(metrics):
        scores[i, j] = report[c][m]

# Create the bar chart
x = np.arange(len(classes)) * 3
fig, ax = plt.subplots()
for j, m in enumerate(metrics):
    ax.bar(x - 1 + j, scores[:, j], width=0.8/len(metrics), label=m)
ax.set_xticks(x)
ax.set_xticklabels(classes)
ax.set_xlabel("XGBoostClassifier - Precision & Recall")
ax.set_ylim([0, 1])
ax.legend()
plt.show()
```



XGboost

In [134]:

```
"""
input_tweet = "welcome tweet" # replace "example tweet" with the tweet you want to class
input_followers = 100 # replace 100 with the number of followers for the Twitter user as
friends=200
status=30
# create a dataframe with the input data
input_df = pd.DataFrame({'tweet': [input_tweet], 'followers_count': [input_followers], '

# use the classifier to make predictions on the input data
predictions = classifier.predict(input_df)

# print the predictions

if(predictions==1):
    print("bot")
else:
    print("human")
#print(predictions)
"""
```

Out[134]:

```
'\ninput_tweet = "welcome tweet" # replace "example tweet" with the tweet
you want to classify\ninput_followers = 100 # replace 100 with the number
of followers for the Twitter user associated with the input tweet\nfriends
=200\nstatus=30\n# create a dataframe with the input data\ninput_df = pd.D
ataFrame({\'tweet\': [input_tweet], \'followers_count\': [input_follower
s], \'friends_count\':[friends], \'statuses_count\':[status]})\n\n# use th
e classifier to make predictions on the input data\npredictions = classifi
er.predict(input_df)\n\n# print the predictions\n\nif(predictions==1):\n
print("bot")\nelse:\n    print("human")\n#print(predictions)\n'
```

In [ ]:

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In [ ]:

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In [ ]:

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