Problem Statement: Abalone Age Prediction

1. Download the dataset: Dataset

2. Load the dataset into the tool.

```
import numpy as np
import pandas as pd

ds=pd.read_csv("abalone.csv")

# Rings / integer / -- / +1.5 gives the age in years

ds['Age']=ds["Rings"]+1.5

ds.head(5)
```

```
  Sex  Length  Diameter  Height  Whole weight  Shucked weight  Viscera
weight  \
0   M   0.455     0.365   0.095        0.5140          0.2245
0.1010
1   M   0.350     0.265   0.090        0.2255          0.0995
0.0485
2   F   0.530     0.420   0.135        0.6770          0.2565
0.1415
3   M   0.440     0.365   0.125        0.5160          0.2155
0.1140
4   I   0.330     0.255   0.080        0.2050          0.0895
0.0395

   Shell weight  Rings   Age
0         0.150     15  16.5
1         0.070      7   8.5
2         0.210      9  10.5
3         0.155     10  11.5
4         0.055      7   8.5
```

3. Perform Below Visualizations.

· Univariate Analysis

· Bi-Variate Analysis

· Multi-Variate Analysis

```
# univarient analysis

#frequency table for age
```

```python
ft = ds1['Age'].value_counts()

print("Frequency table for Age is given below")
print("{}\n\n\n".format(ft))

# mean

print("Mean, Median, std \n")
ma=ds1['Age'].mean() #mean of age
mh = ds1['Height'].mean() #mean of height
mel = ds1['Length'].median() #median value of length
stw = ds1['Whole weight'].std() #standard devation of whole weight


#chart

import matplotlib.pyplot as plt # library for plot or graph
import seaborn as sns

plt.subplot(1,2,1)
ch = ds1.boxplot(column='Diameter',grid=True,color ='red')
plt.title('Box plot')

plt.subplot(1,2,2)
DC = sns.kdeplot(ds1['Diameter'])
plt.title('Density Curve')



print("1-mean of age = ",ma)
print("2-mean of height = ",mh)
print("3-median value of length = ",mel)#
print("4-standard devation of whole weight = ",stw)
print("5-frequency table for rings = \n {}" .format(fre))
print("\nChart\n\n6-boxplot of Diameter",flush=True)
```

```
Frequency table for Age is given below
11.5    32
10.5    28
8.5     20
9.5     18
13.5    17
12.5    16
14.5    13
15.5    11
16.5    10
17.5     7
6.5      6
```

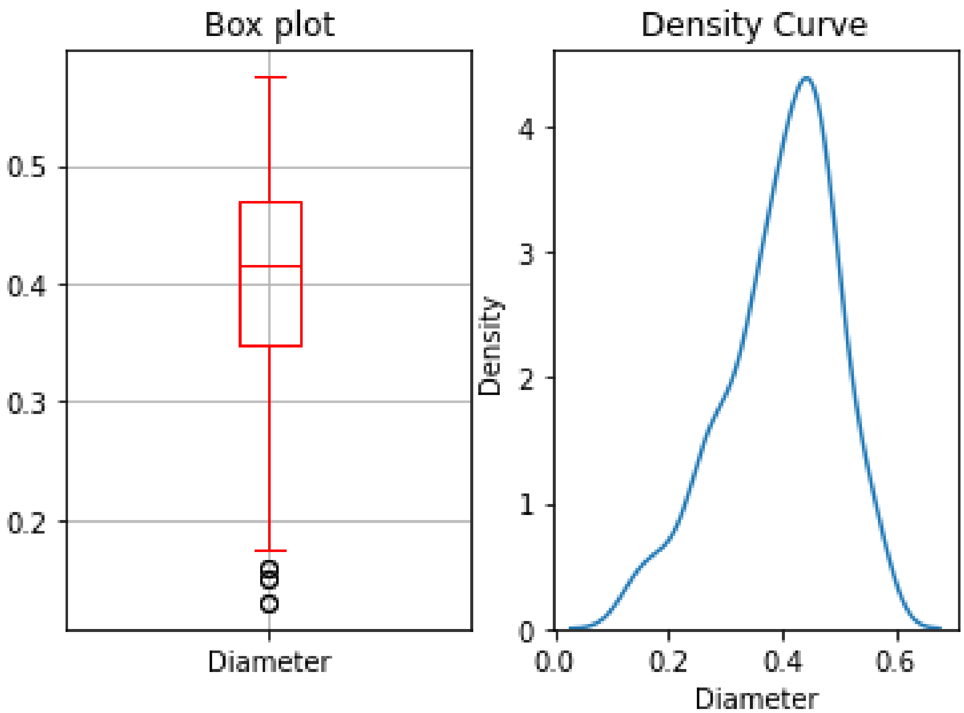
```
7.5      5
21.5     4
5.5      4
20.5     3
19.5     3
22.5     2
18.5     1
Name: Age, dtype: int64
```

Mean, Median, std

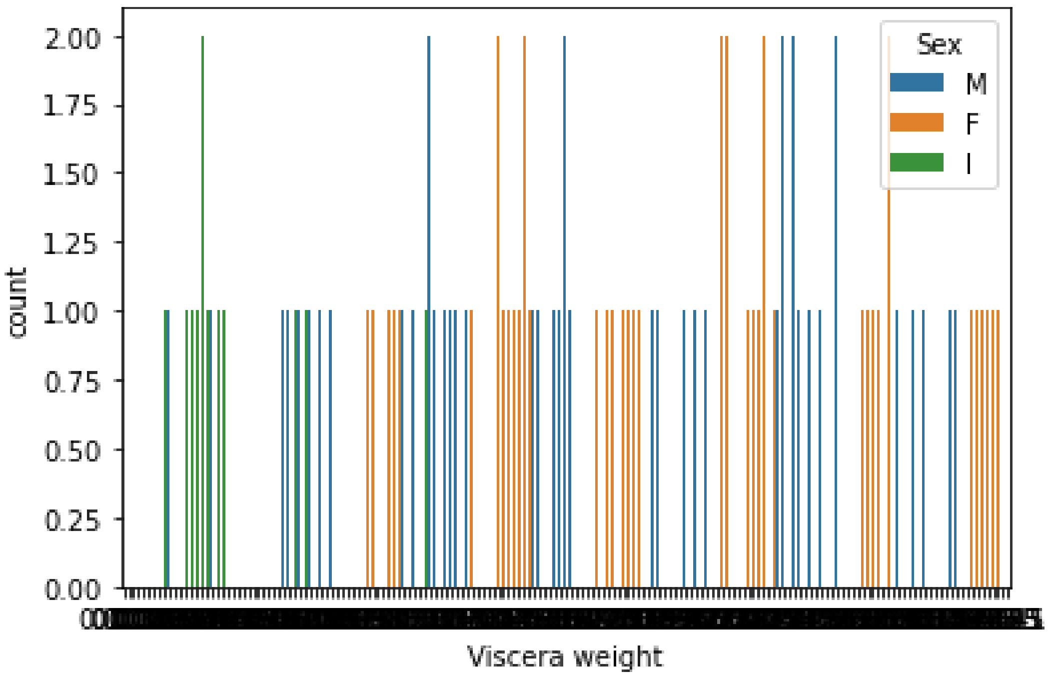
```
1-mean of age =  12.235
2-mean of height = 0.13482500000000003
3-median value of length =  0.53
4-standard devation of whole weight = 0.48292555269001314
5-frequency table for rings =
 10    32
9     28
7     20
8     18
12    17
11    16
13    13
14    11
15    10
16     7
5      6
6      5
20     4
4      4
19     3
18     3
21     2
17     1
Name: Rings, dtype: int64
```

Chart

6-boxplot of Diameter




```
#multi-varient analysis

import matplotlib.pyplot as plt
import seaborn as sns

ds1=ds.head(200)
df=sns.countplot(x="Viscera weight",hue='Sex',data=ds1)

print(df)

AxesSubplot(0.125,0.125;0.775x0.755)
```



4. Perform descriptive statistics on the dataset.

```
ds.describe()

                Length     Diameter       Height  Whole weight  Shucked 
weight  \
count  4177.000000  4177.000000  4177.000000   4177.000000     
4177.000000   
mean      0.523992     0.407881     0.139516      0.828742        
0.359367   
std       0.120093     0.099240     0.041827      0.490389        
0.221963   
min       0.075000     0.055000     0.000000      0.002000        
0.001000   
25%       0.450000     0.350000     0.115000      0.441500        
0.186000   
50%       0.545000     0.425000     0.140000      0.799500        
0.336000   
75%       0.615000     0.480000     0.165000      1.153000        
0.502000   
max       0.815000     0.650000     1.130000      2.825500        
1.488000   

       Viscera weight  Shell weight        Rings          Age  
count     4177.000000   4177.000000  4177.000000  4177.000000  
mean         0.180594      0.238831     9.933684    11.433684  
std          0.109614      0.139203     3.224169     3.224169  
min          0.000500      0.001500     1.000000     2.500000  
25%          0.093500      0.130000     8.000000     9.500000  
50%          0.171000      0.234000     9.000000    10.500000  
```

```
75%           0.253000      0.329000    11.000000    12.500000
max           0.760000      1.005000    29.000000    30.500000
```

5. Check for Missing values and deal with them.

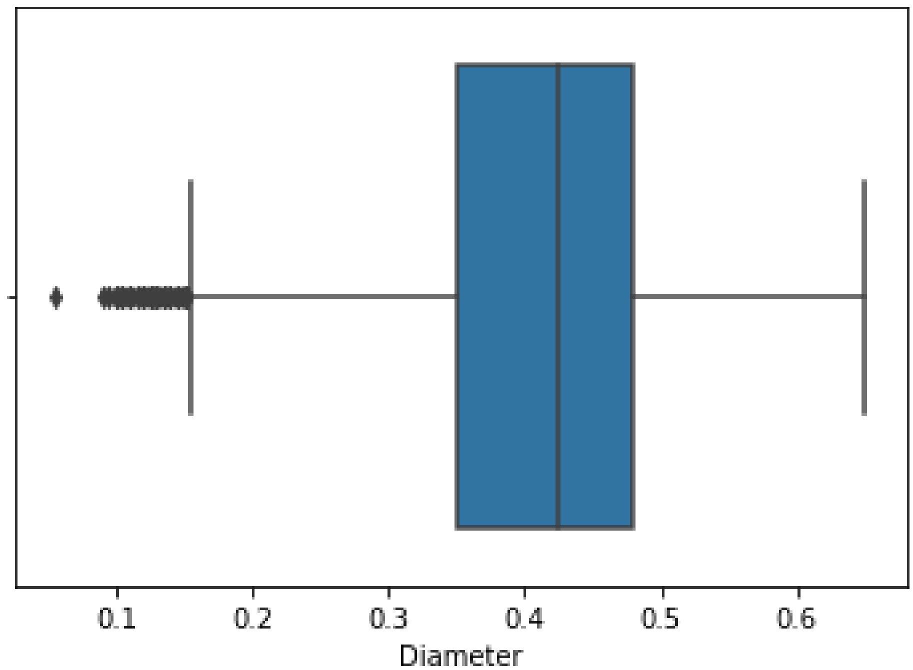
```
ds.info()

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4177 entries, 0 to 4176
Data columns (total 10 columns):
 #   Column          Non-Null Count  Dtype
---  -------         --------------  ------
 0   Sex             4177 non-null   object
 1   Length          4177 non-null   float64
 2   Diameter        4177 non-null   float64
 3   Height          4177 non-null   float64
 4   Whole weight    4177 non-null   float64
 5   Shucked weight  4177 non-null   float64
 6   Viscera weight  4177 non-null   float64
 7   Shell weight    4177 non-null   float64
 8   Rings           4177 non-null   int64
 9   Age             4177 non-null   float64
dtypes: float64(8), int64(1), object(1)
memory usage: 326.5+ KB

ds.isnull().sum()

Sex               0
Length            0
Diameter          0
Height            0
Whole weight      0
Shucked weight    0
Viscera weight    0
Shell weight      0
Rings             0
Age               0
dtype: int64

ds.notnull()

       Sex  Length  Diame
0     True    True      T
1     True    True      T
2     True    True      T
```

```
4176  True    True      True    True          True            True

      Viscera weight  Shell weight  Rings   Age
0               True          True   True  True
1               True          True   True  True
2               True          True   True  True
3               True          True   True  True
4               True          True   True  True
...              ...           ...    ...   ...
4172            True          True   True  True
4173            True          True   True  True
4174            True          True   True  True
4175            True          True   True  True
4176            True          True   True  True

[4177 rows x 10 columns]
```

6. Find the outliers and replace them outliers

```
#occurence of outliers
#a data point in a data set that is distant from all other
observations

sns.boxplot(ds.Diameter)
```

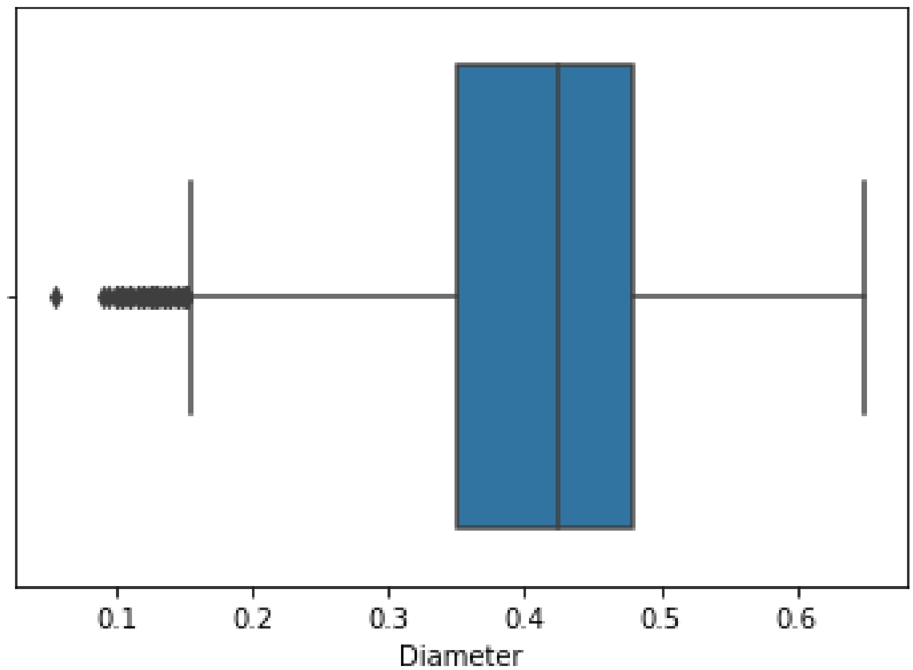
```
/home/lokesh/anaconda3/lib/python3.9/site-packages/seaborn/
_decorators.py:36: FutureWarning: Pass the following variable as a
keyword arg: x. From version 0.12, the only valid positional argument
will be `data`, and passing other arguments without an explicit
keyword will result in an error or misinterpretation.
  warnings.warn(

<AxesSubplot:xlabel='Diameter'>
```




```
Q1= ds.Diameter.quantile(0.25)
Q3=ds.Diameter.quantile(0.75)

IQR=Q3-Q1    #spread the middle values are

upper_limit =Q3 + 1.5*IQR
lower_limit =Q1 - 1.5*IQR

ds['Diameter'] = 
np.where(ds['Diameter']>upper_limit,30,ds['Diameter'])

sns.boxplot(ds.Diameter)
```

```
/home/lokesh/anaconda3/lib/python3.9/site-packages/seaborn/
_decorators.py:36: FutureWarning: Pass the following variable as a 
keyword arg: x. From version 0.12, the only valid positional argument 
will be `data`, and passing other arguments without an explicit 
keyword will result in an error or misinterpretation.
  warnings.warn(
```

```
<AxesSubplot:xlabel='Diameter'>
```



7. Check for Categorical columns and perform encoding.

```
from sklearn.preprocessing import LabelEncoder
le = LabelEncoder()

ds1['Sex'] = le.fit_transform(ds1['Sex'])
ds1

        # 0 = female, 1 = infant, 2 = male
```

```
     Sex  Length  Diameter  Height  Whole weight  Shucked weight  \
0      2   0.455     0.365   0.095        0.5140          0.2245
1      2   0.350     0.265   0.090        0.2255          0.0995
2      0   0.530     0.420   0.135        0.6770          0.2565
3      2   0.440     0.365   0.125        0.5160          0.2155
4      1   0.330     0.255   0.080        0.2050          0.0895
..   ...     ...       ...     ...           ...             ...
195    2   0.500     0.405   0.155        0.7720          0.3460
196    0   0.505     0.410   0.150        0.6440          0.2850
197    2   0.640     0.500   0.185        1.3035          0.4445
198    2   0.560     0.450   0.160        0.9220          0.4320
199    2   0.585     0.460   0.185        0.9220          0.3635

     Viscera weight  Shell weight  Rings   Age
0            0.1010         0.150     15  16.5
1            0.0485         0.070      7   8.5
2            0.1415         0.210      9  10.5
3            0.1140         0.155     10  11.5
4            0.0395         0.055      7   8.5
```

```
..            ...          ...    ...   ...
195        0.1535        0.245     12  13.5
196        0.1450        0.210     11  12.5
197        0.2635        0.465     16  17.5
198        0.1780        0.260     15  16.5
199        0.2130        0.285     10  11.5

[200 rows x 10 columns]
```

8. Split the data into dependent and independent variables.

```
#Splitting the Dataset into the Independent Feature Matrix

x = ds1.iloc[:, 0:9]
x
```

```
     Sex  Length  Diameter  Height  Whole weight  Shucked weight  \
0      2   0.455     0.365   0.095        0.5140          0.2245
1      2   0.350     0.265   0.090        0.2255          0.0995
2      0   0.530     0.420   0.135        0.6770          0.2565
3      2   0.440     0.365   0.125        0.5160          0.2155
4      1   0.330     0.255   0.080        0.2050          0.0895
..   ...     ...       ...     ...           ...             ...
195    2   0.500     0.405   0.155        0.7720          0.3460
196    0   0.505     0.410   0.150        0.6440          0.2850
197    2   0.640     0.500   0.185        1.3035          0.4445
198    2   0.560     0.450   0.160        0.9220          0.4320
199    2   0.585     0.460   0.185        0.9220          0.3635

     Viscera weight  Shell weight  Rings
0            0.1010         0.150     15
1            0.0485         0.070      7
2            0.1415         0.210      9
3            0.1140         0.155     10
4            0.0395         0.055      7
..              ...           ...    ...
195          0.1535         0.245     12
196          0.1450         0.210     11
197          0.2635         0.465     16
198          0.1780         0.260     15
199          0.2130         0.285     10

[200 rows x 9 columns]
```

```
#Extracting the Dataset to Get the Dependent Vector

y = ds1.iloc[:,9:10]
print(y)
```

```
      Age
0    16.5
```

```
1      8.5
2     10.5
3     11.5
4      8.5
..     ...
195   13.5
196   12.5
197   17.5
198   16.5
199   11.5

[200 rows x 1 columns]
```

9. Scale the independent variables

```
#scaling the independent variables using scale and MinMaxScaler

from sklearn.preprocessing import scale
from sklearn.preprocessing import MinMaxScaler

mm = MinMaxScaler()

x_scaled = mm.fit_transform(x)
y_scaled = mm.fit_transform(y)

x_scaled

array([[1.        , 0.51351351, 0.52808989, ..., 0.17680075,
0.14070352,
         0.64705882],
       [1.        , 0.32432432, 0.30337079, ..., 0.07857811,
0.06030151,
         0.17647059],
       [0.        , 0.64864865, 0.65168539, ..., 0.2525725 ,
0.20100503,
         0.29411765],
       ...,
       [1.        , 0.84684685, 0.83146067, ..., 0.4808232 ,
0.45728643,
         0.70588235],
       [1.        , 0.7027027 , 0.71910112, ..., 0.32086062,
0.25125628,
         0.64705882],
       [1.        , 0.74774775, 0.74157303, ..., 0.38634238,
0.27638191,
         0.35294118]])

y_scaled

array([[0.64705882],
       [0.17647059],
```

```
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[0.35294118]])
```

10. Split the data into training and testing

```
from sklearn.model_selection import train_test_split # library for
split the data into training and testing

x_train,x_test,y_train,y_test =
train_test_split(x_scaled,y_scaled,train_size=0.80,test_size =
0.20,random_state=0)

x_train

array([[0.5       , 0.17117117, 0.15730337, ..., 0.0261927 ,
0.01809045,
        0.17647059],
       [0.        , 0.71171171, 0.69662921, ..., 0.34985968,
0.31155779,
        0.47058824],
       [0.        , 0.73873874, 0.71910112, ..., 0.49672591,
0.27638191,
        0.41176471],
       ...,
       [1.        , 0.48648649, 0.47191011, ..., 0.16651076,
0.15577889,
        0.35294118],
       [0.        , 0.52252252, 0.5505618 , ..., 0.19363891,
0.14070352,
        0.17647059],
       [1.        , 0.63963964, 0.68539326, ..., 0.42376052,
0.27638191,
        0.23529412]])

y_train

array([[0.17647059],
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```

```
       [0.88235294],
       [0.52941176],
       [0.64705882],
       [0.41176471],
       [0.29411765],
       [0.64705882],
       [0.94117647],
       [0.23529412],
       [0.05882353],
       [0.82352941],
       [0.70588235],
       [0.47058824],
       [0.29411765],
       [0.41176471],
       [0.35294118],
       [0.70588235],
       [0.58823529],
       [0.41176471],
       [0.05882353],
       [0.23529412],
       [0.94117647],
       [0.35294118],
       [0.41176471],
       [0.58823529],
       [0.47058824],
       [0.41176471],
       [0.05882353],
       [0.52941176],
       [0.29411765],
       [0.        ],
       [0.35294118],
       [0.29411765],
       [0.52941176],
       [0.35294118],
       [0.70588235],
       [0.35294118],
       [0.88235294],
       [0.35294118],
       [0.52941176],
       [0.58823529],
       [0.35294118],
       [0.17647059],
       [0.23529412]])
```

```
x_test
```

```
array([[1.        , 0.35135135, 0.37078652, 0.21052632, 0.08948413,
        0.08160377, 0.06828812, 0.09045226, 0.17647059],
       [1.        , 0.94594595, 0.94382022, 0.92105263, 0.76448413,
        0.66226415, 1.        , 0.58291457, 0.58823529],
       [0.        , 0.59459459, 0.60674157, 0.44736842, 0.25297619,
```

```
 0.23632075, 0.23386342, 0.21105528, 0
[1.        , 0.54054054, 0.53932584, 0
 0.17971698, 0.23666978, 0.15577889, 0
[0.5       , 0.26126126, 0.25842697, 0
 0.04009434, 0.0767072 , 0.04020101, 0
[0.       , 0.7027027 , 0.71910112, 0
 0.39481132, 0.48924228, 0.29145729, 0
[0.5       , 0.45945946, 0.38202247, 0
 0.12311321, 0.13283442, 0.11055276, 0
[1.        , 0.52252252, 0.49438202, 0
 0.20141509, 0.1898971 , 0.14723618, 0
[1.        , 0.57657658, 0.56179775, 0
 0.19528302, 0.1655753 , 0.18090452, 0
[0.       , 0.83783784, 0.86516854, 0
 0.46792453, 0.55846586, 0.44221106, 0
[1.        , 0.6036036 , 0.61797753, 0
 0.27783019, 0.28718428, 0.16582915, 0
[0.5       , 0.18018018, 0.14606742, 0
 0.01698113, 0.03180543, 0.0201005 , 0
[1.        , 0.72072072, 0.78651685, 0
 0.36650943, 0.36202058, 0.28643216, 0
[0.       , 0.71171171, 0.71910112, 0
 0.35518868, 0.26753976, 0.30150754, 0
[0.       , 0.72972973, 0.70786517, 0
 0.35283019, 0.45930776, 0.27638191, 0
[0.       , 0.67567568, 0.66292135, 0
 0.26745283, 0.26753976, 0.25125628, 0
[0.       ,
 0.75896226,
[1.        ,
 0.44622642,
[0.       ,
 0.21367925,
[0.       ,
 0.44386792,
[0.       ,
 0.4009434 ,
[0.       ,
 0.22122642,
[0.5       ,
 0.07264151,
[0.       ,
 0.27169811,
[1.        ,
 0.15990566,
[1.        ,
 0.075     ,
[1.        ,
 0.35330189,
[1.        ,
```

```
        0.50471698, 0.54256314, 0.34673367, 0.52941176],
       [0.        , 0.62162162, 0.66292135, 0.52631579, 0.29206349,
        0.27688679, 0.31057063, 0.24623116, 0.58823529],
       [0.5       , 0.07207207, 0.04494382, 0.05263158, 0.0047619 ,
        0.00660377, 0.01122544, 0.00502513, 0.        ],
       [0.5       , 0.33333333, 0.33707865, 0.23684211, 0.10337302,
        0.07971698, 0.06173994, 0.10552764, 0.17647059],
       [0.        , 0.59459459, 0.60674157, 0.52631579, 0.25059524,
        0.23207547, 0.31618335, 0.21105528, 0.23529412],
       [1.        , 0.75675676, 0.7752809 , 0.55263158, 0.40595238,
        0.40660377, 0.47801684, 0.31658291, 0.64705882],
       [1.        , 0.53153153, 0.51685393, 0.34210526, 0.15912698,
        0.15235849, 0.18802619, 0.16582915, 0.29411765],
       [0.        , 0.71171171, 0.69662921, 0.60526316, 0.3609127 ,
        0.39339623, 0.38821328, 0.26130653, 0.47058824],
       [0.        , 0.74774775, 0.74157303, 0.68421053, 0.35813492,
        0.33443396, 0.494855  , 0.28140704, 0.29411765],
       [1.        , 0.97297297, 0.92134831, 0.65789474, 0.76547619,
        0.71320755, 0.47614593, 0.77386935, 0.82352941],
       [0.5       , 0.28828829, 0.28089888, 0.21052632, 0.06944444,
        0.0745283 , 0.06173994, 0.04522613, 0.17647059],
       [1.        , 0.76576577, 0.7752809 , 0.63157895, 0.5109127 ,
        0.375     , 0.42563143, 0.57286432, 1.        ],
       [0.        , 0.67567568, 0.6741573 , 0.65789474, 0.30634921,
        0.26698113, 0.33021515, 0.27135678, 0.41176471]])
```

```
y_test
```

```
array([[0.17647059],
       [0.58823529],
       [0.35294118],
       [0.17647059],
       [0.23529412],
       [0.35294118],
       [0.23529412],
       [0.35294118],
       [0.41176471],
       [0.35294118],
       [0.29411765],
       [0.05882353],
       [0.58823529],
       [0.47058824],
       [0.29411765],
       [0.70588235],
       [0.88235294],
       [0.76470588],
       [0.23529412],
       [0.52941176],
       [0.35294118],
       [0.35294118],
       [0.17647059],
```

```
        [0.52941176],
        [0.17647059],
        [0.11764706],
        [0.41176471],
        [0.52941176],
        [0.58823529],
        [0.        ],
        [0.17647059],
        [0.23529412],
        [0.64705882],
        [0.29411765],
        [0.47058824],
        [0.29411765],
        [0.82352941],
        [0.17647059],
        [1.        ],
        [0.41176471]])
```

```
print(x_scaled.shape)
print(y_scaled.shape)
print(x_train.shape)
print(y_train.shape)
print(x_test.shape)
print(y_test.shape)
```

```
(200, 9)
(200, 1)
(160, 9)
(160, 1)
(40, 9)
(40, 1)
```

11. Build the Model

```
from sklearn.linear_model import LinearRegression

mlr = LinearRegression()

mlr.fit(x_train,y_train)
```

```
LinearRegression()
```

12. Train the Model

13. Test the Model

```
prediction = mlr.predict(x_test)

prediction
```

```
array([[1.76470588e-01],
       [5.88235294e-01],
       [3.52941176e-01],
```

```
        [1.76470588e-01],
        [2.35294118e-01],
        [3.52941176e-01],
        [2.35294118e-01],
        [3.52941176e-01],
        [4.11764706e-01],
        [3.52941176e-01],
        [2.94117647e-01],
        [5.88235294e-02],
        [5.88235294e-01],
        [4.70588235e-01],
        [2.94117647e-01],
        [7.05882353e-01],
        [8.82352941e-01],
        [7.64705882e-01],
        [2.35294118e-01],
        [5.29411765e-01],
        [3.52941176e-01],
        [3.52941176e-01],
        [1.76470588e-01],
        [5.29411765e-01],
        [1.76470588e-01],
        [1.17647059e-01],
        [4.11764706e-01],
        [5.29411765e-01],
        [5.88235294e-01],
        [2.20691474e-16],
        [1.76470588e-01],
        [2.35294118e-01],
        [6.47058824e-01],
        [2.94117647e-01],
        [4.70588235e-01],
        [2.94117647e-01],
        [8.23529412e-01],
        [1.76470588e-01],
        [1.00000000e+00],
        [4.11764706e-01]])
```

```
prediction.astype(int)
```

```
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],
       [0],
       [0],
       [1],
       [0]])
```

```
y_test.astype(int)
```

```
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],
       [0],
       [0],
       [1],
       [0]])
```

14. Measure the performance using Metrics.

```
from sklearn.metrics import r2_score
r2_score(prediction,y_test)
```

```
1.0
```

```
from sklearn.preprocessing import PolynomialFeatures
plr = PolynomialFeatures(degree=2)
x_poly = plr.fit_transform(x)
```

```
x_poly
```

```
array([[1.00000e+00, 2.00000e+00, 4.55000e-01, ..., 2.25000e-02,
        2.25000e+00, 2.25000e+02],
       [1.00000e+00, 2.00000e+00, 3.50000e-01, ..., 4.90000e-03,
        4.90000e-01, 4.90000e+01],
       [1.00000e+00, 0.00000e+00, 5.30000e-01, ..., 4.41000e-02,
        1.89000e+00, 8.10000e+01],
       ...,
       [1.00000e+00, 2.00000e+00, 6.40000e-01, ..., 2.16225e-01,
        7.44000e+00, 2.56000e+02],
       [1.00000e+00, 2.00000e+00, 5.60000e-01, ..., 6.76000e-02,
        3.90000e+00, 2.25000e+02],
       [1.00000e+00, 2.00000e+00, 5.85000e-01, ..., 8.12250e-02,
        2.85000e+00, 1.00000e+02]])
```

Abalone Age Prediction

1. LinearRegression

```
from sklearn.linear_model import LinearRegression
lr = LinearRegression()
lr.fit(x_poly,y)
```

```
LinearRegression()
```

```
lr.predict(plr.transform([[1,0.350,0.410,0.185,1.3035,0.3635,0.1010,0.
285,16]]))
```

```
/home/lokesh/anaconda3/lib/python3.9/site-packages/sklearn/
base.py:450: UserWarning: X does not have valid feature names, but
PolynomialFeatures was fitted with feature names
  warnings.warn(
```

```
array([[17.5]])
```

2. Ridge

```
from sklearn.linear_model import Ridge
r = Ridge()
r.fit(x,y)
```

```
Ridge()
```

```
r.predict([[1,0.350,0.410,0.185,1.3035,0.3635,0.1010,0.285,16]])
```

```
/home/lokesh/anaconda3/lib/python3.9/site-packages/sklearn/
base.py:450: UserWarning: X does not have valid feature names, but
Ridge was fitted with feature names
  warnings.warn(
```

```
array([[17.49624459]])
```

3. Lasso

```
from sklearn.linear_model import Lasso
l = Lasso()
l.fit(x,y)
```

```
Lasso()
```

```
l.predict([[1,0.350,0.410,0.185,1.3035,0.3635,0.1010,0.285,16]])
```

```
/home/lokesh/anaconda3/lib/python3.9/site-packages/sklearn/
base.py:450: UserWarning: X does not have valid feature names, but
Lasso was fitted with feature names
  warnings.warn(
```

```
array([17.08721342])
```