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	Shell weight	Rings	Age
0	M	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.150	15	16.5
1	M	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.070	7	8.5
2	F	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.210	9	10.5
3	M	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.155	10	11.5
4	I	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.055	7	8.5

3. Perform Below Visualizations.

· Univariate Analysis

· Bi-Variate Analysis

· Multi-Variate Analysis

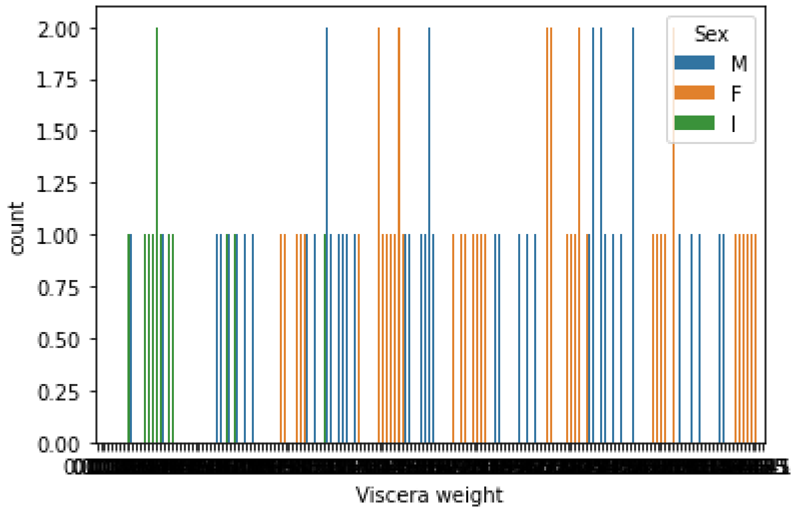
```
# univarient analysis

#frequency table for age

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
```

```
#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	Viscera weight
count	4177.000000	4177.000000	4177.000000	4177.000000	4177.000000	4177.000000
mean	0.523992	0.407881	0.139516	0.828742	0.359367	0.180594
std	0.120093	0.099240	0.041827	0.490389	0.221963	0.109614
min	0.075000	0.055000	0.000000	0.002000	0.001000	0.000500
25%	0.450000	0.350000	0.115000	0.441500	0.186000	0.093500
50%	0.545000	0.425000	0.140000	0.799500	0.336000	0.171000
75%	0.615000	0.480000	0.165000	1.153000	0.502000	0.253000

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
```

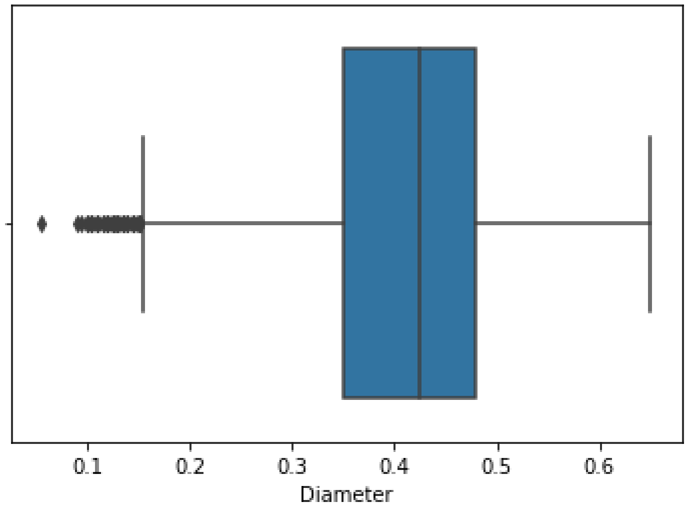
```
ds.notnull()
```

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings	Ag
0	True	True	True	True	True	True	True	True	True	Tru
1	True	True	True	True	True	True	True	True	True	Tru
2	True	True	True	True	True	True	True	True	True	Tru
3	True	True	True	True	True	True	True	True	True	Tru
4	True	True	True	True	True	True	True	True	True	Tru
...	...	...	...	...	...	...	...	...	...	..
4172	True	True	True	True	True	True	True	True	True	Tru
4173	True	True	True	True	True	True	True	True	True	Tru
4174	True	True	True	True	True	True	True	True	True	Tru
4175	True	True	True	True	True	True	True	True	True	Tru
4176	True	True	True	True	True	True	True	True	True	Tru

6. Find the outliers and replace them outliers

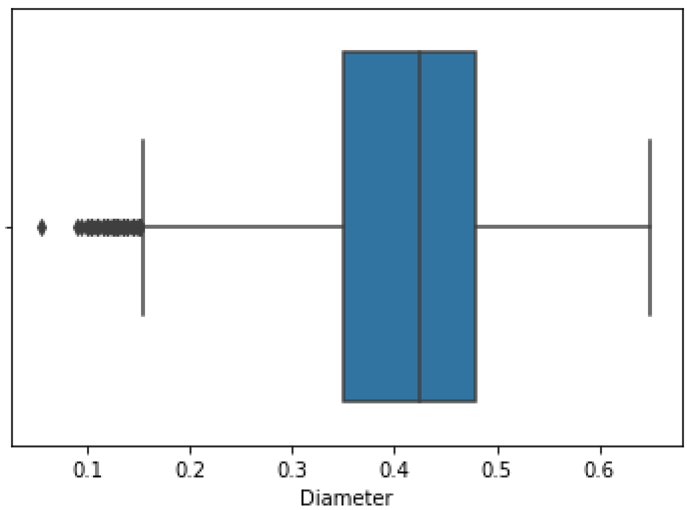
```
#occurence of outliers
#a data point in a data set that is distant from all other observations

sns.boxplot(ds.Diameter)
```

```
/home/lokesh/anaconda3/lib/python3.9/site-packages/seaborn/_decorators.py:36: Futu
  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: Futu
  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	Viscera weight	Shell weight	Rings	Age
0	2	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.150	15	16.5
1	2	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.070	7	8.5
2	0	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.210	9	10.5
3	2	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.155	10	11.5
4	1	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.055	7	8.5
...	...	...	...	...	...	...	...	...	...	...
195	2	0.500	0.405	0.155	0.7720	0.3460	0.1535	0.245	12	13.5
196	0	0.505	0.410	0.150	0.6440	0.2850	0.1450	0.210	11	12.5
197	2	0.640	0.500	0.185	1.3035	0.4445	0.2635	0.465	16	17.5
198	2	0.560	0.450	0.160	0.9220	0.4320	0.1780	0.260	15	16.5
199	2	0.585	0.460	0.185	0.9220	0.3635	0.2130	0.285	10	11.5

200 rows × 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	Viscera weight	Shell weight	Rings
0	2	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.150	15
1	2	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.070	7
2	0	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.210	9
3	2	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.155	10

```
#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],
       [0.29411765],
       [0.35294118],
       [0.17647059],
       [0.23529412],
       [0.94117647],
       [0.70588235],
       [0.29411765],
       [0.88235294],
       [0.58823529],
       [0.35294118],
       [0.41176471],
       [0.35294118],
       [0.35294118],
       [0.47058824],
       [0.17647059],
       [0.35294118],
       [0.17647059],
       [0.29411765],
       [0.41176471],
       [0.35294118],
       [0.47058824],
       [0.29411765],
       [0.35294118],
       [0.41176471],
       [0.41176471],
       [0.47058824],
       [0.64705882],
       [0.41176471],
       [0.35294118],
       [0.64705882],
       [0.82352941],
       [0.88235294],
       [0.52941176],
       [0.23529412],
       [0.70588235],
       [0.23529412],
       [0.41176471],
       [0.29411765],
       [0.29411765],
       [0.58823529],
       [0.05882353],
       [0.05882353],
       [0.        ],
       [0.17647059],
       [0.29411765],
       [0.17647059],
       [0.11764706],
       [0.29411765],
       [0.23529412],
       [0.17647059],
       [0.35294118],
```

```
           [0.35294118],
           [0.17647059],
           [0.23529412],
           [0.23529412],
           [0.23529412],
```

10. Split the data into training and testing

```
from sklearn.model_selection import train_test_split # library for split the data into tra

x_train,x_test,y_train,y_test = train_test_split(x_scaled,y_scaled,train_size=0.80,test_si
```

```
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],
       [0.47058824],
       [0.41176471],
       [0.29411765],
       [0.58823529],
       [0.17647059],
       [0.29411765],
       [0.64705882],
       [0.29411765],
       [0.41176471],
       [0.23529412],
       [0.11764706],
       [0.47058824],
       [0.23529412],
       [0.        ],
       [0.35294118],
       [0.35294118],
       [0.52941176],
       [0.29411765],
       [0.23529412],
       [0.29411765],
       [0.29411765],
       [1.        ],
       [0.29411765],
```

```
       [0.35294118],
       [0.52941176],
       [0.17647059],
       [0.82352941],
       [0.17647059],
       [0.52941176],
       [0.29411765],
       [0.64705882],
       [0.29411765],
       [0.64705882],
       [0.35294118],
       [0.47058824],
       [0.29411765],
       [0.35294118],
       [0.47058824],
       [0.35294118],
       [0.35294118],
       [0.29411765],
       [0.29411765],
       [0.47058824],
       [0.29411765],
       [0.35294118],
       [0.29411765],
       [0.17647059],
       [0.17647059],
       [0.70588235],
       [0.05882353],
       [0.58823529],
       [0.35294118],
       [0.41176471],
       [0.41176471],
       [0.        ],
       [0.17647059],
       [0.11764706],
```

```
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, 0.35294118],
       [1.        , 0.54054054, 0.53932584, 0.47368421, 0.19543651,
        0.17971698, 0.23666978, 0.15577889, 0.17647059],
       [0.5       , 0.26126126, 0.25842697, 0.23684211, 0.04503968,
        0.04009434, 0.0767072 , 0.04020101, 0.23529412],
       [0.        , 0.7027027 , 0.71910112, 0.63157895, 0.39424603,
        0.39481132, 0.48924228, 0.29145729, 0.35294118],
       [0.5       , 0.45945946, 0.38202247, 0.28947368, 0.12757937,
        0.12311321, 0.13283442, 0.11055276, 0.23529412],
       [1.        , 0.52252252, 0.49438202, 0.42105263, 0.19246032,
        0.20141509, 0.1898971 , 0.14723618, 0.35294118],
       [1.        , 0.57657658, 0.56179775, 0.5       , 0.20297619,
        0.19528302, 0.1655753 , 0.18090452, 0.41176471],
       [0.        , 0.83783784, 0.86516854, 0.78947368, 0.53234127,
        0.46792453, 0.55846586, 0.44221106, 0.35294118],
       [1.        , 0.6036036 , 0.61797753, 0.36842105, 0.23611111,
        0.27783019, 0.28718428, 0.16582915, 0.29411765],
       [0.5       , 0.18018018, 0.14606742, 0.10526316, 0.01706349,
```

```
        0.01698113, 0.03180543, 0.0201005 , 0.05882353],
       [1.        , 0.72072072, 0.78651685, 0.73684211, 0.3609127 ,
        0.36650943, 0.36202058, 0.28643216, 0.58823529],
       [0.        , 0.71171171, 0.71910112, 0.5       , 0.38035714,
        0.35518868, 0.26753976, 0.30150754, 0.47058824],
       [0.        , 0.72972973, 0.70786517, 0.52631579, 0.36150794,
        0.35283019, 0.45930776, 0.27638191, 0.29411765],
       [0.        , 0.67567568, 0.66292135, 0.44736842, 0.29285714,
        0.26745283, 0.26753976, 0.25125628, 0.70588235],
       [0.        , 0.91891892, 0.94382022, 0.71052632, 0.7015873 ,
        0.75896226, 0.72217025, 0.44723618, 0.88235294],
       [1.        , 0.76576577, 0.78651685, 0.65789474, 0.48888889,
        0.44622642, 0.51730589, 0.40201005, 0.76470588],
       [0.        , 0.5045045 , 0.50561798, 0.34210526, 0.19543651,
        0.21367925, 0.20579981, 0.13567839, 0.23529412],
       [0.        , 0.78378378, 0.71910112, 0.81578947, 0.42380952,
        0.44386792, 0.52946679, 0.30653266, 0.52941176],
       [0.        , 0.81081081, 0.7752809 , 0.71052632, 0.39146825,
        0.4009434 , 0.38821328, 0.31658291, 0.35294118],
       [0.        , 0.57657658, 0.56179775, 0.44736842, 0.20595238,
        0.22122642, 0.18896165, 0.16482412, 0.35294118],
       [0.5       , 0.3963964 , 0.37078652, 0.28947368, 0.06865079,
        0.07264151, 0.07202993, 0.06532663, 0.17647059],
       [0.        , 0.72972973, 0.74157303, 0.65789474, 0.43412698,
        0.27169811, 0.32179607, 0.4321608 , 0.52941176],
       [1.        , 0.5045045 , 0.48314607, 0.34210526, 0.15138889,
        0.15990566, 0.19831618, 0.12562814, 0.17647059],
       [1.        , 0.36036036, 0.30337079, 0.18421053, 0.07301587,
        0.075     , 0.08325538, 0.06030151, 0.11764706],
       [1.        , 0.73873874, 0.7752809 , 0.57894737, 0.37301587,
        0.35330189, 0.39289055, 0.34170854, 0.41176471],
       [1.        , 0.81081081, 0.80898876, 0.78947368, 0.47142857,
        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],
```

```
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:
  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:
  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:
  warnings.warn(
array([17.08721342])
```