## **Bot**

```
In [1]:
         import numpy as np
         import pandas as pd
         import matplotlib.pyplot as plt
         import seaborn as sns
         from sklearn.linear model import LogisticRegression
In [3]: df=pd.read_csv(r"C:\Users\user\Downloads\bot.csv")
                102101
                                          against
                                                                                                       15:29:50
                                           natural
                                          majori...
                                         Authority
                                         research
                                                                                                         2022-
              1 289683
                         hinesstephanie
                                        natural life
                                                       55
                                                                5
                                                                      9617
                                                                              True
                                                                                       0
                                                                                            Sanderston
                                                                                                         11-26
                                          materia
                                                                                                       05:18:10
                                           staff...
                                          Manage
                                           whose
                                                                                                         2022-
                                           quickly
              2 779715
                                                                2
                                                                      4363
                             roberttran
                                                       6
                                                                              True
                                                                                       0
                                                                                            Harrisonfurt
                                                                                                         80-80
                                        especially
                                                                                                       03:16:54
                                       foot none to
                                              g...
                                        Just cover
                                            eight
                                                                                                         2021-
                                        opportunity
              3 696168
                               pmason
                                                       54
                                                                5
                                                                      2242
                                                                              True
                                                                                           Martinezberg
                                                                                                         08-14
                                           strong
                                                                                                       22:27:05
                                           policy
                                           which.
In [4]: | df.info()
         <class 'pandas.core.frame.DataFrame'>
         RangeIndex: 50000 entries, 0 to 49999
         Data columns (total 11 columns):
          #
              Column
                                Non-Null Count Dtype
          0
              User ID
                                50000 non-null
                                                 int64
          1
              Username
                                50000 non-null
                                                  object
          2
              Tweet
                                50000 non-null
                                                  object
          3
              Retweet Count
                                50000 non-null
                                                  int64
                                50000 non-null
          4
              Mention Count
                                                  int64
          5
              Follower Count
                                50000 non-null
                                                  int64
          6
              Verified
                                50000 non-null
                                                  bool
          7
              Bot Label
                                50000 non-null
                                                  int64
          8
              Location
                                50000 non-null
                                                  object
          9
              Created At
                                50000 non-null
                                                  object
          10 Hashtags
                                41659 non-null
         dtypes: bool(1), int64(5), object(5)
         memory usage: 3.9+ MB
         df1=df[['Retweet Count', 'Mention Count', 'Follower Count', 'Bot Label']][0:50]
```

In [6]: df1.fillna(value=1)

## Out[6]:

1       55       5       9617       0         2       6       2       4363       0         3       54       5       2242       3         4       26       3       8438       3         5       41       4       3792       3         5       54       0       10       0         6       4       0       1442       3         8       25       2       836       0         9       67       3       6523       3         9       67       3       6523       3         9       67       3       6523       3         9       67       3       6523       3         9       1       5986       3       3         1       29       1       5986       3         2       60       2       6779       0         3       61       0       6073       0         4       21       2       4846       0         4       3       4       7945       0         3       39       0       8305       0		Retweet Count	Mention Count	Follower Count	Bot Label
2       6       2       4363       6         3       54       5       2242       3         4       26       3       8438       3         5       41       4       3792       3         5       54       0       10       0         6       4       0       1442       3         8       25       2       836       6         9       67       3       6523       3         9       67       3       6523       3         9       67       3       6523       3         9       1       5986       3       4         1       29       1       5986       3         2       60       2       6779       6         3       61       0       6073       6         4       21       2       4846       6         4       3       4       7945       6         3       39       0       8305       6         4       3       4       5466       1       5131         3       45       5       7600 <th>0</th> <th>85</th> <th>1</th> <th>2353</th> <th>1</th>	0	85	1	2353	1
3       54       5       2242         4       26       3       8438         5       41       4       3792         6       54       0       10       0         7       64       0       1442       0         8       25       2       836       0         9       67       3       6523       0         9       67       3       6523       0         9       67       3       6523       0         9       67       3       6523       0         9       67       4       8694       0         1       29       1       5986       0         2       60       2       6779       0         3       61       0       6073       0         4       21       2       4846       0         4       3       4       7945       0         3       39       0       8305       0         4       3       4       5466       0         2       86       1       5131       0         3       43	1	55	5	9617	0
4       26       3       8438         5       41       4       3792         6       54       0       10         7       64       0       1442         8       25       2       836         9       67       3       6523         9       57       4       8694         1       29       1       5986         2       60       2       6779       6         3       61       0       6073       6         4       21       2       4846       6         5       78       1       2342       6         6       64       5       6947       7         7       43       4       7945       6         8       39       0       8305       6         9       8       2       1256       6         10       26       4       653       6         10       26       4       653       6         10       26       4       5347       6         10       343       2       4851       6	2	6	2	4363	0
5       41       4       3792       6         6       54       0       10       0         7       64       0       1442       6         8       25       2       836       0         9       67       3       6523       6         9       57       4       8694       6         1       29       1       5986       6         2       60       2       6779       0         3       61       0       6073       0         4       21       2       4846       0         5       78       1       2342       0         6       64       5       6947       6         7       43       4       7945       0         8       39       0       8305       6         9       8       2       1256       0         9       8       2       1256       0         9       8       2       1256       0         9       1       5131       1       3347         9       3       3547       1       7313	3	54	5	2242	1
6       54       0       10       0         7       64       0       1442       2         8       25       2       836       0         9       67       3       6523       3         9       57       4       8694       4         1       29       1       5986       6         2       60       2       6779       0         3       61       0       6073       0         4       21       2       4846       0         5       78       1       2342       0         6       64       5       6947       0         7       43       4       7945       0         8       39       0       8305       0         8       2       1256       0         9       8       2       1256       0         9       8       2       1256       0         9       8       2       1256       0         9       8       4       5466       0         9       8       1       5131       0	4	26	3	8438	1
64       0       1442         3       25       2       836         6       67       3       6523         6       57       4       8694         6       29       1       5986         6       2       6779       0         6       60       2       6779       0         8       61       0       6073       0         8       21       2       4846       0         6       78       1       2342       0         6       64       5       6947       0         7       43       4       7945       0         8       39       0       8305       0         8       2       1256       0         9       8       2       1256       0         9       8       2       1256       0         9       8       2       1256       0         10       26       4       653       0         10       26       4       5466       0         10       34       5       7600       0	5	41	4	3792	1
3       25       2       836       0         6       67       3       6523       3         6       57       4       8694       3         1       29       1       5986       3         2       60       2       6779       0         3       61       0       6073       0         4       21       2       4846       0         5       78       1       2342       0         6       64       5       6947       3         7       43       4       7945       0         8       39       0       8305       3         8       39       0       8305       3         9       8       2       1256       0         10       26       4       653       3         10       26       4       5346       0         10       26       4       5347       3         10       343       2       4851       0         10       349       5       7600       3         10       77       1       7006	6	54	0	10	0
67 3 6523 67 4 8694 67 57 4 8694 67 57 4 8694 67 6986 69 60 2 6779 68 61 0 6073 68 61 0 6073 68 62 68 64 5 6947 68 39 0 8305 69 8 2 1256 60 26 4 653 61 84 4 5466 62 86 1 5131 63 55 0 5278 64 63 49 5 7600 67 7 0 706 68 75 1 7313 69 75 1 7313 69 75 1 7313 69 77 1 7006 60 77 7 0 706 61 40 2 697 62 25 5 4517 63 13 0 7925 64 85 0 4057 65 13 0 7925 66 63 4 2804 67 75 4 3544 68 58 1 2063 69 34 5 466	7	64	0	1442	1
57       4       8694         1       29       1       5986         2       60       2       6779       0         3       61       0       6073       0         4       21       2       4846       0         5       78       1       2342       0         6       64       5       6947       0         7       43       4       7945       0         8       39       0       8305       0         8       2       1256       0       0         9       8       2       1256       0         9       8       2       1256       0         9       26       4       653       0         9       86       1       5131       0         9       86       1       5131       0         9       5       7600       0       0         9       7       7       0       706       0         9       7       1       7006       0       0         10       40       2       697       0 <tr< th=""><th>8</th><td>25</td><td>2</td><td>836</td><td>0</td></tr<>	8	25	2	836	0
1 29 1 5986 2 60 2 6779 3 61 0 6073 4 21 2 4846 5 78 1 2342 6 6 6 6 78 1 2342 6 6 6 78 1 2342 7 43 4 7945 7 43 4 7945 8 39 0 8305 9 8 2 1256 9 4 653 1 84 4 5466 1 5131 1 3347 1 34 56 1 3347 1 35 39 0 337 1 77 0 706 1 40 2 697 1 706 1 40 2 697 1 706 1 40 2 697 1 706 1 40 2 697 1 706 1 40 2 697 1 706 1 40 2 697 1 706 1 40 2 697 1 706 1 40 2 697 1 77 1 7006 1 77 1 7006 1 70 1 7006 1	9	67	3	6523	1
2 60 2 6779 0 6 673 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	10	57	4	8694	1
3       61       0       6073       0         4       21       2       4846       0         5       78       1       2342       0         6       64       5       6947       0         7       43       4       7945       0         8       39       0       8305       0         8       39       0       8305       0         9       8       2       1256       0         1       84       4       5466       0         2       86       1       5131       0         3       55       0       5278       0         4       56       1       3347       0         5       43       2       4851       0         6       43       2       4851       0         7       7       0       706       0         7       7       0       706       0         8       75       1       7313       0         9       25       5       4517       0         10       40       2       697       0 <th>11</th> <td>29</td> <td>1</td> <td>5986</td> <td>1</td>	11	29	1	5986	1
4       21       2       4846       0         5       78       1       2342       0         6       64       5       6947       6         7       43       4       7945       0         8       39       0       8305       6         8       2       1256       0         9       8       2       1256       0         9       8       2       1256       0         9       8       2       1256       0         9       8       4       5466       0         9       8       4       5466       0         1       84       4       5466       0         1       3347       0       5278       0         1       3347       0       0       0         2       4851       0       0       0         3       75       1       7313       0         3       39       0       337       0         4       40       2       697       0         3       4       40       2       697       0	12	60	2	6779	0
5       78       1       2342       0         6       64       5       6947       6         7       43       4       7945       0         8       39       0       8305       6         8       2       1256       0         9       26       4       653       6         1       84       4       5466       0         2       86       1       5131       6         3       55       0       5278       6         4       56       1       3347       6         5       43       2       4851       0         6       43       2       4851       0         7       7       0       706       6         7       7       0       706       6         8       75       1       7313       6         9       39       0       337       6         9       39       0       337       6         1       40       2       697       0         2       25       5       4517       0	13	61	0	6073	0
6       64       5       6947       6         7       43       4       7945       0         8       39       0       8305       6         9       8       2       1256       0         9       8       2       1256       0         9       8       2       1256       0         1       84       4       5466       0         2       86       1       5131       1         3       55       0       5278       1         3       55       0       5278       1         3       43       2       4851       0         4       49       5       7600       1         3       75       1       7313       1         3       39       0       337       1         4       40       2       697       0         4       40       2       697       0         4       45       5       4517       0         3       15       2       1785       0         4       3544       2804       3	14	21	2	4846	0
7       43       4       7945       6         8       39       0       8305       6         9       8       2       1256       6         10       26       4       653       6         11       84       4       5466       6         12       86       1       5131       6         13       55       0       5278       6         14       56       1       3347       6         15       43       2       4851       6         16       49       5       7600       6         17       7       0       706       6         18       75       1       7313       6         19       39       0       337       7         10       77       1       7006       6         11       40       2       697       6         12       25       5       4517       6         13       15       2       1785       6         14       85       0       4057       6         15       13       0       7925	15	78	1	2342	0
3       39       0       8305       6         3       8       2       1256       0         4       653       6       1       653       6         4       5466       0       0       1       1311       6       1       1311       6       1       1347       6       1       3347       6       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1<	16	64	5	6947	1
8       2       1256       0         9       26       4       653       6         1       84       4       5466       0         2       86       1       5131       6         3       55       0       5278       6         4       56       1       3347       6         5       43       2       4851       0         6       43       2       4851       0         7       7       0       706       6         8       75       1       7313       6         9       39       0       337       6         9       77       1       7006       0         1       40       2       697       0         2       25       5       4517       0         3       15       2       1785       0         4       85       0       4057       6         3       4       2804       6         4       3544       6       6         3       34       5       466       0	17	43	4	7945	0
26       4       653         4       5466       6         2       86       1       5131         3       55       0       5278         4       56       1       3347         5       43       2       4851       0         6       49       5       7600       6         7       7       0       706       6         8       75       1       7313       6         9       39       0       337       6         1       40       2       697       0         2       25       5       4517       0         3       15       2       1785       0         4       85       0       4057       6         5       13       0       7925       0         6       63       4       2804       6         7       75       4       3544       6         8       5       466       0	18	39	0	8305	1
1       84       4       5466       6         2       86       1       5131       6         3       55       0       5278       6         4       56       1       3347       6         5       43       2       4851       0         6       49       5       7600       6         7       7       0       706       6         8       75       1       7313       6         9       39       0       337       6         1       40       2       697       0         2       25       5       4517       0         3       15       2       1785       0         4       85       0       4057       6         5       13       0       7925       0         6       63       4       2804       6         7       7       4       3544       6         8       5       466       0	19	8	2	1256	0
2       86       1       5131       6         3       55       0       5278       6         4       56       1       3347       6         5       43       2       4851       0         6       49       5       7600       6         7       7       0       706       6         8       75       1       7313       6         9       39       0       337       6         1       40       2       697       0         2       25       5       4517       0         3       15       2       1785       0         4       85       0       4057       6         5       13       0       7925       0         6       63       4       2804       6         7       75       4       3544       6         8       58       1       2063       0         9       34       5       466       0	20	26	4	653	1
3       55       0       5278         4       56       1       3347         5       43       2       4851       0         6       49       5       7600       6         7       7       0       706       6         8       75       1       7313       6         9       39       0       337       6         1       40       2       697       0         2       25       5       4517       0         3       15       2       1785       0         4       85       0       4057       6         5       13       0       7925       0         6       63       4       2804       6         7       75       4       3544       6         8       58       1       2063       0         9       34       5       466       0	21	84	4	5466	0
4       56       1       3347       6         5       43       2       4851       0         6       49       5       7600       6         7       7       0       706       6         8       75       1       7313       6         9       39       0       337       6         9       77       1       7006       0         1       40       2       697       0         2       25       5       4517       0         3       15       2       1785       0         4       85       0       4057       6         5       13       0       7925       0         6       63       4       2804       6         7       75       4       3544       6         8       58       1       2063       0         9       34       5       466       0	22	86	1	5131	1
6       43       2       4851       0         6       49       5       7600       6         7       7       0       706       6         8       75       1       7313       6         9       39       0       337       6         1       40       2       697       0         2       25       5       4517       0         3       15       2       1785       0         4       85       0       4057       6         5       13       0       7925       0         6       63       4       2804       6         7       75       4       3544       6         8       58       1       2063       0         9       34       5       466       0	23	55	0	5278	1
3       49       5       7600       6         4       7       0       706       6         3       75       1       7313       6         3       39       0       337       6         3       77       1       7006       0         4       40       2       697       0         2       25       5       4517       0         3       15       2       1785       0         4       85       0       4057       6         5       13       0       7925       0         6       63       4       2804       6         7       75       4       3544       6         8       58       1       2063       0         9       34       5       466       0	24	56	1	3347	1
7 7 0 706 706 706 706 706 706 706 706 70	25	43	2	4851	0
3       75       1       7313       6         3       39       0       337       6         4       77       1       7006       0         4       40       2       697       0         2       25       5       4517       0         3       15       2       1785       0         4       85       0       4057       6         5       13       0       7925       0         6       63       4       2804       6         7       75       4       3544       6         8       58       1       2063       0         9       34       5       466       0	26	49	5	7600	1
39 0 337 6 77 1 7006 0 1 40 2 697 0 2 25 5 4517 0 3 15 2 1785 0 4 85 0 4057 6 5 13 0 7925 0 6 63 4 2804 6 7 75 4 3544 6 8 58 1 2063 0	27	7	0	706	1
77 1 7006 0 1 40 2 697 0 2 25 5 4517 0 3 15 2 1785 0 4 85 0 4057 6 5 13 0 7925 0 6 63 4 2804 6 7 75 4 3544 6 8 58 1 2063 0 8 34 5 466 0	28	75	1	7313	1
40 2 697 0 2 25 5 4517 0 3 15 2 1785 0 4 85 0 4057 6 5 13 0 7925 0 6 63 4 2804 6 7 75 4 3544 6 8 58 1 2063 0 9 34 5 466 0	29	39	0	337	1
2 25 5 4517 0 3 15 2 1785 0 4 85 0 4057 7 5 13 0 7925 0 6 63 4 2804 7 7 75 4 3544 7 8 58 1 2063 0 9 34 5 466 0	30	77	1	7006	0
3     15     2     1785     0       4     85     0     4057     6       5     13     0     7925     0       6     63     4     2804     6       7     75     4     3544     6       8     58     1     2063     0       9     34     5     466     0	31	40	2	697	0
4     85     0     4057       5     13     0     7925     0       6     63     4     2804     2       7     75     4     3544     2       8     58     1     2063     0       9     34     5     466     0	32	25	5	4517	0
5     13     0     7925     0       6     63     4     2804     6       7     75     4     3544     6       8     58     1     2063     0       9     34     5     466     0	33	15	2	1785	0
63       4       2804       6         7       75       4       3544       6         8       58       1       2063       0         9       34       5       466       0	34	85	0	4057	1
7 75 4 3544 6 3 58 1 2063 6 9 34 5 466 6	35	13	0	7925	0
3 58 1 2063 C 3 34 5 466 C	36	63	4	2804	1
<b>9</b> 34 5 466 0	37	75	4	3544	1
	38	58	1	2063	0
0 66 1 2852	39	34	5	466	0
	40	66	1	2852	1

41 42

0

3782

4581

Retweet Count Mention Count Follower Count Bot Label

3

0

		-	_		-						
	43	21	3	6979	0						
	44	7	3	7523	0						
	45	39	0	3755	0						
	46	34	4	6933	0						
	47	72	0	8386	1						
	48	24	5	4096	1						
	49	77	0	7967	1						
In [7]:	<pre>feature_matrix = df1.iloc[:,0:3] target_vector = df1.iloc[:,-1]</pre>										
In [8]:	feature_matrix.shape										
Out[8]:	(50, 3)										
In [9]:	target_vector.shape										
Out[9]:	(50,)										
In [10]:	<pre>from sklearn.preprocessing import StandardScaler</pre>										
In [11]:	<pre>fs=StandardScaler().fit_transform(feature_matrix)</pre>										
In [12]:	<pre>logr=LogisticRegression()</pre>										
In [13]:	<pre>logr.fit(fs,target_vector)</pre>										
Out[13]:	LogisticRegression()										
In [14]:	observation=[[3,4,4]]										
In [15]:	<pre>prediction = logr.predict(observation) print(prediction)</pre>										
	[1]										
In [16]:	logr.classes	_									
Out[16]:	array([0, 1]	, dtype=int64	1)								
In [17]:	logr.predict	_proba(observ	vation)[0][	0]							
Out[17]:	0.0836249800	4517882									
In [18]:	logr.predict	_proba(observ	vation)[0][	1]							
Out[18]:	0.9163750199	548212									

## **Logistic Regression-2**

```
In [19]: import re
         from sklearn.datasets import load_digits
         import numpy as np
         import pandas as pd
         import matplotlib.pyplot as plt
         import seaborn as sns
         from sklearn.linear_model import LogisticRegression
         from sklearn.model_selection import train_test_split
In [20]: digits=load_digits()
         digits
                 [[ 0., 0., 1., ..., 1., 0., 0.],
                  [ 0., 0., 13., ..., 2., 1.,
                  [ 0., 0., 16., ..., 16., 5.,
                                                 0.],
                        0., 16., ..., 15., 0.,
                  [ 0.,
                       0., 15., ..., 16., 0., 0.],
                  [ 0.,
                        0., 2., ..., 6., 0., 0.]],
                  [ 0.,
                 [[0., 0., 2., ..., 0., 0., 0.],
                  [0., 0., 14., ..., 15., 1., 0.],
                  [ 0., 4., 16., ..., 16., 7.,
                                                 0.],
                       0., 0., ..., 16., 2., 0.],
                  [ 0.,
                        0., 4., ..., 16., 2., 0.],
                  [ 0.,
                  [0., 0., 5., ..., 12., 0., 0.]
                 [[ 0., 0., 10., ..., 1., 0., 0.],
                  [0., 2., 16., \ldots, 1., 0., 0.],
                  [0., 0., 15., ..., 15., 0., 0.],
                  . . . ,
In [21]: plt.figure(figsize=(20,4))
         for index,(image,label) in enumerate(zip(digits.data[0:5],digits.target[0:5])):
             plt.subplot(1,5,index+1)
             plt.imshow(np.reshape(image,(8,8)),cmap=plt.cm.gray)
             plt.title("Number:%i\n"%label,fontsize=15)
               Number:0
                                  Number:1
                                                     Number:2
                                                                       Number:3
                                                                                          Number:4
In [22]: x train,x test,y train,y test=train test split(digits.data,digits.target,test size=0.30)
In [23]: print(x_train.shape)
         print(x_test.shape)
         print(y_train.shape)
         print(y_test.shape)
         (1257, 64)
         (540, 64)
         (1257,)
         (540,)
```

```
logr=LogisticRegression(max_iter=10000)
In [24]:
In [25]:
         logr.fit(x_train,y_train)
Out[25]: LogisticRegression(max iter=10000)
         print(logr.predict(x test))
In [26]:
         [2 5 0 5 8 5 1 1 0 4 5 1 2 9 5 6 4 4 6 0 2 2 8 2 7 9 4 4 2 6 7 5 2 3 7 4 6
          5 3 7 9 0 5 6 4 0 6 9 5 1 5 5 4 9 9 7 0 5 1 7 5 1 0 7 6 2 4 4 2 5 6 2 0 8
          3 2 2 9 1 2 6 3 9 0 8 6 6 3 3 9 3 0 9 6 8 6 5 4 8 2 2 9 9 5 1 6 5 6 0 5 2
          0 2 7 2 4 3 8 2 9 9 1 0 6 1 4 2 7 9 0 0 0 6 3 4 1 4 5 2 8 2 3 5 2 6 6 3 1
          1 1 7 4 0 4 6 1 4 2 4 5 1 9 5 3 6 9 0 3 2 2 2 0 6 6 3 6 2 1 5 6 7 7 0 1 7
          4 5 4 8 9 9 9 4 3 2 7 8 6 8 8 6 2 7 4 2 7 2 1 3 1 1 9 0 9 9 4 1 2 3 1 0 0
            3 1 7 3 1 0 4 6 7 5 3 6 2 8 8 8 0 9 5 4 6 8 8 7 0 9 2 8 5 2 4 7 5 1 8 6
              2 6 1 2 0 2 4 8 8 6 4 1 3 9 6 7 6 3 7 0 8 9 4 1 8 4 7
                                                                    2 0 5 0 8
              7 9 3 0 7 1 7 1 6 0 0 9 6 9 9 3 0 3 1 1 2 4 5
                                                            6 8 7 1 3 6 7 7 8 2 3 2
            2 3 4 0 9 2 1 4 6 1 3 1 1 8 4 0 9 1 4 0 4 8 7 6 3 7 2 9 1 3 3 7 2 4 5 1
          5 1 4 9 2 3 2 8 1 5 7 9 0 8 8 3 5 7 8 4 3 6 1 8 1 7 5 8 7 5 0 7 5 3 6 6 6
          8 4 3 0 9 4 5 3 7 6 4 3 8 5 9 4 0 7 1 2 2 2 2 0 0 0 2 3 8 5 1 6 3 0 9 5 5
            3 4 9 7 8 0 5 7 4 7 4 0 3 3 8 4 6 3 6 0 0 6 7 7 4 1 0 3 4 5 0 5 4 8 7 4
          7 1 8 0 1 2 7 3 1 7 2 8 0 5 6 4 1 2 4 5 4 7 6 0 5 4 8 5 0 6 7 7 1 6 2 9 3
          3 6 6 6 9 6 4 4 8 7 3 0 5 1 8 3 5 5 7 0 0 0]
In [27]: |print(logr.score(x_test,y_test))
         0.96666666666666
```

## **Random Forest**

import matplotlib.pyplot as plt

import numpy as np
import pandas as pd

In [28]:

```
import seaborn as sns
In [43]:
           df=pd.read_csv(r"C:\Users\user\Downloads\ionosphere.csv")
            df
Out[43]:
                  1
                      0 0,99539
                                  -0.05889
                                             0.85243
                                                       0.02306
                                                                0.83398 -0.37708
                                                                                        1.1
                                                                                             0.03760
                                                                                                          -0,51171
                                                                                                                     0.41078 0.461
                      0
                         1.00000
                                  -0.18829
                                             0.93035
                                                      -0.36156
                                                                -0.10868
                                                                          -0.93597
                                                                                    1.00000
                                                                                             -0.04549
                                                                                                           -0.26569
                                                                                                                    -0.20468
                                                                                                                              -0.1840
                      0
                         1.00000
                                  -0.03365
                                             1.00000
                                                       0.00485
                                                                 1.00000
                                                                          -0.12062 0.88965
                                                                                              0.01198
                                                                                                          -0.40220
                                                                                                                     0.58984
                  1
                                                                                                                              -0.2214
               1
               2
                  1
                      0
                         1.00000
                                   -0.45161
                                             1.00000
                                                       1.00000
                                                                 0.71216
                                                                          -1.00000
                                                                                    0.00000
                                                                                              0.00000
                                                                                                           0.90695
                                                                                                                     0.51613
                                                                                                                               1.0000
               3
                  1
                      0
                         1.00000
                                   -0.02401
                                             0.94140
                                                       0.06531
                                                                 0.92106
                                                                          -0.23255
                                                                                   0.77152
                                                                                             -0.16399
                                                                                                           -0.65158
                                                                                                                     0.13290
                                                                                                                              -0.5320
                  1
                      0
                         0.02337
                                  -0.00592
                                             -0.09924
                                                      -0.11949
                                                                -0.00763
                                                                          -0.11824
                                                                                   0.14706
                                                                                             0.06637
                                                                                                           -0.01535
                                                                                                                    -0.03240
                                                                                                                               0.092
                                                  ...
                                                            ...
             345
                  1
                      0
                         0.83508
                                   0.08298
                                             0.73739
                                                      -0.14706
                                                                0.84349
                                                                          -0.05567 0.90441
                                                                                             -0.04622
                                                                                                          -0.04202
                                                                                                                     0.83479
                                                                                                                               0.0012
```

0.93438

0.95177

0.95691

0.87873

-0.01920

-0.03431

-0.03646

0.94590

0.95584

0.85746

0.08260 0.88928 -0.09139

0.01606

0.02446

0.00110

0.01361

0.03193

-0.02099

-0.15114

0.93522

0.92489

0.89147

0.81147

350 rows × 35 columns

0

0

0.95113

0.94701

0.90608

0 0.84710

0.00419

-0.00034

-0.01657

0.13533

0.95183

0.93207

0.98122

0.73638

-0.02723

-0.03227

-0.01989

-0.06151

**346** 1 0

347

348

349 1

0.0492

0.0254

-0.0770

-0.048

```
In [49]: |df['g'].value_counts()
Out[49]:
              224
         g
              126
         Name: g, dtype: int64
In [50]:
         x=df.drop('g',axis=1)
         y=df['g']
In [51]: |g1={"g":{1:"g",2:"b"}}
         df=df.replace(Bot_Label1)
         print(df)
                    0.99539 -0.05889 0.85243 0.02306 0.83398
              1
                 0
                                                                  -0.37708
                                                                                 1.1
         0
              1
                 0
                    1.00000
                             -0.18829
                                       0.93035 -0.36156 -0.10868
                                                                  -0.93597
                                                                            1.00000
         1
              1
                 0
                    1.00000
                             -0.03365
                                       1.00000 0.00485 1.00000
                                                                  -0.12062
                                                                            0.88965
         2
              1
                 0
                    1.00000
                             -0.45161
                                       1.00000 1.00000
                                                         0.71216
                                                                  -1.00000
                                                                            0.00000
         3
              1
                 0
                    1.00000
                             -0.02401 0.94140 0.06531 0.92106
                                                                  -0.23255
                                                                            0.77152
                             -0.00592 -0.09924 -0.11949 -0.00763
              1 0
                   0.02337
                                                                  -0.11824
                                                                            0.14706
             . . . .
             1 0
                    0.83508
                              0.08298
                                      0.73739 -0.14706
                                                        0.84349
                                                                  -0.05567
                                                                            0.90441
         345
         346 1 0
                   0.95113
                              0.00419
                                       0.95183 -0.02723
                                                         0.93438
                                                                  -0.01920
                                                                            0.94590
                                                                            0.95584
         347
              1 0 0.94701
                             -0.00034 0.93207 -0.03227
                                                         0.95177
                                                                  -0.03431
         348 1 0
                   0.90608
                             -0.01657
                                       0.98122 -0.01989
                                                         0.95691
                                                                  -0.03646
                                                                            0.85746
         349
              1
                 0 0.84710
                              0.13533 0.73638 -0.06151
                                                         0.87873
                                                                   0.08260
                                                                            0.88928
                       ... -0.51171 0.41078 -0.46168 0.21266
              0.03760
                                                                  -0.34090
                                                                            0.42267
         a
             -0.04549
                       ... -0.26569 -0.20468
                                              -0.18401 -0.19040
                                                                  -0.11593 -0.16626
         1
              0.01198
                       ... -0.40220 0.58984
                                              -0.22145 0.43100
                                                                  -0.17365 0.60436
         2
              0.00000
                            0.90695 0.51613
                                                1.00000 1.00000
                                                                  -0.20099 0.25682
                       . . .
                       ... -0.65158 0.13290
         3
             -0.16399
                                               -0.53206 0.02431
                                                                  -0.62197 -0.05707
                                                0.09223 -0.07859
         4
              0.06637
                            -0.01535 -0.03240
                                                                   0.00732
                                                                            0.00000
                       . . .
                  . . .
                       . . .
                                 . . .
                                          . . .
                                                    . . .
                                                              . . .
                                                                        . . .
         345 -0.04622
                            -0.04202
                                      0.83479
                                                0.00123
                                                         1.00000
                                                                   0.12815
                                                                            0.86660
                       . . .
         346
              0.01606
                             0.01361 0.93522
                                                0.04925
                                                         0.93159
                                                                   0.08168
                                                                            0.94066
                       . . .
         347
                             0.03193 0.92489
                                                0.02542
                                                         0.92120
                                                                   0.02242
              0.02446
                                                                            0.92459
                       . . .
         348 0.00110
                            -0.02099 0.89147
                                               -0.07760 0.82983
                                                                  -0.17238
                                                                            0.96022
         349 -0.09139
                            -0.15114
                                      0.81147
                                               -0.04822 0.78207
                                                                  -0.00703
                       . . .
                                                                            0.75747
              -0.54487 0.18641
                                 -0.45300
                                           g
         a
              -0.06288 -0.13738
                                 -0.02447
                                           b
         1
              -0.24180 0.56045
                                 -0.38238
                                           g
         2
               1.00000 -0.32382
                                  1.00000
                                           b
         3
              -0.59573 -0.04608
                                 -0.65697
         4
               0.00000 -0.00039
                                  0.12011 b
         345
              -0.10714
                        0.90546
                                 -0.04307 g
         346
              -0.00035 0.91483
                                  0.04712
         347
               0.00442 0.92697
                                 -0.00577
                                           g
         348
              -0.03757
                        0.87403
                                 -0.16243
                                           g
         349
              -0.06678 0.85764
                                 -0.06151
         [350 rows x 35 columns]
In [52]: from sklearn.model selection import train test split
In [53]: | x train, x test, y train, y test=train test split(x,y,train size=0.70)
In [54]: from sklearn.ensemble import RandomForestClassifier
```

```
In [55]: rfc=RandomForestClassifier()
         rfc.fit(x_train,y_train)
Out[55]: RandomForestClassifier()
In [56]: parameters={'max_depth':[1,2,3,4,5],
                     'min samples leaf':[5,10,15,20,25],
                     'n_estimators':[10,20,30,40,50]
         }
In [57]: | from sklearn.model_selection import GridSearchCV
         grid_search=GridSearchCV(estimator=rfc,param_grid=parameters,cv=2,scoring="accuracy")
         grid_search.fit(x_train,y_train)
Out[57]: GridSearchCV(cv=2, estimator=RandomForestClassifier(),
                      param_grid={'max_depth': [1, 2, 3, 4, 5],
                                   'min_samples_leaf': [5, 10, 15, 20, 25],
                                   'n_estimators': [10, 20, 30, 40, 50]},
                      scoring='accuracy')
In [58]: grid_search.best_score_
Out[58]: 0.9262295081967213
In [59]: from sklearn.tree import plot_tree
In [60]: rfc_best=grid_search.best_estimator_
```

```
In [61]: plt.figure(figsize=(80,40))
          plot_tree(rfc_best.estimators_[5],feature_names=x.columns,class_names=['Yes','No'],filled=True
Out[61]: [Text(1116.0, 1956.96, '0.99539 <= 0.26\ngini = 0.484\nsamples = 147\nvalue = [100, 144]\ncla
          ss = No'),
           Text(558.0, 1522.0800000000002, 'gini = 0.0\nsamples = 32\nvalue = [50, 0]\nclass = Yes'),
           Text(1674.0, 1522.0800000000000, '0.42267 <= -0.877\ngini = 0.383\nsamples = 115\nvalue = [5
          0, 144]\nclass = No'),
           Text(1116.0, 1087.2, 'gini = 0.0\nsamples = 6\nvalue = [18, 0]\nclass = Yes'),
           Text(2232.0, 1087.2, '0.58212 <= 0.999\ngini = 0.298\nsamples = 109\nvalue = [32, 144]\nclas
          s = No'),
           Text(1116.0, 652.3200000000000, '-0.37708 <= -0.487\ngini = 0.21\nsamples = 93\nvalue = [18,
          133]\nclass = No'),
           Text(558.0, 217.44000000000005, 'gini = 0.42\nsamples = 5\nvalue = [7, 3]\nclass = Yes'),
           Text(1674.0, 217.44000000000005, 'gini = 0.144\nsamples = 88\nvalue = [11, 130]\nclass = N
          o'),
           Text(3348.0, 652.3200000000002, '-0.38223 <= -0.146\ngini = 0.493\nsamples = 16\nvalue = [1
          4, 11]\nclass = Yes'),
           Text(2790.0, 217.44000000000000, 'gini = 0.153\nsamples = 7\nvalue = [11, 1]\nclass = Yes'),
           Text(3906.0, 217.44000000000000, 'gini = 0.355\nsamples = 9\nvalue = [3, 10]\nclass = No')]
                              0.99539 \le 0.26
                                gini = 0.484
                               samples = 147
                             value = [100, 144]
                                class = No
                                          0.42267 <= -0.877
                    gini = 0.0
                                             gini = 0.383
                  samples = 32
                                            samples = 115
                  value = [50, 0]
                                           value = [50, 144]
                   class = Yes
                                              class = No
                                                        0.58212 <= 0.999
                                 gini = 0.0
                                                          gini = 0.298
                                samples = 6
                                                        samples = 109
value = [32, 144]
                               value = [18, 0]
                                class = Yes
                                                           class = No
                             -0.37708 <= -0.487
                                                                                 -0.38223 <= -0.146
                                gini = 0.21
                                                                                    gini = 0.493
                               samples = 93
                                                                                    samples = 16
                              value = [18, 133]
                                                                                   value = [14, 11]
                                class = No
                                                                                     class = Yes
                                                                                                 gini = 0.355
                   gini = 0.42
                                             gini = 0.144
                                                                       gini = 0.153
                   samples = 5
                                            samples = 88
                                                                                                 samples = 9
                                                                       samples = 7
                  value = [7, 3]
                                           value = [11, 130]
                                                                      value = [11, 1]
                                                                                                value = [3, 10]
                                                                        class = Yes
                   class = Yes
```