Import Libraries

In [2]:
```
import numpy as np
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score
```

Data Set

In [3]:
```
#dataset impliment and read using pandas and there is no header in the top coloumn
#thats why we use header =None
df = pd.read_csv("sonar data.csv" , header=None)
```

In [4]:
```
#head shows the csv
df.head(10)
```

Out[4]:

	0	1	2	3	4	5	6	7	8	9	...	51	52	53	54	55	56	57	58	59	60
0	0.0200	0.0371	0.0428	0.0207	0.0954	0.0986	0.1539	0.1601	0.3109	0.2111	...	0.0027	0.0065	0.0159	0.0072	0.0167	0.0180	0.0084	0.0090	0.0032	R
1	0.0453	0.0523	0.0843	0.0689	0.1183	0.2583	0.2156	0.3481	0.3337	0.2872	...	0.0084	0.0089	0.0048	0.0094	0.0191	0.0140	0.0049	0.0052	0.0044	R
2	0.0262	0.0582	0.1099	0.1083	0.0974	0.2280	0.2431	0.3771	0.5598	0.6194	...	0.0232	0.0166	0.0095	0.0180	0.0244	0.0316	0.0164	0.0095	0.0078	R
3	0.0100	0.0171	0.0623	0.0205	0.0205	0.0368	0.1098	0.1276	0.0598	0.1264	...	0.0121	0.0036	0.0150	0.0085	0.0073	0.0050	0.0044	0.0040	0.0117	R
4	0.0762	0.0666	0.0481	0.0394	0.0590	0.0649	0.1209	0.2467	0.3564	0.4459	...	0.0031	0.0054	0.0105	0.0110	0.0015	0.0072	0.0048	0.0107	0.0094	R
5	0.0286	0.0453	0.0277	0.0174	0.0384	0.0990	0.1201	0.1833	0.2105	0.3039	...	0.0045	0.0014	0.0038	0.0013	0.0089	0.0057	0.0027	0.0051	0.0062	R
6	0.0317	0.0956	0.1321	0.1408	0.1674	0.1710	0.0731	0.1401	0.2083	0.3513	...	0.0201	0.0248	0.0131	0.0070	0.0138	0.0092	0.0143	0.0036	0.0103	R
7	0.0519	0.0548	0.0842	0.0319	0.1158	0.0922	0.1027	0.0613	0.1465	0.2838	...	0.0081	0.0120	0.0045	0.0121	0.0097	0.0085	0.0047	0.0048	0.0053	R
8	0.0223	0.0375	0.0484	0.0475	0.0647	0.0591	0.0753	0.0098	0.0684	0.1487	...	0.0145	0.0128	0.0145	0.0058	0.0049	0.0065	0.0093	0.0059	0.0022	R
9	0.0164	0.0173	0.0347	0.0070	0.0187	0.0671	0.1056	0.0697	0.0962	0.0251	...	0.0090	0.0223	0.0179	0.0084	0.0068	0.0032	0.0035	0.0056	0.0040	R

10 rows × 61 columns

In [22]:
```
df.tail(10)
```

Out[22]:

	0	1	2	3	4	5	6	7	8	9	...	51	52	53	54	55	56	57	58	59	60
198	0.0238	0.0318	0.0422	0.0399	0.0788	0.0766	0.0881	0.1143	0.1594	0.2048	...	0.0096	0.0071	0.0084	0.0038	0.0026	0.0028	0.0013	0.0035	0.0060	M
199	0.0116	0.0744	0.0367	0.0225	0.0076	0.0545	0.1110	0.1069	0.1708	0.2271	...	0.0141	0.0103	0.0100	0.0034	0.0026	0.0037	0.0044	0.0057	0.0035	M
200	0.0131	0.0387	0.0329	0.0078	0.0721	0.1341	0.1626	0.1902	0.2610	0.3193	...	0.0150	0.0076	0.0032	0.0037	0.0071	0.0040	0.0009	0.0015	0.0085	M
201	0.0335	0.0258	0.0398	0.0570	0.0529	0.1091	0.1709	0.1684	0.1865	0.2660	...	0.0120	0.0039	0.0053	0.0062	0.0046	0.0045	0.0022	0.0005	0.0031	M
202	0.0272	0.0378	0.0488	0.0848	0.1127	0.1103	0.1349	0.2337	0.3113	0.3997	...	0.0091	0.0045	0.0043	0.0043	0.0098	0.0054	0.0051	0.0065	0.0103	M
203	0.0187	0.0346	0.0168	0.0177	0.0393	0.1630	0.2028	0.1694	0.2328	0.2684	...	0.0116	0.0098	0.0199	0.0033	0.0101	0.0065	0.0115	0.0193	0.0157	M
204	0.0323	0.0101	0.0298	0.0564	0.0760	0.0958	0.0990	0.1018	0.1030	0.2154	...	0.0061	0.0093	0.0135	0.0063	0.0063	0.0034	0.0032	0.0062	0.0067	M
205	0.0522	0.0437	0.0180	0.0292	0.0351	0.1171	0.1257	0.1178	0.1258	0.2529	...	0.0160	0.0029	0.0051	0.0062	0.0089	0.0140	0.0138	0.0077	0.0031	M
206	0.0303	0.0353	0.0490	0.0608	0.0167	0.1354	0.1465	0.1123	0.1945	0.2354	...	0.0086	0.0046	0.0126	0.0036	0.0035	0.0034	0.0079	0.0036	0.0048	M
207	0.0260	0.0363	0.0136	0.0272	0.0214	0.0338	0.0655	0.1400	0.1843	0.2354	...	0.0146	0.0129	0.0047	0.0039	0.0061	0.0040	0.0036	0.0061	0.0115	M

10 rows × 61 columns

In [5]:
```
#Number of rows and columns
df.shape
```

Out[5]:
```
(208, 61)
```

In [6]:
```
df.describe()
```

Out[6]:

	0	1	2	3	4	5	6	7	8	9	...	50	51	52	53	54	55	56	57	58	59
count	208.000000	208.000000	208.000000	208.000000	208.000000	208.000000	208.000000	208.000000	208.000000	208.000000	...	208.000000	208.000000	208.000000	208.000000	208.000000	208.000000	208.000000	208.000000	208.000000	208.000000
mean	0.029164	0.038437	0.043832	0.053892	0.075202	0.104570	0.121747	0.134799	0.178003	0.208259	...	0.016069	0.013420	0.010709	0.010941	0.009290	0.008222	0.007820	0.007949	0.007941	0.006507
std	0.022991	0.032960	0.038428	0.046528	0.055552	0.059105	0.061788	0.085152	0.118387	0.134416	...	0.012008	0.009634	0.007060	0.007301	0.007088	0.005736	0.005785	0.006470	0.006181	0.005031
min	0.001500	0.000600	0.001500	0.005800	0.006700	0.010200	0.003300	0.005500	0.007500	0.011300	...	0.000000	0.000800	0.000500	0.001000	0.000600	0.000400	0.000300	0.000300	0.000100	0.000600
25%	0.013350	0.016450	0.018950	0.024375	0.038050	0.067025	0.080900	0.080425	0.097025	0.111275	...	0.008425	0.007275	0.005075	0.005375	0.004150	0.004400	0.003700	0.003600	0.003675	0.003100
50%	0.022800	0.030800	0.034300	0.044050	0.062500	0.092150	0.106950	0.112100	0.152250	0.182400	...	0.013900	0.011400	0.009550	0.009300	0.007500	0.006850	0.005950	0.005800	0.006400	0.005300
75%	0.035550	0.047950	0.057950	0.064500	0.100275	0.134125	0.154000	0.169600	0.233425	0.268700	...	0.020825	0.016725	0.014900	0.014500	0.012100	0.010575	0.010425	0.010350	0.010325	0.008525
max	0.137100	0.233900	0.305900	0.426400	0.401000	0.382300	0.372900	0.459000	0.682800	0.710600	...	0.100400	0.070900	0.039000	0.035200	0.044700	0.039400	0.035500	0.044000	0.036400	0.043900

8 rows × 60 columns

In [7]:
```
df[60].value_counts()
```

Out[7]:
```
M    111
R     97
Name: 60, dtype: int64
```

M ---> Mine R ---> Rock

In [8]:
```
#grouping
df.groupby(60).mean()
```

Out[8]:

	0	1	2	3	4	5	6	7	8	9	...	50	51	52	53	54	55	56	57	58	59
60																					
M	0.034989	0.045544	0.050720	0.064768	0.086715	0.111864	0.128359	0.149832	0.213492	0.251022	...	0.019352	0.016014	0.011643	0.012185	0.009923	0.008914	0.007825	0.009060	0.008695	0.006930
R	0.022498	0.030303	0.035951	0.041447	0.062028	0.096224	0.114180	0.117596	0.137392	0.159325	...	0.012311	0.010453	0.009640	0.009518	0.008567	0.007430	0.007814	0.006677	0.007078	0.006024

2 rows × 60 columns

In [9]:
```
# Separating data and labels
x = df.drop(columns=60, axis=1)
y =df[60]
```

In [10]:
```
print(x)
print(y)
```
```
       0       1       2       3       4       5       6       7       8  \
0    0.0200  0.0371  0.0428  0.0207  0.0954  0.0986  0.1539  0.1601  0.3109
1    0.0453  0.0523  0.0843  0.0689  0.1183  0.2583  0.2156  0.3481  0.3337
2    0.0262  0.0582  0.1099  0.1083  0.0974  0.2280  0.2431  0.3771  0.5598
3    0.0100  0.0171  0.0623  0.0205  0.0205  0.0368  0.1098  0.1276  0.0598
4    0.0762  0.0666  0.0481  0.0394  0.0590  0.0649  0.1209  0.2467  0.3564
..      ...     ...     ...     ...     ...     ...     ...     ...     ...
203  0.0187  0.0346  0.0168  0.0177  0.0393  0.1630  0.2028  0.1694  0.2328
204  0.0323  0.0101  0.0298  0.0564  0.0760  0.0958  0.0990  0.1018  0.1030
205  0.0522  0.0437  0.0180  0.0292  0.0351  0.1171  0.1257  0.1178  0.1258
206  0.0303  0.0353  0.0490  0.0608  0.0167  0.1354  0.1465  0.1123  0.1945
207  0.0260  0.0363  0.0136  0.0272  0.0214  0.0338  0.0655  0.1400  0.1843

          9  ...      50      51      52      53      54      55      56  \
0    0.2111  ...  0.0232  0.0027  0.0065  0.0159  0.0072  0.0167  0.0180
1    0.2872  ...  0.0125  0.0084  0.0089  0.0048  0.0094  0.0191  0.0140
2    0.6194  ...  0.0033  0.0232  0.0166  0.0095  0.0180  0.0244  0.0316
3    0.1264  ...  0.0241  0.0121  0.0036  0.0150  0.0085  0.0073  0.0050
4    0.4459  ...  0.0156  0.0031  0.0054  0.0105  0.0110  0.0015  0.0072
..      ...  ...     ...     ...     ...     ...     ...     ...     ...
203  0.2684  ...  0.0203  0.0116  0.0098  0.0199  0.0033  0.0101  0.0065
204  0.2154  ...  0.0051  0.0061  0.0093  0.0135  0.0063  0.0063  0.0034
205  0.2529  ...  0.0155  0.0160  0.0029  0.0051  0.0062  0.0089  0.0140
206  0.2354  ...  0.0042  0.0086  0.0046  0.0126  0.0036  0.0035  0.0034
207  0.2354  ...  0.0181  0.0146  0.0129  0.0047  0.0039  0.0061  0.0040

         57      58      59
0    0.0084  0.0090  0.0032
1    0.0049  0.0052  0.0044
2    0.0164  0.0095  0.0078
3    0.0044  0.0040  0.0117
4    0.0048  0.0107  0.0094
..      ...     ...     ...
203  0.0115  0.0193  0.0157
204  0.0032  0.0062  0.0067
205  0.0138  0.0077  0.0031
206  0.0079  0.0036  0.0048
207  0.0036  0.0061  0.0115

[208 rows x 60 columns]
0      R
1      R
2      R
3      R
4      R
      ..
203    M
204    M
205    M
206    M
207    M
Name: 60, Length: 208, dtype: object
```

Training & test data

In [11]:
```
x_train, x_test, y_train, y_test= train_test_split(x, y, test_size = 0.1, stratify=y,random_state=1)
```

In [12]:
```
print(x.shape, x_train.shape, x_test.shape)
print(y.shape, y_train.shape, y_test.shape)
```
```
(208, 60) (187, 60) (21, 60)
(208,) (187,) (21,)
```

Model = Logistrick regression

In [13]:
```
model = LogisticRegression()
```

In [14]:
```
print(x_train,y_train)
```
```
       0       1       2       3       4       5       6       7       8  \
115  0.0414  0.0436  0.0447  0.0844  0.0419  0.1215  0.2002  0.1516  0.0818
38   0.0123  0.0022  0.0196  0.0206  0.0180  0.0492  0.0033  0.0398  0.0791
56   0.0152  0.0102  0.0113  0.0263  0.0097  0.0391  0.0857  0.0915  0.0949
123  0.0270  0.0163  0.0341  0.0247  0.0822  0.1256  0.1323  0.1584  0.2017
18   0.0270  0.0092  0.0145  0.0278  0.0412  0.0757  0.1026  0.1138  0.0794
..      ...     ...     ...     ...     ...     ...     ...     ...     ...
140  0.0412  0.1135  0.0518  0.0232  0.0646  0.1124  0.1787  0.2407  0.2682
5    0.0286  0.0453  0.0277  0.0174  0.0384  0.0990  0.1201  0.1833  0.2105
154  0.0117  0.0069  0.0279  0.0583  0.0915  0.1267  0.1577  0.1927  0.2361
131  0.1150  0.1163  0.0866  0.0358  0.0232  0.1267  0.2417  0.2661  0.4346
203  0.0187  0.0346  0.0168  0.0177  0.0393  0.1630  0.2028  0.1694  0.2328

          9  ...      50      51      52      53      54      55      56  \
115  0.1975  ...  0.0222  0.0045  0.0136  0.0113  0.0053  0.0165  0.0141
38   0.0475  ...  0.0149  0.0125  0.0134  0.0026  0.0038  0.0018  0.0113
56   0.1504  ...  0.0048  0.0049  0.0041  0.0036  0.0013  0.0046  0.0037
123  0.2122  ...  0.0197  0.0189  0.0204  0.0085  0.0043  0.0092  0.0138
18   0.1520  ...  0.0045  0.0084  0.0010  0.0018  0.0068  0.0039  0.0120
..      ...  ...     ...     ...     ...     ...     ...     ...     ...
140  0.2058  ...  0.0798  0.0376  0.0143  0.0272  0.0127  0.0166  0.0095
5    0.3039  ...  0.0104  0.0045  0.0014  0.0038  0.0013  0.0089  0.0057
154  0.2169  ...  0.0039  0.0053  0.0029  0.0020  0.0013  0.0029  0.0020
131  0.5378  ...  0.0228  0.0099  0.0065  0.0085  0.0166  0.0110  0.0190
203  0.2684  ...  0.0203  0.0116  0.0098  0.0199  0.0033  0.0101  0.0065

         57      58      59
115  0.0077  0.0246  0.0198
38   0.0058  0.0047  0.0071
56   0.0011  0.0034  0.0033
123  0.0094  0.0105  0.0093
18   0.0132  0.0070  0.0088
..      ...     ...     ...
140  0.0225  0.0098  0.0085
5    0.0027  0.0051  0.0062
154  0.0062  0.0026  0.0052
131  0.0141  0.0068  0.0086
203  0.0115  0.0193  0.0157

[187 rows x 60 columns] 115    M
38     R
56     R
123    M
18     R
      ..
140    M
5      R
154    M
131    M
203    M
Name: 60, Length: 187, dtype: object
```

In [15]:
```
#trainning the logistic regression data
model.fit(x_train, y_train)
```

Out[15]:
```
LogisticRegression()
```

Model eveluation

In [16]:
```
#accuracy on the trainning data
x_train_prediction = model.predict(x_train)
trainning_data_accuracy = accuracy_score(x_train_prediction,y_train)
```

In [17]:
```
print('Accuracy on trainning data : ', trainning_data_accuracy)
```
```
Accuracy on trainning data :  0.8342245989304813
```

In [18]:
```
#accuracy on the test data
x_test_prediction = model.predict(x_test)
test_data_accuracy = accuracy_score(x_test_prediction,y_test)
```

In [19]:
```
print('Accuracy on test data : ', test_data_accuracy)
```
```
Accuracy on test data :  0.7619047619047619
```

Making a System

In [21]:
```
input_data = (0.0374,0.0586,0.0628,0.0534,0.0255,0.1422,0.2072,0.2734,0.3070,0.2597,0.3483,0.3999,0.4574,0.5950,0.7924,0.8272,0.8087,0.8977,0.9828,0.8982,0.8890,0.9367,0.9122,0.7936,0.6718,0.6318,0.4865,0.3388,0.4832,0.3822,0.3075,0.1

#converting in a numpy array
input_data_as_numpy_array = np.asarray(input_data)

#reshape the numpy array as we are predicting for one instance
input_data_reshaped = input_data_as_numpy_array.reshape(1,-1)

prediction = model.predict(input_data_reshaped)
print(prediction)

if(prediction == 'R'):
    print('The object is a Rock')
else:
    print('The object is a mine')
```

```
['M']
The object is a mine
```

In [ ]: