Importing the Dependencies

```
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 Collection and Data Processing

```
sonar_data = pd.read_csv('Sonar_Data.csv',header =None)
```

```
sonar_data.head()
```

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
0	0.0200	0.0371	0.0428	0.0207	0.0954	0.0986	0.1539	0.1601	0.3109	0.2111	0.1609	0.1582	0.2238	0.0645	0.0660	0.2273	0.3100	0.2999
1	0.0453	0.0523	0.0843	0.0689	0.1183	0.2583	0.2156	0.3481	0.3337	0.2872	0.4918	0.6552	0.6919	0.7797	0.7464	0.9444	1.0000	0.8874
2	0.0262	0.0582	0.1099	0.1083	0.0974	0.2280	0.2431	0.3771	0.5598	0.6194	0.6333	0.7060	0.5544	0.5320	0.6479	0.6931	0.6759	0.7551
3	0.0100	0.0171	0.0623	0.0205	0.0205	0.0368	0.1098	0.1276	0.0598	0.1264	0.0881	0.1992	0.0184	0.2261	0.1729	0.2131	0.0693	0.2281
4	0.0762	0.0666	0.0481	0.0394	0.0590	0.0649	0.1209	0.2467	0.3564	0.4459	0.4152	0.3952	0.4256	0.4135	0.4528	0.5326	0.7306	0.6193

```
# number of rows and columns
sonar_data.shape
```

```
(208, 61)
```

```
# describes the statistical measures of data
sonar_data.describe()
```

	0	1	2	3	4	5	6	7	8	9	10	
count	208.000000	208.000000	208.000000	208.000000	208.000000	208.000000	208.000000	208.000000	208.000000	208.000000	208.000000	20
mean	0.029164	0.038437	0.043832	0.053892	0.075202	0.104570	0.121747	0.134799	0.178003	0.208259	0.236013	
std	0.022991	0.032960	0.038428	0.046528	0.055552	0.059105	0.061788	0.085152	0.118387	0.134416	0.132705	
min	0.001500	0.000600	0.001500	0.005800	0.006700	0.010200	0.003300	0.005500	0.007500	0.011300	0.028900	
25%	0.013350	0.016450	0.018950	0.024375	0.038050	0.067025	0.080900	0.080425	0.097025	0.111275	0.129250	
50%	0.022800	0.030800	0.034300	0.044050	0.062500	0.092150	0.106950	0.112100	0.152250	0.182400	0.224800	
75%	0.035550	0.047950	0.057950	0.064500	0.100275	0.134125	0.154000	0.169600	0.233425	0.268700	0.301650	
max	0.137100	0.233900	0.305900	0.426400	0.401000	0.382300	0.372900	0.459000	0.682800	0.710600	0.734200	

```
sonar_data[60].value_counts()
```

60	count
M	111
R	97

dtype: int64

M ---> Mine

R ---> Rock

```
sonar_data.groupby(60).mean()
```

60	0	1	2	3	4	5	6	7	8	9	10	11	12	13
M	0.034989	0.045544	0.050720	0.064768	0.086715	0.111864	0.128359	0.149832	0.213492	0.251022	0.289581	0.301459	0.314426	0.320692
R	0.022498	0.030303	0.035951	0.041447	0.062028	0.096224	0.114180	0.117596	0.137392	0.159325	0.174713	0.191589	0.226249	0.268963

```
# separating data and labels
X = sonar_data.drop(columns = 60,axis = 1)
Y = sonar_data[60]
```

```
print(X)
print(Y)
```

```
          0       1       2       3   ...      56      57      58      59
0    0.0200  0.0371  0.0428  0.0207  ...  0.0180  0.0084  0.0090  0.0032
1    0.0453  0.0523  0.0843  0.0689  ...  0.0140  0.0049  0.0052  0.0044
2    0.0262  0.0582  0.1099  0.1083  ...  0.0316  0.0164  0.0095  0.0078
3    0.0100  0.0171  0.0623  0.0205  ...  0.0050  0.0044  0.0040  0.0117
4    0.0762  0.0666  0.0481  0.0394  ...  0.0072  0.0048  0.0107  0.0094
..      ...     ...     ...     ...  ...     ...     ...     ...     ...
203  0.0187  0.0346  0.0168  0.0177  ...  0.0065  0.0115  0.0193  0.0157
204  0.0323  0.0101  0.0298  0.0564  ...  0.0034  0.0032  0.0062  0.0067
205  0.0522  0.0437  0.0180  0.0292  ...  0.0140  0.0138  0.0077  0.0031
206  0.0303  0.0353  0.0490  0.0608  ...  0.0034  0.0079  0.0036  0.0048
207  0.0260  0.0363  0.0136  0.0272  ...  0.0040  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 and Test data

```
X_train, Y_train, X_test, Y_train = train_test_split(X,Y, test_size = 0.1, stratify = Y, random_state = 1)
```

```
print(X.shape, X_train.shape, X_test.shape)
```

```
(208, 60) (187, 60) (187,)
```

```
print(X_train)
print(Y_train)
```

```
          0       1       2       3   ...      56      57      58      59
115  0.0414  0.0436  0.0447  0.0844  ...  0.0141  0.0077  0.0246  0.0198
38   0.0123  0.0022  0.0196  0.0206  ...  0.0113  0.0058  0.0047  0.0071
56   0.0152  0.0102  0.0113  0.0263  ...  0.0037  0.0011  0.0034  0.0033
123  0.0270  0.0163  0.0341  0.0247  ...  0.0138  0.0094  0.0105  0.0093
18   0.0270  0.0092  0.0145  0.0278  ...  0.0120  0.0132  0.0070  0.0088
..      ...     ...     ...     ...  ...     ...     ...     ...     ...
140  0.0412  0.1135  0.0518  0.0232  ...  0.0095  0.0225  0.0098  0.0085
5    0.0286  0.0453  0.0277  0.0174  ...  0.0057  0.0027  0.0051  0.0062
154  0.0117  0.0069  0.0279  0.0583  ...  0.0020  0.0062  0.0026  0.0052
131  0.1150  0.1163  0.0866  0.0358  ...  0.0190  0.0141  0.0068  0.0086
203  0.0187  0.0346  0.0168  0.0177  ...  0.0065  0.0115  0.0193  0.0157

[187 rows x 60 columns]
113    M
23     R
45     R
81     R
82     R
109    M
176    M
134    M
96     R
```

```
98     M
57     R
169    M
13     R
204    M
10     R
161    M
7      R
172    M
68     R
102    M
106    M
Name: 60, dtype: object
```

Model Training --> Logistic Regression

```
model = LogisticRegression


#training the Logistic Regression model with training data
model.fit(X_train, Y_train)
```

```
LogisticRegression()
```

Model Evaluation

```
#accuracy on training data
X_train_prediction = model.predict(X_train)
training_data_accuracy = accuracy_score(X_train_prediction, Y_train)


print('Accuracy on training data : ', training_data_accuracy)
```

```
Accuracy on training data :  0.8342245989304813
```

```
#accuracy on test data
X_test_prediction = model.predict(X_test)
test_data_accuracy = accuracy_score(X_test_prediction, Y_test)


print('Accuracy on test data : ', test_data_accuracy)
```

```
Accuracy on test data :  0.7619047619047619
```

Making a predictive system

```
input_data = (0.0307,0.0523,0.0653,0.0521,0.0611,0.0577,0.0665,0.0664,0.1460,0.2792,0.3877,0.4992,0.4981,0.4972,0.5607,0.7339,0.8230,0.9173,0

# changing the input_data to a numpy array
input_data_as_numpy_array = np.asarray(input_data)

# reshape the np 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[0]=='R'):
  print('The object is a Rock')
else:
  print('The object is a mine')
```

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