

## ASSIGNMENT - 4

Name: Navaneethan C

In [1]:

```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
```

In [3]:

```
import os
os.chdir("C:/Users/cselab/Desktop/DATASETS")
```

In [4]:

```
df = pd.read_csv('abalone.csv')
```

In [5]:

```
df
```

Out[5]:

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Vizcera weight
0	M	0.455	0.365	0.095	0.5140	0.2245	0.10
1	M	0.350	0.265	0.090	0.2255	0.0995	0.04
2	F	0.530	0.420	0.135	0.6770	0.2565	0.14
3	M	0.440	0.365	0.125	0.5160	0.2155	0.11
4	I	0.330	0.255	0.080	0.2050	0.0895	0.03
...	...	...	...	...	...	...	...
4172	F	0.565	0.450	0.165	0.8870	0.3700	0.15
4173	M	0.590	0.440	0.135	0.9660	0.4390	0.16
4174	M	0.600	0.475	0.205	1.1760	0.5255	0.17
4175	F	0.625	0.485	0.150	1.0945	0.5310	0.18
4176	M	0.710	0.555	0.195	1.9485	0.9455	0.20

4177 rows × 9 columns



In [6]:

```
df.head()
```

Out[6]:

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Vizcera weight
0	M	0.455	0.365	0.095	0.5140	0.2245	0.10
1	M	0.350	0.265	0.090	0.2255	0.0995	0.04
2	F	0.530	0.420	0.135	0.6770	0.2565	0.14
3	M	0.440	0.365	0.125	0.5160	0.2155	0.11
4	I	0.330	0.255	0.080	0.2050	0.0895	0.03

```
In [7]: df.tail()
```

```
Out[7]:
```

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	V
4172	F	0.565	0.450	0.165	0.8870	0.3700	
4173	M	0.590	0.440	0.135	0.9660	0.4390	
4174	M	0.600	0.475	0.205	1.1760	0.5255	
4175	F	0.625	0.485	0.150	1.0945	0.5310	
4176	M	0.710	0.555	0.195	1.9485	0.9455	

```
In [12]: #Abalone age prediction
```

```
In [48]: df['age'] = df['Rings']+1.5  
df = df.drop('Rings', axis = 1)
```

```
-----  
-----  
KeyError Traceback (most recent call last)  
File ~\anaconda3\lib\site-packages\pandas\core\indexes\base.py:3621, in Index.get_loc(self, key, method, tolerance)  
    3620     try:  
-> 3621         return self._engine.get_loc(casted_key)  
    3622     except KeyError as err:  
  
File ~\anaconda3\lib\site-packages\pandas\_libs\index.pyx:136, in pandas._libs.index.IndexEngine.get_loc()  
  
File ~\anaconda3\lib\site-packages\pandas\_libs\index.pyx:163, in pandas._libs.index.IndexEngine.get_loc()  
  
File pandas\_libs\hashtable_class_helper.pxi:5198, in pandas._libs.hashtable.PyObjectHashTable.get_item()  
  
File pandas\_libs\hashtable_class_helper.pxi:5206, in pandas._libs.hashtable.PyObjectHashTable.get_item()  
  
KeyError: 'Rings'
```

The above exception was the direct cause of the following exception:

```
KeyError Traceback
```

```

k (most recent call last)
Input In [48], in ()
----> 1 df['age'] = df['Rings']+1.5
      2 df = df.drop('Rings', axis = 1)

File ~\anaconda3\lib\site-packages\pandas\core\frame.py:3505, in DataFrame.__getitem__(self, key)
    3503 if self.columns.nlevels > 1:
    3504     return self._getitem_multilevel(key)
-> 3505 indexer = self.columns.get_loc(key)
    3506 if is_integer(indexer):
    3507     indexer = [indexer]

File ~\anaconda3\lib\site-packages\pandas\core\indexes\base.py:3623, in Index.get_loc(self, key, method, tolerance)
    3621     return self._engine.get_loc(casted_key)
    3622 except KeyError as err:
-> 3623     raise KeyError(key) from err
    3624 except TypeError:
        # If we have a listlike key, _check_indexing_error will raise
        # InvalidIndexError. Otherwise we fall through and re-raise
        # the TypeError.
    3627     self._check_indexing_error(key)

KeyError: 'Rings'

```

In [49]: df

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	V
<b>0</b>	M	0.455	0.365	0.095	0.5140	0.2245	
<b>1</b>	M	0.350	0.265	0.090	0.2255	0.0995	
<b>2</b>	F	0.530	0.420	0.135	0.6770	0.2565	
<b>3</b>	M	0.440	0.365	0.125	0.5160	0.2155	
<b>4</b>	I	0.330	0.255	0.080	0.2050	0.0895	
...	...	...	...	...	...	...	...
<b>4172</b>	F	0.565	0.450	0.165	0.8870	0.3700	
<b>4173</b>	M	0.590	0.440	0.135	0.9660	0.4390	
<b>4174</b>	M	0.600	0.475	0.205	1.1760	0.5255	
<b>4175</b>	F	0.625	0.485	0.150	1.0945	0.5310	
<b>4176</b>	M	0.710	0.555	0.195	1.9485	0.9455	

4177 rows × 9 columns



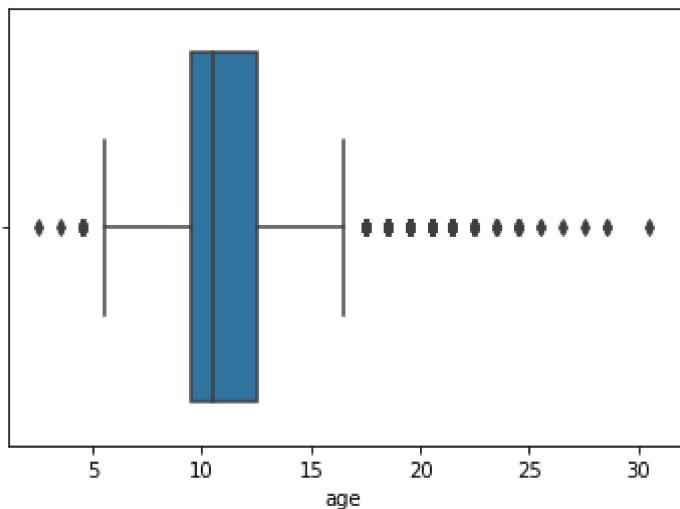
```
In [19]: #Perform visualisations  
#Univariate analysis
```

```
In [37]: sns.boxplot(df.age)
```

C:\Users\cselab\anaconda3\lib\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.

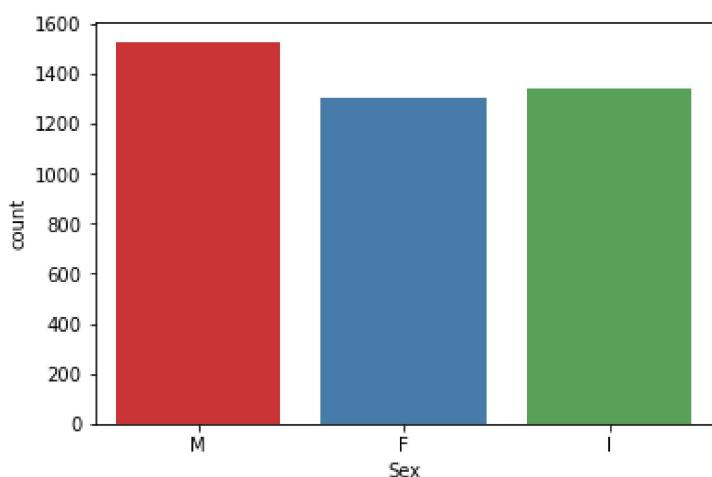
```
    warnings.warn(
```

```
Out[37]:
```



```
In [38]: sns.countplot(x = 'Sex', data = df, palette = 'Se'
```

```
Out[38]:
```



```
In [51]: sns.heatmap(df , linewidth= 1, cmap = 'coolwarm')
```

-----  
ValueError Traceback

```

k (most recent call last)
Input In [51], in ()
----> 1 sns.heatmap(df , linewidth=1, cmap = 'cool
warm')

File ~\anaconda3\lib\site-packages\seaborn\_decora
tors.py:46, in _deprecate_positional_args..inner_f
(*args, **kwargs)
    36     warnings.warn(
    37         "Pass the following variable{} as
{})keyword arg{}: {}."
    38         "From version 0.12, the only valid
positional argument "
    (...)

    43         FutureWarning
    44     )
    45 kwargs.update({k: arg for k, arg in zip(si
g.parameters, args)})
--> 46 return f(**kwargs)

File ~\anaconda3\lib\site-packages\seaborn\matrix.
py:540, in heatmap(data, vmin, vmax, cmap, center,
robust, annot, fmt, annot_kws, linewidths, linecol
or, cbar, cbar_kws, cbar_ax, square, xticklabels,
yticklabels, mask, ax, **kwargs)
    362 """Plot rectangular data as a color-encode
d matrix.
    363
    364 This is an Axes-level function and will dr
aw the heatmap into the
    (...)

    537     ...     ax = sns.heatmap(corr, mask=ma
sk, vmax=.3, square=True)
    538 """
    539 # Initialize the plotter object
--> 540 plotter = HeatMapper(data, vmin, vmax, cm
ap, center, robust, annot, fmt,
    541                 annot_kws, cbar, cba
r_kws, xticklabels,
    542                 yticklabels, mask)
    544 # Add the pcolormesh kwargs here
    545 kwargs["linewidths"] = linewidths

File ~\anaconda3\lib\site-packages\seaborn\matrix.
py:159, in _HeatMapper.__init__(self, data, vmin,
vmax, cmap, center, robust, annot, fmt, annot_kw
s, cbar, cbar_kws, xticklabels, yticklabels, mask)
    156 self.ylabel = ylabel if ylabel is not None
else ""
    158 # Determine good default values for the co
lormapping
--> 159 self._determine_cmap_params(plot_data, vmi
n, vmax,
    160                 cmap, center,
robust)
    162 # Sort out the annotations
    163 if annot is None or annot is False:

File ~\anaconda3\lib\site-packages\seaborn\matrix.
py:193, in _HeatMapper._determine_cmap_params(sel

```

```
f, plot_data, vmin, vmax, cmap, center, robust)
    190     """Use some heuristics to set good default
s for colorbar and range."""
    191     # plot_data is a np.ma.array instance
--> 193 calc_data = plot_data.astype(float).filled
(np.nan)
    194 if vmin is None:
    195     if robust:

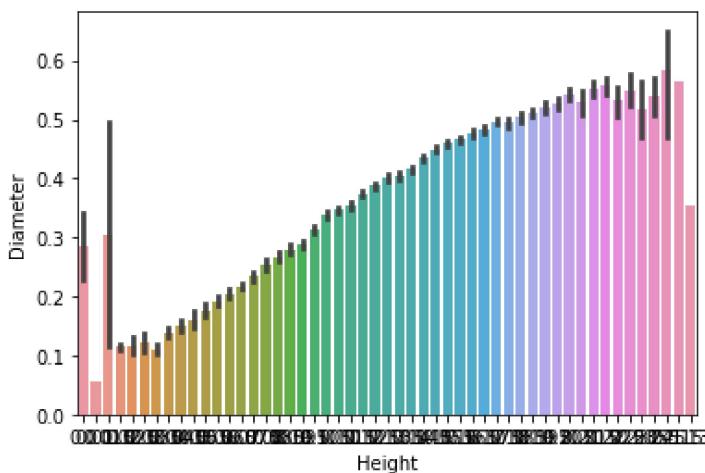
ValueError: could not convert string to float: 'M'


```

In [50]: *#Bivariate analysis*

In [52]: `sns.barplot(x=df.Height,y=df.Diameter)`

Out[52]:



In [53]: `numerical_features = df.select_dtypes(include = [`  
`categorical_features = df.select_dtypes(include = [`

```
C:\Users\cselab\AppData\Local\Temp\ipykernel_3408
\1755490424.py:2: DeprecationWarning: `np.object` is a deprecated alias for the builtin `object`. To silence this warning, use `object` by itself. Doing this will not modify any behavior and is safe.
  Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/devdocs/release/1.20.0-notes.html#deprecations
      categorical_features = df.select_dtypes(include = [np.object]).columns
```

In [55]: `numerical_features`

Out[55]: `Index(['Length', 'Diameter', 'Height', 'Whole weight', 'Shucked weight', 'Viscera weight', 'Shell weight', 'age'], dtype='object')`

In [56]: `categorical_features`

```
Out[56]: Index(['Sex'], dtype='object')
```

```
In [57]: plt.figure(figsize = (20,7))
sns.heatmap(df[numerical_features].corr(), annot =
```

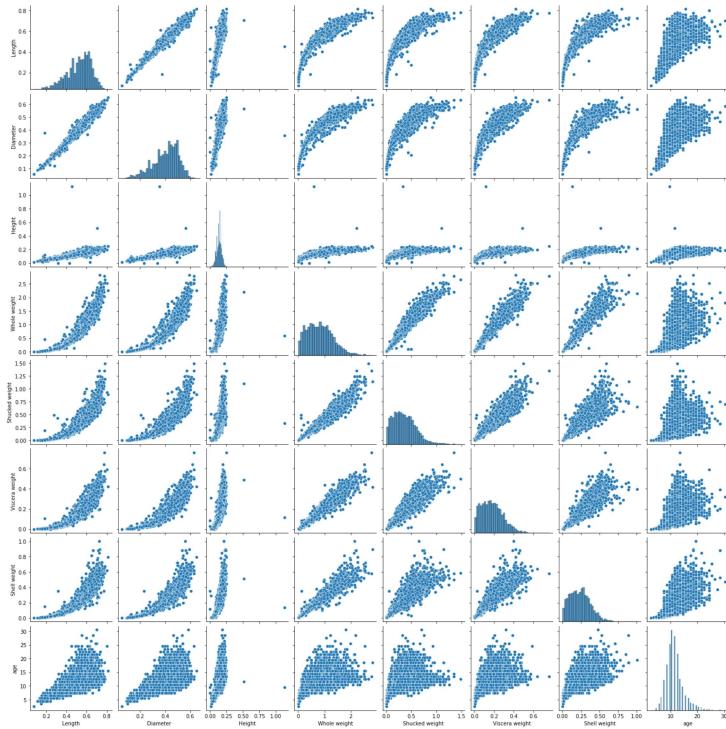
```
Out[57]:
```



```
In [58]: #Multivariate Analysis
```

```
In [59]: sns.pairplot(df)
```

```
Out[59]:
```



```
In [60]: #Perform descriptive model on the dataset
```

```
In [61]: df['Height'].describe()
```

```
Out[61]: count    4177.000000
mean      0.139516
std       0.041827
min       0.000000
25%      0.115000
```

```
25%      0.115000
50%      0.140000
75%      0.165000
max      1.130000
Name: Height, dtype: float64
```

```
In [62]: df['Height'].mean()
```

```
Out[62]: 0.1395163993296614
```

```
In [63]: df.max()
```

```
Out[63]: Sex          M
Length       0.815
Diameter    0.65
Height       1.13
Whole weight 2.8255
Shucked weight 1.488
Viscera weight 0.76
Shell weight 1.005
age          30.5
dtype: object
```

```
In [64]: df['Sex'].value_counts()
```

```
Out[64]: M    1528
I    1342
F    1307
Name: Sex, dtype: int64
```

```
In [65]: df[df.Height == 0]
```

```
Out[65]:   Sex  Length  Diameter  Height  Whole weight  Shucked weight  Viscera weight  Shell weight  age
1257     I     0.430      0.34      0.0     0.428     0.2065
3996     I     0.315      0.23      0.0     0.134     0.0575
```

```
In [66]: df['Shucked weight'].kurtosis()
```

```
Out[66]: 0.5951236783694207
```

```
In [67]: df['Diameter'].median()
```

```
Out[67]: 0.425
```

```
In [68]: df['Shucked weight'].skew()
```

```
Out[68]: 0.7190979217612694
```

```
In [69]: #Missing values
```

```
In [70]: df.isnull().sum()
```

```
Out[70]: Sex      0  
Length     0  
Diameter   0  
Height     0  
Whole weight 0  
Shucked weight 0  
Viscera weight 0  
Shell weight 0  
age         0  
dtype: int64
```

```
In [71]: df.isna().sum()
```

```
Out[71]: Sex      0  
Length     0  
Diameter   0  
Height     0  
Whole weight 0  
Shucked weight 0  
Viscera weight 0  
Shell weight 0  
age         0  
dtype: int64
```

```
In [72]: df.isna().any()
```

```
Out[72]: Sex      False  
Length     False  
Diameter  False  
Height    False  
Whole weight  False  
Shucked weight  False  
Viscera weight  False  
Shell weight  False  
age        False  
dtype: bool
```

```
In [73]: #Missing values
```

```
In [74]: missing_values = df.isnull().sum().sort_values(as  
percentage_missing_values = (missing_values/len(d  
pd.concat([missing_values, percentage_missing_val
```

	Missing values	% Missing
Sex	0	0.0
Length	0	0.0

<b>Diameter</b>	0	0.0
<b>Height</b>	0	0.0
<b>Whole weight</b>	0	0.0
<b>Shucked weight</b>	0	0.0
<b>Viscera weight</b>	0	0.0
<b>Shell weight</b>	0	0.0
<b>age</b>	0	0.0

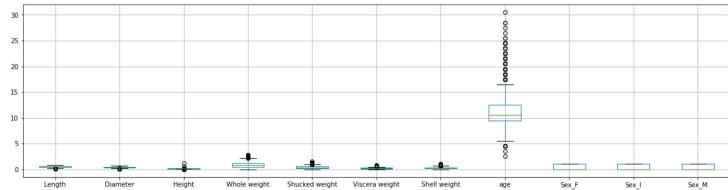
In [75]: `len(df)`

Out[75]: 4177

In [76]: `#Find the outliers`

In [85]: `df = pd.get_dummies(df)  
dummy_df = df  
df.boxplot( rot = 0, figsize=(20,5))`

Out[85]:



In [86]: `df.drop(df[(df['Viscera weight'] > 0.5) & (df['age'] < 10)], axis=0)  
df.drop(df[(df['Viscera weight'] < 0.5) & (df['age'] > 10)], axis=0)`

In [87]: `df`

Out[87]:

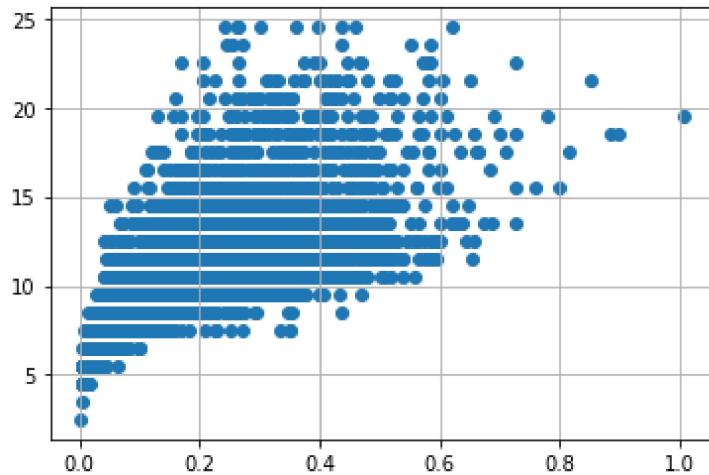
	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight
<b>0</b>	0.455	0.365	0.095	0.5140	0.2245	0.1010
<b>1</b>	0.350	0.265	0.090	0.2255	0.0995	0.0485
<b>2</b>	0.530	0.420	0.135	0.6770	0.2565	0.1415
<b>3</b>	0.440	0.365	0.125	0.5160	0.2155	0.1140
<b>4</b>	0.330	0.255	0.080	0.2050	0.0895	0.0395
...	...	...	...	...	...	...
<b>4172</b>	0.565	0.450	0.165	0.8870	0.3700	0.2390
<b>4173</b>	0.590	0.440	0.135	0.9660	0.4390	0.2145
<b>4174</b>	0.600	0.475	0.205	1.1760	0.5255	0.2875

```
4175    0.625      0.485     0.150   1.0945    0.5310    0.2610  
4176    0.710      0.555     0.195   1.9485    0.9455    0.3765
```

4147 rows × 11 columns

In [88]:

```
var = 'Shell weight'  
plt.scatter(x = df[var], y = df['age'])  
plt.grid(True)
```



In [89]:

```
#Dependent and Independent Variables
```

In [101]:

```
x = df.iloc[:, 0:1].values
```

In [102]:

```
x
```

```
Out[102]: array([[0.455],  
                  [0.35 ],  
                  [0.53 ],  
                  ...,  
                  [0.6 ],  
                  [0.625],  
                  [0.71 ]])
```

In [92]:

```
y = df.iloc[:, 1]
```

In [93]:

```
y
```

```
Out[93]: 0      0.365  
1      0.265  
2      0.420  
3      0.365  
4      0.255
```

```
4172    0.450
4173    0.440
4174    0.475
4175    0.485
4176    0.555
Name: Diameter, Length: 4147, dtype: float64
```

```
In [98]: #Scaling the Independent Variables
print ("\n ORIGINAL VALUES: \n\n", x,y)
```

ORIGINAL VALUES:

```
[[0.455]
[0.35 ]
[0.53 ]
...
[0.6 ]
[0.625]
[0.71 ]] 0      0.365
1      0.265
2      0.420
3      0.365
4      0.255
...
4172  0.450
4173  0.440
4174  0.475
4175  0.485
4176  0.555
Name: Diameter, Length: 4147, dtype: float64
```

```
In [103... from sklearn import preprocessing
min_max_scaler = preprocessing.MinMaxScaler(features)
new_y= min_max_scaler.fit_transform(x,y)
print ("\n VALUES AFTER MIN MAX SCALING: \n\n", n
```

VALUES AFTER MIN MAX SCALING:

```
[[0.51351351]
[0.37162162]
[0.61486486]
...
[0.70945946]
[0.74324324]
[0.85810811]]
```

```
In [108... #Split the data into Training and Testing
X = df.drop('age', axis = 1)
y = df['age']
```

```
In [109... from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split
from sklearn.feature_selection import SelectKBest
standardScale = StandardScaler()
standardScale.fit_transform(X)

selectkBest = SelectKBest()
X_new = selectkBest.fit_transform(X)
```

```
X_new = selectKBest.TIL_transform(X, y)

X_train, X_test, y_train, y_test = train_test_spl
X_train
```

```
Out[109]: array([[0.72 , 0.59 , 0.205, ..., 1.    , 0.    , 0.
   ],
   [0.6  , 0.475, 0.16 , ..., 0.    , 0.    , 1.
   ],
   [0.565, 0.445, 0.155, ..., 1.    , 0.    , 0.
   ],
   ...,
   [0.535, 0.42 , 0.13 , ..., 1.    , 0.    , 0.
   ],
   [0.385, 0.275, 0.115, ..., 0.    , 0.    , 1.
   ],
   [0.3  , 0.24 , 0.09 , ..., 0.    , 0.    , 1.
   ]])
```

```
In [110]: y_train
```

```
Out[110]: 4106    12.5
3501    13.5
140     11.5
803     8.5
233     8.5
...
2291    11.5
1836    7.5
2065    9.5
772     9.5
3249    7.5
Name: age, Length: 3110, dtype: float64
```

```
In [111]: # Build the model
# Linear Regression
```

```
In [112]: from sklearn import linear_model as lm
from sklearn.linear_model import LinearRegression
model=lm.LinearRegression()
results=model.fit(X_train,y_train)
```

```
In [113]: accuracy = model.score(X_train, y_train)
print('Accuracy of the model:', accuracy)
```

```
Accuracy of the model: 0.5345240899781238
```

```
In [114]: #Training the model
lm = LinearRegression()
lm.fit(X_train, y_train)
y_train_pred = lm.predict(X_train)
y_train_pred
```

```
Out[114]: array([13.93218248, 12.77125849, 12.37911511, ...,
11.42060958,
```

```
... .
9.92718831, 8.91330011])

In [115]: X_train
```

```
Out[115]: array([[0.72 , 0.59 , 0.205, ..., 1.   , 0.   , 0.
],
[0.6  , 0.475, 0.16 , ..., 0.   , 0.   , 1.
],
[0.565, 0.445, 0.155, ..., 1.   , 0.   , 0.
],
... ,
[0.535, 0.42 , 0.13 , ..., 1.   , 0.   , 0.
],
[0.385, 0.275, 0.115, ..., 0.   , 0.   , 1.
],
[0.3  , 0.24 , 0.09 , ..., 0.   , 0.   , 1.
]])
```

```
In [116]: y_train
```

```
Out[116]: 4106    12.5
3501    13.5
140     11.5
803     8.5
233     8.5
...
2291    11.5
1836    7.5
2065    9.5
772     9.5
3249    7.5
Name: age, Length: 3110, dtype: float64
```

```
In [117]: from sklearn.metrics import mean_absolute_error,
s = mean_squared_error(y_train, y_train_pred)
print('Mean Squared error of training set :%2f'%s)
```

```
Mean Squared error of training set :4.559881
```

```
In [118]: #Testing the model
```

```
In [119]: y_train_pred = lm.predict(X_train)
y_test_pred = lm.predict(X_test)
```

```
In [120]: y_test_pred
```

```
Out[120]: array([14.09032428, 11.30893194, 8.21840963, ...,
8.35582227,
13.91067006, 8.51141958])
```

```
In [121]: X_test
```

```
Out[121]: array([[0.57, 0.48, 0.15, ...],  
   [0.46, 0.355, 0.14, ...],  
   [0.375, 0.275, 0.085, ...],  
   ...,  
   [0.355, 0.27, 0.075, ...],  
   [0.57, 0.45, 0.165, ...],  
   [0.35, 0.26, 0.095, ...]])
```

```
In [122]: y_test
```

```
Out[122]: 73    12.5  
3090   11.5  
2004    8.5  
399     12.5  
1674    10.5  
...  
3202    18.5  
474     11.5  
1538    7.5  
2234    15.5  
133     8.5  
Name: age, Length: 1037, dtype: float64
```

```
In [123]: p = mean_squared_error(y_test, y_test_pred)  
print('Mean Squared error of testing set :%2f'%p)
```

```
Mean Squared error of testing set :5.077154
```

```
In [124]: #Measure the performance using metrices
```

```
In [125]: from sklearn.metrics import r2_score
```