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

```
from google.colab import files
upload=files.upload()
df = pd.read_csv('abalone.csv')
```

Choose Files abalone.csv

- **abalone.csv**(text/csv) - 191962 bytes, last modified: 11/5/2022 - 100% done

```
Saving abalone.csv to abalone.csv
```

```
df.describe()
```

	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	
count	4177.000000	4177.000000	4177.000000	4177.000000	4177.000000	4177.000000	41
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	

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

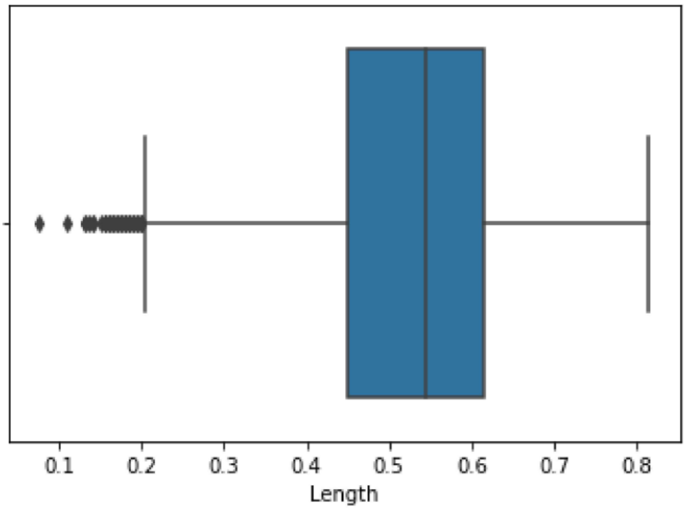
```
df.tail()
```

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
4172	F	0.565	0.450	0.165	0.8870	0.3700	0.2390	0.2490	11
4173	M	0.590	0.440	0.135	0.9660	0.4390	0.2145	0.2605	10
4174	M	0.600	0.475	0.205	1.1760	0.5255	0.2875	0.3080	9
4175	F	0.625	0.485	0.150	1.0945	0.5310	0.2610	0.2960	10

Univariate analysis

```
sns.boxplot(df.Length)
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7fde01392090>
```



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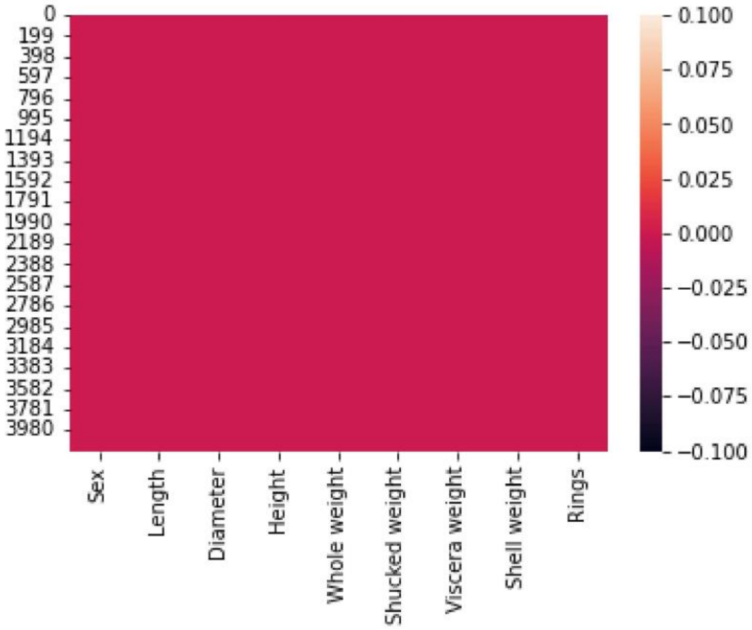
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fde012ebbd0>
```

```
sns.heatmap(df.isnull())
```

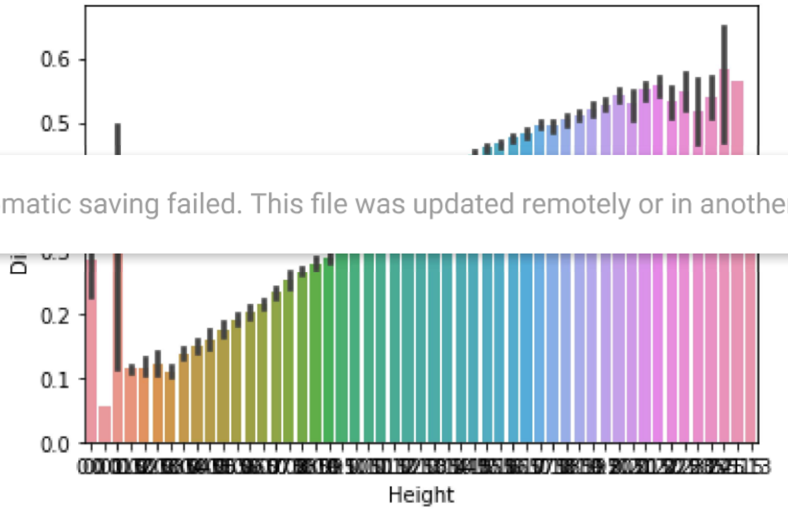
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fde00dba850>
```



Bivariate analysis

```
sns.barplot(x=df.Height,y=df.Diameter)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fddfe4e7c10>
```




```
numerical_features = df.select_dtypes(include = [np.number]).columns
categorical_features = df.select_dtypes(include = [np.object]).columns
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:2: DeprecationWarning: `
Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/devdocs/re
```

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

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fddfe288b50>
```

Multivariate Analysis

```
sns.pairplot(df)
```

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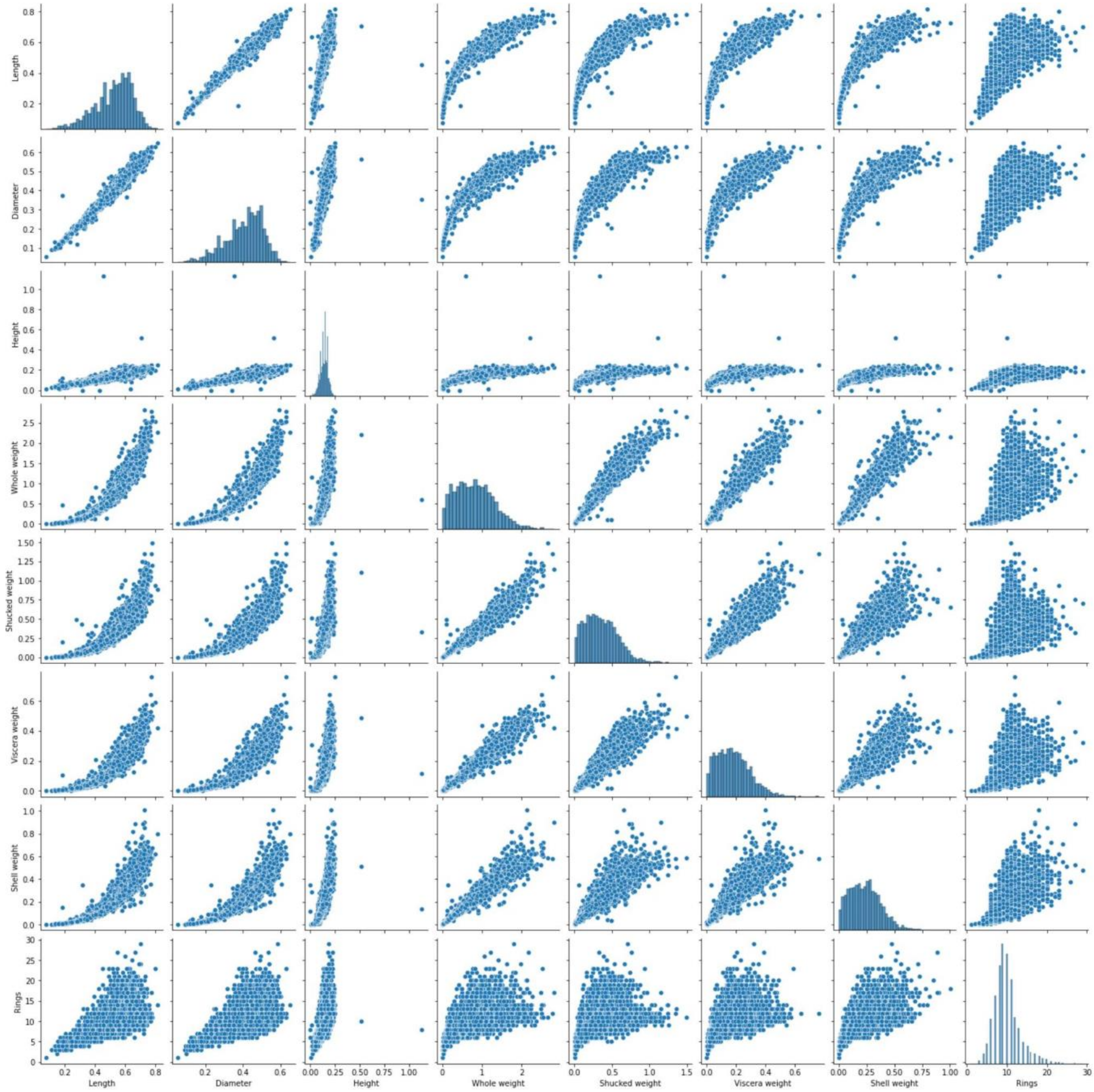
<seaborn.axisgrid.PairGrid at 0x7fddfe1e85d0>



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Perform descriptive model on the dataset

```
df['Height'].describe()
```

```
count    4177.000000
mean        0.139516
std         0.041827
min         0.000000
25%         0.115000
50%         0.140000
75%         0.165000
max         1.130000
Name: Height, dtype: float64
```

```
df['Height'].mean()
```

```
0.13951639932966242
```

```
df.max()
```

```
Sex                       M

Length                0.815
                       1.13
Diameter               0.65
Height               2.8255
                      1.488
Whole weight
                       0.76
Shucked weight
Viscera weight
Shell weight          1.005
```



```
df['Sex'].value_counts()
```

```
M    1528
I    1342
F    1307
Name: Sex, dtype: int64
```

```
df[df.Height == 0]
```

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings

```
df['Shucked weight'].kurtosis()
```

```
0.5951236783694207
```

```
df['Diameter'].median()
```

```
0.425
```

```
df['Shucked weight'].skew()
```

```
0.7190979217612694
```

Missing values

```
df.isna().any()
```

```
Sex               False
Length            False
Diameter          False
Height            False
Whole weight      False
Shucked weight    False
Viscera weight    False
Shell weight      False
Rings             False
dtype: bool
```

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```
percentage_missing_values = (missing_values/len(df))*100
pd.concat([missing_values, percentage_missing_values], axis = 1, keys= ['Missing values',
```

	Missing values	% Missing
Sex	0	0.0
Length	0	0.0

Find the outliers

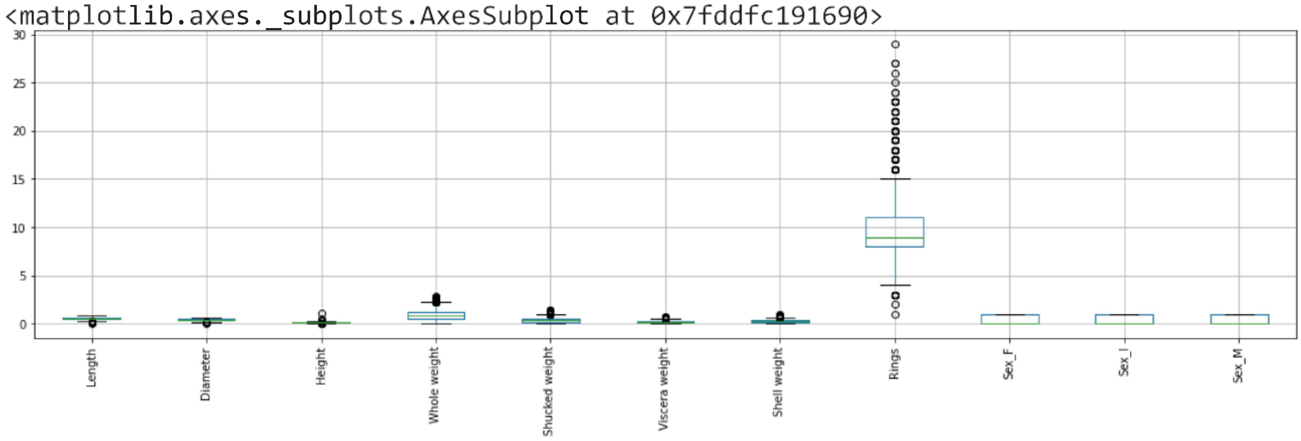
```
q1=df.Rings.quantile(0.25)
q2=df.Rings.quantile(0.75)
iqr=q2-q1

print(iqr)
```

```
3.0
```

```
df = pd.get_dummies(df)
dummy_df = df
df.boxplot( rot = 90, figsize=(20,5))
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fddfc191690>
```



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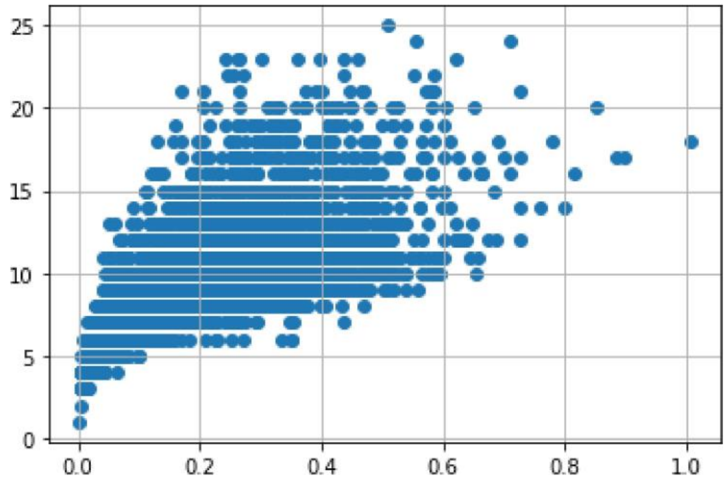
```
df['age'] = df['Rings']
df = df.drop('Rings', axis = 1)
```

```
df.drop(df[(df['Viscera weight']> 0.5) & (df['age'] < 20)].index, inplace=True)
df.drop(df[(df['Viscera weight']<0.5) & (df['age'] > 25)].index, inplace=True)
```

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



Check for categorical columns and perform encoding

```
numerical_features = df.select_dtypes(include = [np.number]).columns
categorical_features = df.select_dtypes(include = [np.object]).columns
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:2: DeprecationWarning: `
Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/devdocs/re
```

```
numerical_features
categorical_features
```

```
Index([], dtype='object')
```

```
weight','Vi
ed
```

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```
abalone_numeric.head()
```

	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	age	Sex_F	Sex_I	Se
0	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.150	15	0	0	
1	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.070	7	0	0	
2	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.210	9	1	0	
3	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.155	10	0	0	

Dependent and Independent Variables

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

```
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: 4150, dtype: float64
```

```
#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
```

Automatic saving failed. This file was updated remotely or in another tab. Show diff

```
4174    0.475
4173    0.440
4175    0.485
4176    0.555
Name: Diameter, Length: 4150, dtype: float64
```

```
from sklearn import preprocessing
min_max_scaler = preprocessing.MinMaxScaler(feature_range =(0, 1))
new_y= min_max_scaler.fit_transform(x,y)
print ("\n VALUES AFTER MIN MAX SCALING: \n\n", new_y)
```

```
 VALUES AFTER MIN MAX SCALING:
```

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

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


from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split, cross_val_score
from sklearn.feature_selection import SelectKBest
standardScale = StandardScaler()
standardScale.fit_transform(X)

selectkBest = SelectKBest()
X_new = selectkBest.fit_transform(X, y)

X_train, X_test, y_train, y_test = train_test_split(X_new, y, test_size = 0.25)
X_train
```

```
array([[0.505, 0.39 , 0.12 , ..., 1.   , 0.   , 0.   ],
       [0.69 , 0.55 , 0.18 , ..., 0.   , 0.   , 1.   ],
       [0.27 , 0.195, 0.07 , ..., 0.   , 0.   , 1.   ],
       ...,
       [0.67 , 0.51 , 0.155, ..., 1.   , 0.   , 0.   ],
       [0.325, 0.24 , 0.075, ..., 0.   , 1.   , 0.   ],
       [0.41 , 0.325, 0.1  , ..., 0.   , 1.   , 0.   ]])
```

```
y_train
```

```
3447     8
1975    11
2149     7
```



```
        ..
3487     8
1399    11
3703    11
3430     6
1075     6
Name: age, Length: 3112, dtype: int64
```

Build the model

Linear Regression

```
from sklearn import linear_model as lm
```

```
from sklearn.linear_model import LinearRegression
model=lm.LinearRegression()
results=model.fit(X_train,y_train)
```

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

```
    Accuracy of the model: 0.528142126401383
```

```
#Training the model
lm = LinearRegression()
lm.fit(X_train, y_train)
y_train_pred = lm.predict(X_train)
y_train_pred
```

```
    array([ 9.28125, 13.90625,  7.125  , ..., 11.1875 ,  6.65625,  8.0625 ])
```

```
X_train
```

```
    array([[0.505, 0.39 , 0.12 , ..., 1.   , 0.   , 0.   ],
           [0.69 , 0.55 , 0.18 , ..., 0.   , 0.   , 1.   ],
           [0.27 , 0.195, 0.07 , ..., 0.   , 0.   , 1.   ],
           ...,
           [0.67 , 0.51 , 0.155, ..., 1.   , 0.   , 0.   ],
           [0.325, 0.24 , 0.075, ..., 0.   , 1.   , 0.   ],
           [0.41 , 0.325, 0.1  , ..., 0.   , 1.   , 0.   ]])
```

```
y_train
```

```
    3447     8
    1975    11
    2149     7
    2678     7
    3301    13
```

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```
    3483     8
    3703    11
    3430     6
    1075     6
    Name: age, Length: 3112, dtype: int64
```

```
    sklearn.metrics import mean_absolute_error, mean_squared_error
frommean_squared_error(y_train, y_train_pred)
print('Mean Squared error of training set :%2f'%s)
```

```
    Mean Squared error of training set :4.933080
```

Testing the model

```
y_train_pred = lm.predict(X_train)
y_test_pred = lm.predict(X_test)
```

```
y_test_pred
```

```
array([16.25    , 11.      ,  9.25    , ..., 12.1875  , 10.53125,  5.1875  ])
```

```
X_test
```

```
array([[0.595, 0.495, 0.185, ..., 1.   , 0.   , 0.   ],
       [0.605, 0.485, 0.16 , ..., 1.   , 0.   , 0.   ],
       [0.52 , 0.39 , 0.12 , ..., 0.   , 0.   , 1.   ],
       ...,
       [0.635, 0.515, 0.165, ..., 0.   , 0.   , 1.   ],
       [0.565, 0.45 , 0.175, ..., 1.   , 0.   , 0.   ],
       [0.2  , 0.145, 0.025, ..., 0.   , 1.   , 0.   ]])
```

```
y_test
```

```
67      13
161     13
3448     7
4019    10
378     15
        ..
984     10
3862    10
1948    10
1132     9
3190     5
Name: age, Length: 1038, dtype: int64
```

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```
Mean Squared error of testing set :4.058311
```

Measure the performance using metrices

```
from sklearn.metrics import r2_score
s = r2_score(y_train, y_train_pred)
print('R2 Score of training set:%.2f'%s)
```

```
R2 Score of training set:0.53
```

```
from sklearn.metrics import r2_score
```

```
p = r2_score(y_test, y_test_pred)
print('R2 Score of testing set:%.2f'%p)
```

```
R2 Score of testing set:0.56
```