

```
import pandas as pd
import numpy as np
from matplotlib import pyplot as plt
import seaborn as sns
from sklearn.linear_model import LinearRegression
```

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

```
df
```

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

	Viscera weight	Shell weight	Rings
0	0.1010	0.1500	15
1	0.0485	0.0700	7
2	0.1415	0.2100	9
3	0.1140	0.1550	10
4	0.0395	0.0550	7
...	...	...	...
4172	0.2390	0.2490	11
4173	0.2145	0.2605	10
4174	0.2875	0.3080	9
4175	0.2610	0.2960	10
4176	0.3765	0.4950	12

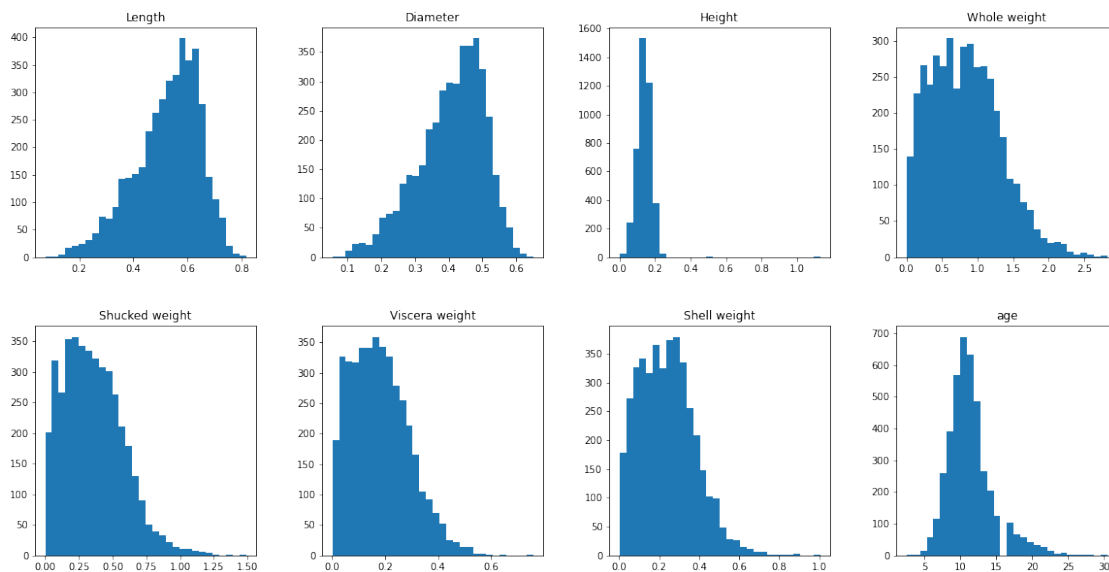
```
[4177 rows x 9 columns]
```

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

```
df.hist(figsize=(20,10), grid=False, layout=(2, 4), bins = 30)
```

```
array([[<matplotlib.axes._subplots.AxesSubplot object at
0x7f3a9eb4af90>,
      <matplotlib.axes._subplots.AxesSubplot object at
0x7f3a9defc2d0>,
      <matplotlib.axes._subplots.AxesSubplot object at
0x7f3a9deb68d0>,
      <matplotlib.axes._subplots.AxesSubplot object at
0x7f3a9de6bed0>],
```

```
[<matplotlib.axes._subplots.AxesSubplot object at
0x7f3a9de30510>,
 <matplotlib.axes._subplots.AxesSubplot object at
0x7f3a9dde6b10>,
 <matplotlib.axes._subplots.AxesSubplot object at
0x7f3a9dda1d0>,
 <matplotlib.axes._subplots.AxesSubplot object at
0x7f3a9dd5d710>]],
 dtype=object)
```



```
df.groupby('Sex')[['Length', 'Diameter', 'Height', 'Whole weight',
'Shucked weight',
'Viscera weight', 'Shell weight',
'age']].mean().sort_values('age')
```

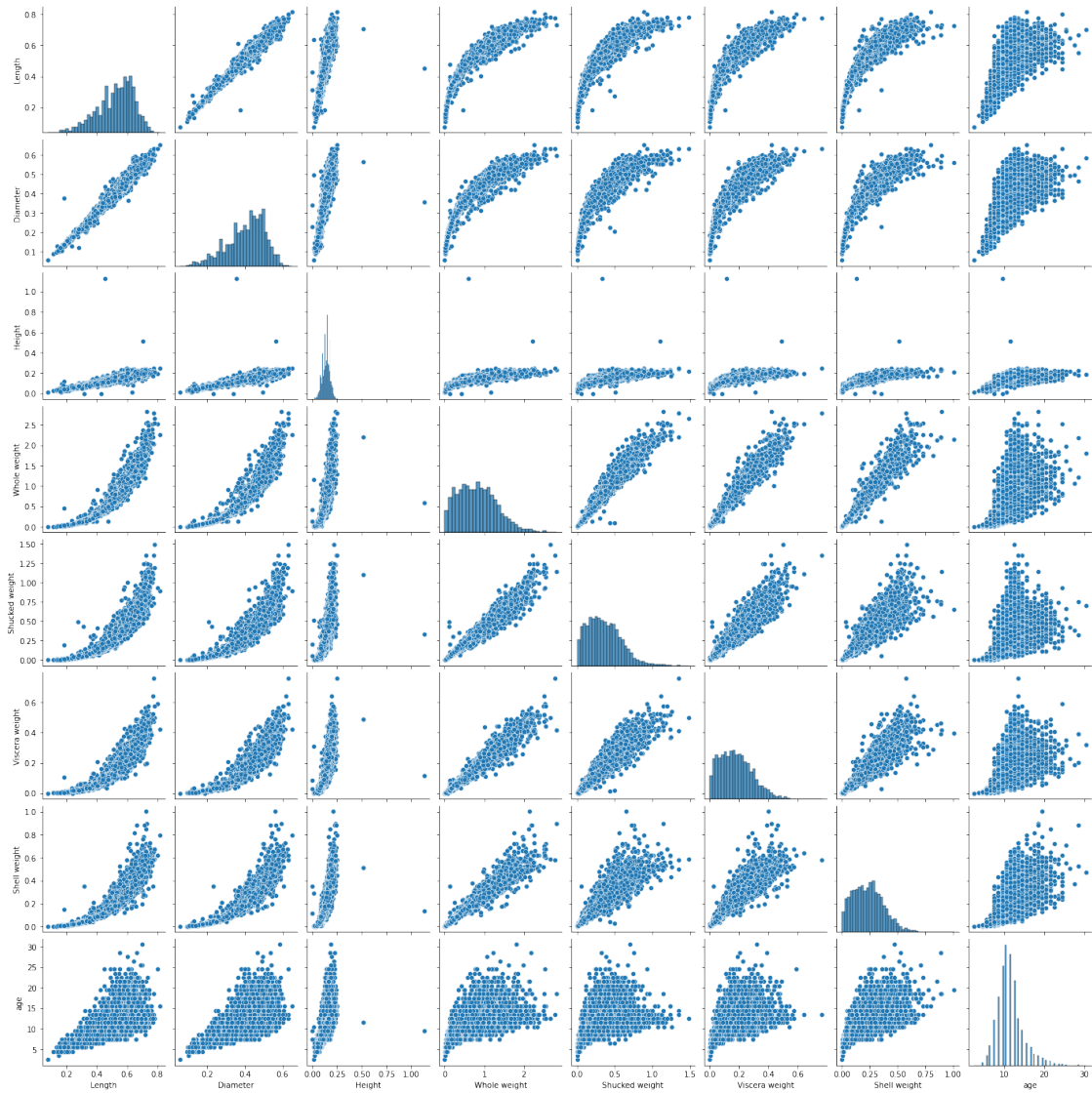
	Length	Diameter	Height	Whole weight	Shucked weight \
Sex					
I	0.427746	0.326494	0.107996	0.431363	0.191035
M	0.561391	0.439287	0.151381	0.991459	0.432946
F	0.579093	0.454732	0.158011	1.046532	0.446188

	Viscera weight	Shell weight	age
Sex			
I	0.092010	0.128182	9.390462
M	0.215545	0.281969	12.205497
F	0.230689	0.302010	12.629304

```
numerical_features = df.select_dtypes(include = [np.number]).columns
sns.pairplot(df[numerical_features])
```

```
<seaborn.axisgrid.PairGrid at 0x7f3a9d89c490>
```



```
df.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
```

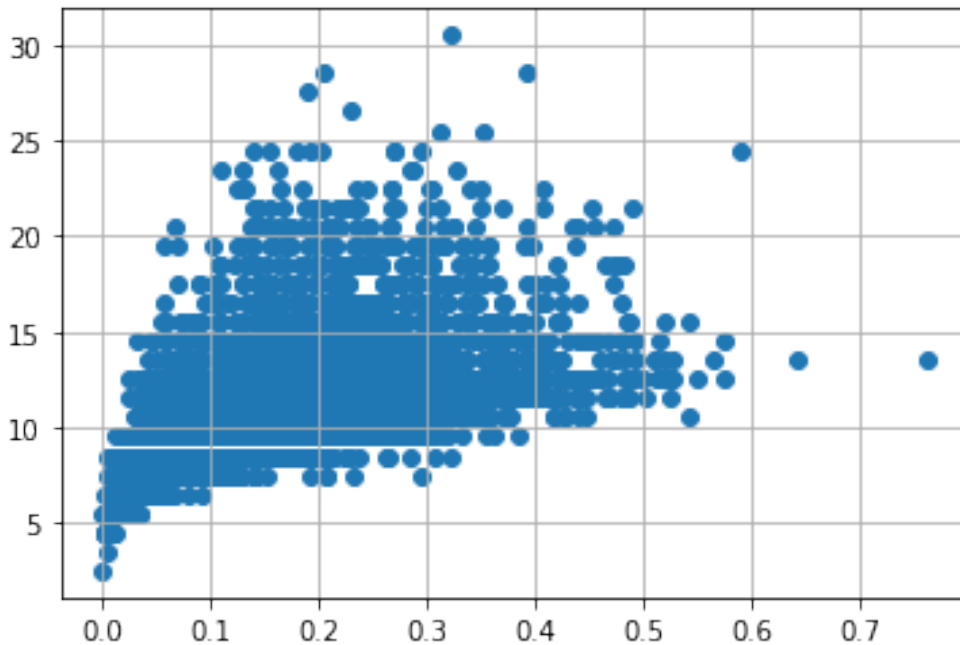
	Viscera weight	Shell weight	age
count	4177.000000	4177.000000	4177.000000
mean	0.180594	0.238831	11.433684
std	0.109614	0.139203	3.224169
min	0.000500	0.001500	2.500000
25%	0.093500	0.130000	9.500000
50%	0.171000	0.234000	10.500000
75%	0.253000	0.329000	12.500000
max	0.760000	1.005000	30.500000

```
df.isnull().sum()
```

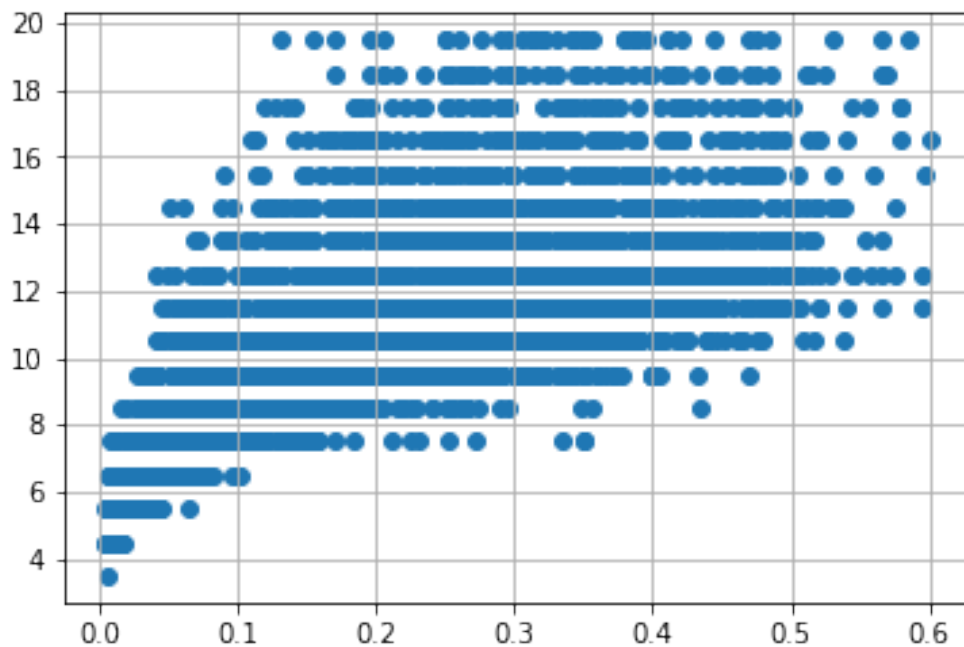
```
Sex      0
Length   0
Diameter 0
Height   0
Whole weight  0
Shucked weight  0
Viscera weight  0
Shell weight  0
age      0
dtype: int64
```

```
df = pd.get_dummies(df)
dummy_data = df.copy()
```

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



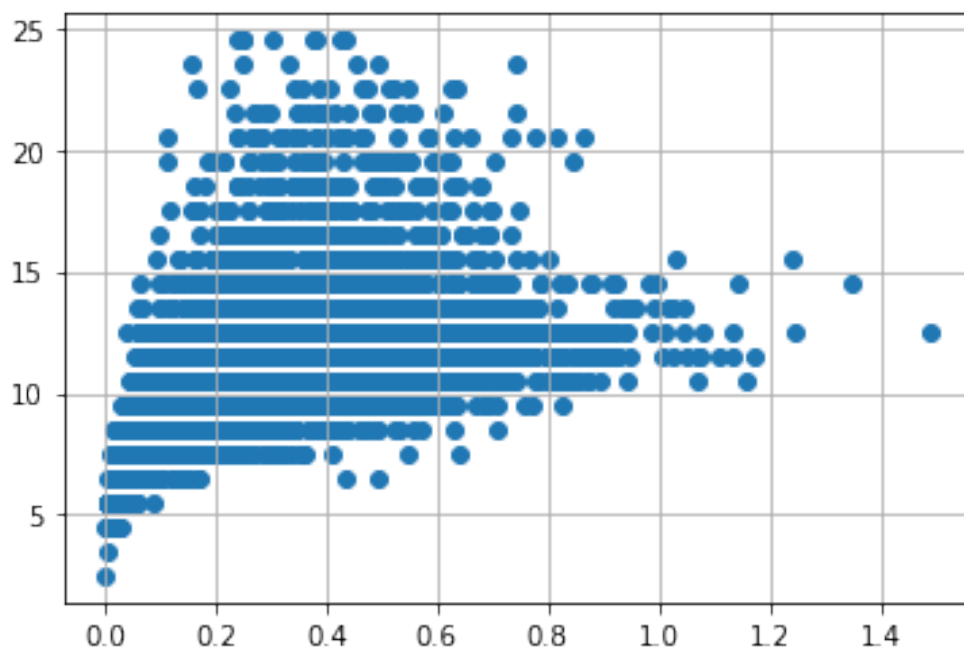
```
df.drop(df[(df['Viscera weight']> 0.5) & (df['age'] < 20)].index,  
inplace=True)  
df.drop(df[(df['Viscera weight']<0.5) & (df['age'] > 25)].index,  
inplace=True)  
var = 'Shell weight'  
plt.scatter(x = df[var], y = df['age'],)  
plt.grid(True)  
#Outliers removal  
df.drop(df[(df['Shell weight']> 0.6) & (df['age'] < 25)].index,  
inplace=True)  
df.drop(df[(df['Shell weight']<0.8) & (df['age'] > 25)].index,  
inplace=True)
```



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

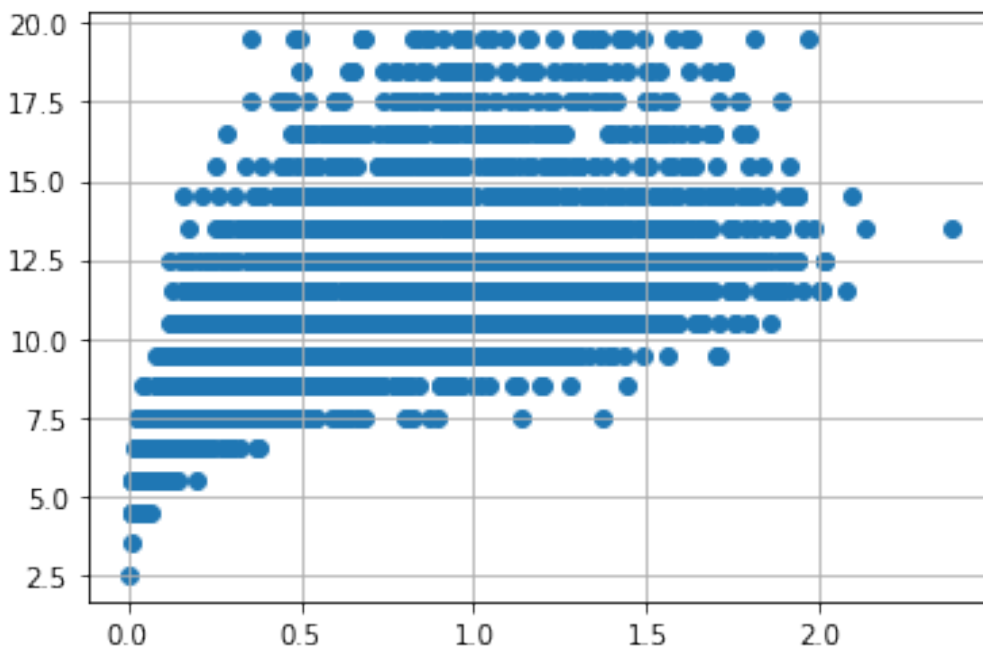
*#Outlier removal*

```
df.drop(df[(df['Shucked weight']>= 1) & (df['age'] < 20)].index,
        inplace=True)
df.drop(df[(df['Shucked weight']<1) & (df['age'] > 20)].index,
        inplace=True)
```



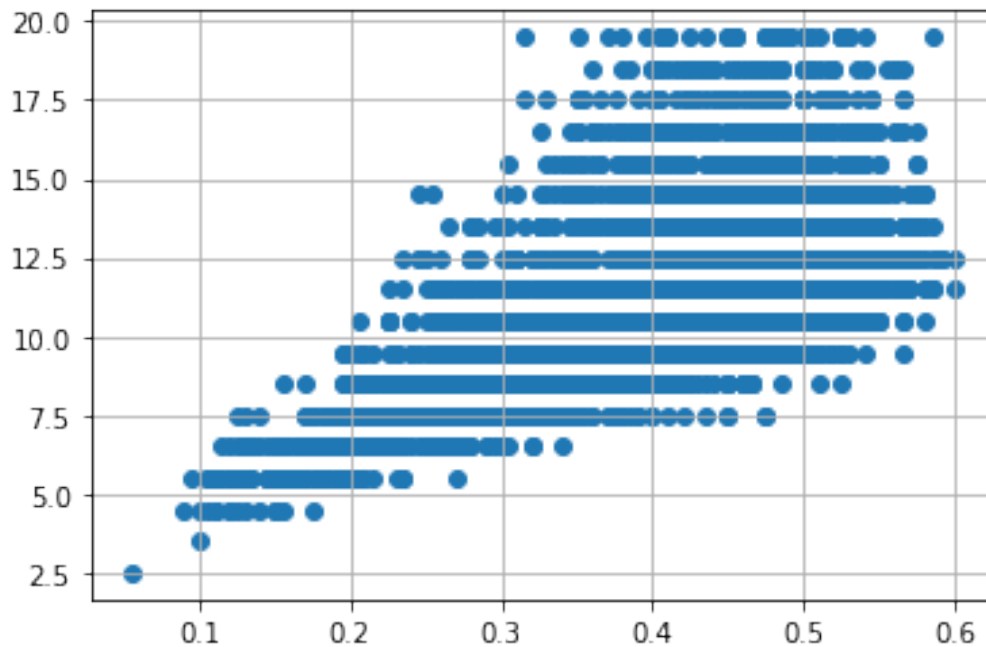
```
var = 'Whole weight'
plt.scatter(x = df[var], y = df['age'])
plt.grid(True)
```

```
df.drop(df[(df['Whole weight'] >= 2.5) &
          (df['age'] < 25)].index, inplace = True)
df.drop(df[(df['Whole weight'] < 2.5) & (
df['age'] > 25)].index, inplace = True)
```

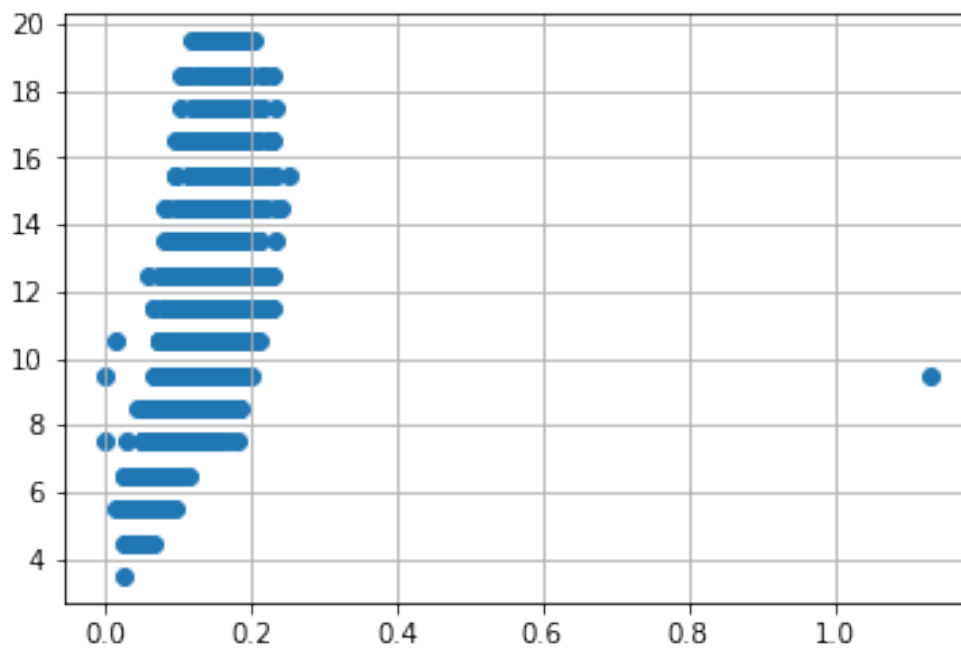


```
var = 'Diameter'
plt.scatter(x = df[var], y = df['age'])
plt.grid(True)
```

```
df.drop(df[(df['Diameter'] < 0.1) &
          (df['age'] < 5)].index, inplace = True)
df.drop(df[(df['Diameter'] < 0.6) & (
df['age'] > 25)].index, inplace = True)
df.drop(df[(df['Diameter'] >= 0.6) & (
df['age'] < 25)].index, inplace = True)
```



```
var = 'Height'
plt.scatter(x = df[var], y = df['age'])
plt.grid(True)
df.drop(df[(df['Height'] > 0.4) &
           (df['age'] < 15)].index, inplace = True)
df.drop(df[(df['Height'] < 0.4) & (
df['age'] > 25)].index, inplace = True)
```

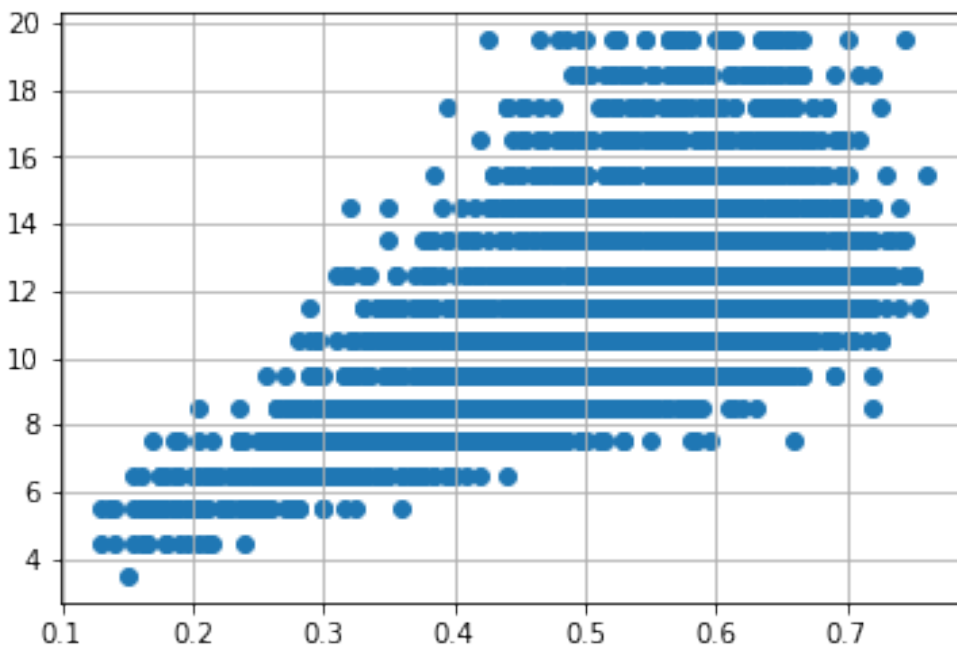


```
var = 'Length'
plt.scatter(x = df[var], y = df['age'])
```



```
plt.grid(True)

df.drop(df[(df['Length'] < 0.1) &
          (df['age'] < 5)].index, inplace = True)
df.drop(df[(df['Length'] < 0.8) & (
df['age'] > 25)].index, inplace = True)
df.drop(df[(df['Length'] >= 0.8) & (
df['age'] < 25)].index, inplace = True)
```



```
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: `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
```

```
numerical_features
```

```
Index(['Length', 'Diameter', 'Height', 'Whole weight', 'Shucked
weight',
       'Viscera weight', 'Shell weight', 'age', 'Sex_F', 'Sex_I',
       'Sex_M'],
      dtype='object')
```

```
categorical_features
```

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

```

from sklearn.preprocessing import LabelEncoder
le=LabelEncoder()
print(df.Length.value_counts())

```

```

0.575    93
0.625    91
0.580    89
0.550    89
0.620    83

```

```

..
0.220     2
0.150     1
0.755     1
0.135     1
0.760     1

```

```
Name: Length, Length: 126, dtype: int64
```

```
x=df.iloc[:,5]
```

```
x
```

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

```
[3995 rows x 5 columns]
```

```
y=df.iloc[:,5:]
```

```
y
```

	Viscera weight	Shell weight	age	Sex_F	Sex_I	Sex_M
0	0.1010	0.1500	16.5	0	0	1
1	0.0485	0.0700	8.5	0	0	1
2	0.1415	0.2100	10.5	1	0	0
3	0.1140	0.1550	11.5	0	0	1
4	0.0395	0.0550	8.5	0	1	0
...	...	...	...	...	...	...
4172	0.2390	0.2490	12.5	1	0	0
4173	0.2145	0.2605	11.5	0	0	1
4174	0.2875	0.3080	10.5	0	0	1
4175	0.2610	0.2960	11.5	1	0	0
4176	0.3765	0.4950	13.5	0	0	1

```
[3995 rows x 6 columns]
```

```
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.3)
```

```
from sklearn.linear_model import LinearRegression
mlr=LinearRegression()
mlr.fit(x_train,y_train)
```

```
LinearRegression()
```

```
x_test.head()
```

	Length	Diameter	Height	Whole weight	Shucked weight
3330	0.385	0.305	0.125	0.3140	0.1460
508	0.560	0.435	0.180	0.8890	0.3600
3988	0.665	0.515	0.165	1.3855	0.6210
2435	0.465	0.380	0.135	0.5790	0.2080
763	0.640	0.510	0.190	1.6130	0.6215

```
y_test.head()
```

	Viscera weight	Shell weight	age	Sex_F	Sex_I	Sex_M
3330	0.0555	0.0800	11.5	1	0	0
508	0.2040	0.2500	12.5	0	0	1
3988	0.3020	0.3445	9.5	0	0	1
2435	0.1095	0.2200	15.5	1	0	0
763	0.3610	0.4700	15.5	0	0	1

```
from sklearn.preprocessing import StandardScaler
ss=StandardScaler()
x_train=ss.fit_transform(x_train)
```

```
mlrpred=mlr.predict(x_test[0:9])
mlrpred
```

```
from sklearn.metrics import r2_score
r2_score(mlr.predict(x_test),y_test)
```

```
-3.3893282910298814
```