PythonUebung3_Metrics

October 20, 2021

1 Python Übung 3 - Fehlermaße für Regression

[1]:
```
import pandas as pd
import seaborn as sns
```

Laden der Zahlen aus Übung 1 (und plotten)

[2]:
```
df = sns.load_dataset("anscombe")
```

Selektion eines der vier Datensätze

[3]:
```
print(df)
```

```
   dataset     x      y
0        I  10.0   8.04
1        I   8.0   6.95
2        I  13.0   7.58
3        I   9.0   8.81
4        I  11.0   8.33
5        I  14.0   9.96
6        I   6.0   7.24
7        I   4.0   4.26
8        I  12.0  10.84
9        I   7.0   4.82
10       I   5.0   5.68
11      II  10.0   9.14
12      II   8.0   8.14
13      II  13.0   8.74
14      II   9.0   8.77
15      II  11.0   9.26
16      II  14.0   8.10
17      II   6.0   6.13
18      II   4.0   3.10
19      II  12.0   9.13
20      II   7.0   7.26
21      II   5.0   4.74
22     III  10.0   7.46
23     III   8.0   6.77
```

```
24     III  13.0  12.74
25     III   9.0   7.11
26     III  11.0   7.81
27     III  14.0   8.84
28     III   6.0   6.08
29     III   4.0   5.39
30     III  12.0   8.15
31     III   7.0   6.42
32     III   5.0   5.73
33      IV   8.0   6.58
34      IV   8.0   5.76
35      IV   8.0   7.71
36      IV   8.0   8.84
37      IV   8.0   8.47
38      IV   8.0   7.04
39      IV   8.0   5.25
40      IV  19.0  12.50
41      IV   8.0   5.56
42      IV   8.0   7.91
43      IV   8.0   6.89
```

[4]:
```
#df.loc[df['x']>8]
print(df.groupby("dataset").describe())
dataSet3 = df.loc[df["dataset"]=='III']
```

```
           x                                                    y            \
       count mean       std  min  25%  50%   75%   max count      mean
dataset
I       11.0  9.0  3.316625  4.0  6.5  9.0  11.5  14.0  11.0  7.500909
II      11.0  9.0  3.316625  4.0  6.5  9.0  11.5  14.0  11.0  7.500909
III     11.0  9.0  3.316625  4.0  6.5  9.0  11.5  14.0  11.0  7.500000
IV      11.0  9.0  3.316625  8.0  8.0  8.0   8.0  19.0  11.0  7.500909


              std   min    25%   50%   75%    max
dataset
I        2.031568  4.26  6.315  7.58  8.57  10.84
II       2.031657  3.10  6.695  8.14  8.95   9.26
III      2.030424  5.39  6.250  7.11  7.98  12.74
IV       2.030579  5.25  6.170  7.04  8.19  12.50
```

Linare Regression durchführen

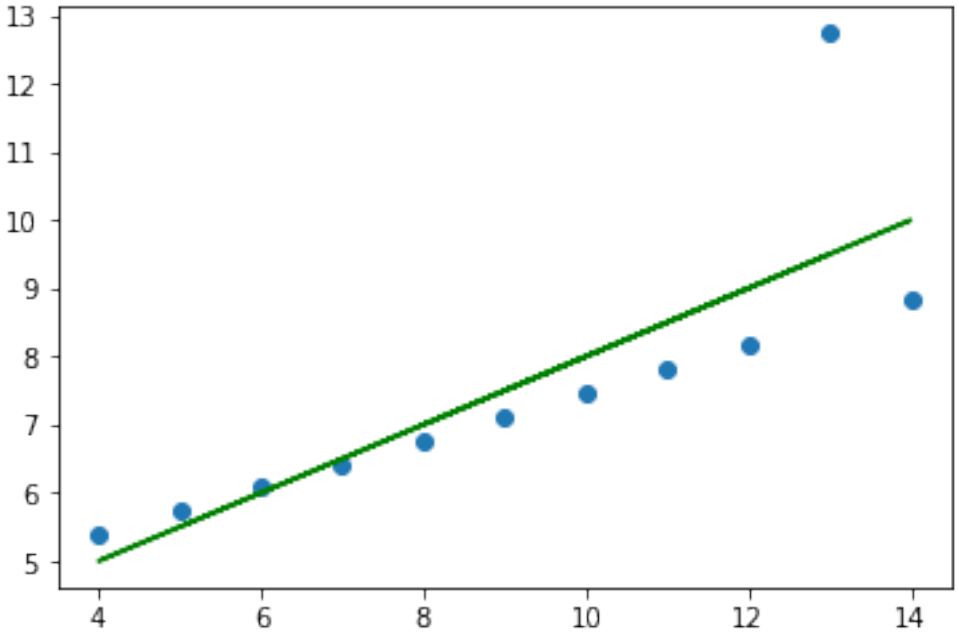
[5]:
```
import matplotlib.pyplot as plt
from sklearn.linear_model import LinearRegression

X = dataSet3.iloc[:, 1].values.reshape(-1, 1)  # numpy!
Y = dataSet3.iloc[:, 2].values.reshape(-1, 1)
```

```
reg = LinearRegression()
reg.fit(X, Y)
print(reg.score(X, Y) , " " , reg.coef_ , " " , reg.intercept_)
```

```
0.6663240410665592    [[0.49972727]]    [3.00245455]
```

Werte vorhersagen und einzeichnen

[6]:
```
Y_pred = reg.predict(X)  # make predictions
plt.scatter(X, Y)
plt.plot(X, Y_pred, color='green')
plt.show()
```



[7]:
```
#TODO
```

Aufgabe: 1. Lesen Sie sich die Metrics durch. Siehe Link https://scikit-learn.org/stable/modules/model_evaluation.html#regression-metrics

2. Vergleichen Sie diese mit denen aus der Vorlesung.

sklearn.metrics mean_absolute_error –> MAE mean_squared_error –> MSE mean_absolute_percentage_error –> MAPE r2_score –> R^2 max_error –> MAX

3. Bewerten Sie die Trendlinien für alle vier Datensätze. Was schließen Sie daraus?

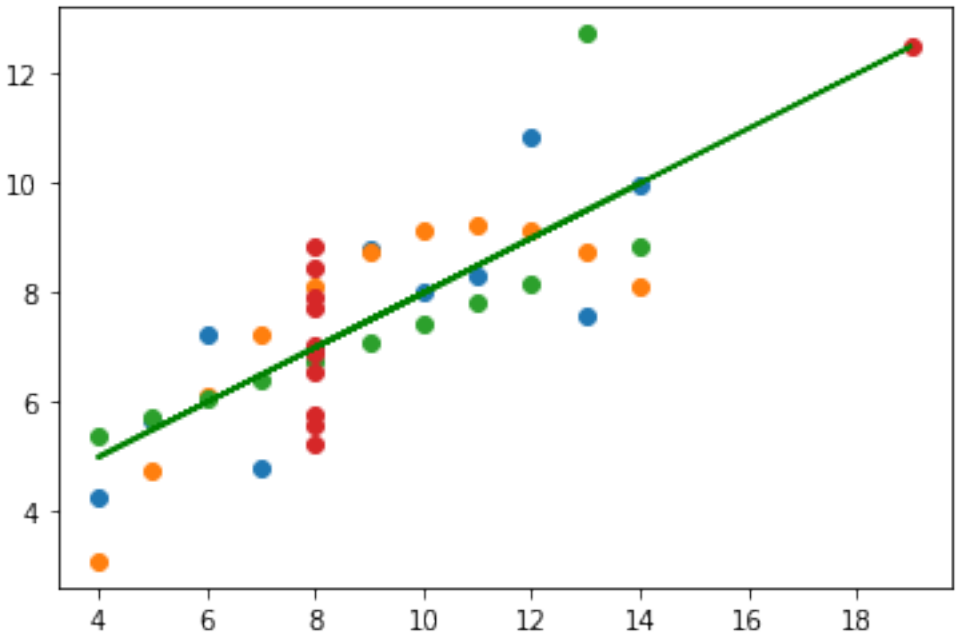
[8]:
```
datasets = [df.loc[df["dataset"]=='I'*i] for i in range(1, 4)] + [df.
↪loc[df["dataset"]=='IV']]
```

[9]:
```
regs = []
reshaped_data = []

for ds in datasets:
    X = ds.iloc[:, 1].values.reshape(-1, 1)  # numpy!
    Y = ds.iloc[:, 2].values.reshape(-1, 1)

    reg = LinearRegression()
    reg.fit(X, Y)
    regs.append(reg)
    reshaped_data.append([X, Y])
```

[10]:
```
from sklearn.metrics import mean_absolute_error, mean_squared_error, r2_score,␣
 ↪mean_absolute_percentage_error, max_error
import math

print("{:12}|{:12}|{:12}|{:12}|{:12}|{:12}|{:12}".format("Score", "MAE", "MSE",␣
 ↪"RMSE", "MAPE", "R^2", "MAX"))
print("-"*90)

for i, reg in enumerate(regs):
    X = reshaped_data[i][0]
    Y = reshaped_data[i][1]

    Y_pred = reg.predict(X)

    plt.scatter(X, Y)
    plt.plot(X, Y_pred, color='green')

    print("{:1.10f}|{:1.10f}|{:1.10f}|{:1.10f}|{:1.10f}|{:1.10f}|{:1.10f}".
 ↪format(
        reg.score(X, Y),
        mean_absolute_error(Y, Y_pred),
        mean_squared_error(Y, Y_pred),
        math.sqrt(mean_squared_error(Y, Y_pred)),
        mean_absolute_percentage_error(Y, Y_pred),
        r2_score(Y, Y_pred),
        max_error(Y, Y_pred)
    ))

plt.show()
```

```
Score       |MAE         |MSE         |RMSE        |MAPE        |R^2
|MAX
------------------------------------------------------------------------------
----------
0.6665424595|0.8374049587|1.2511536364|1.1185497916|0.1212578348|0.6665424595|1.
```

```
9212727273
0.6662420337|0.9679338843|1.2523900826|1.1191023557|0.1569518620|0.6662420337|1.
9009090909
0.6663240411|0.7159669421|1.2505628926|1.1182856936|0.0797072761|0.6663240411|3.
2410909091
0.6667072569|0.9027272727|1.2493172727|1.1177286221|0.1347384865|0.6667072569|1.
8390000000
```



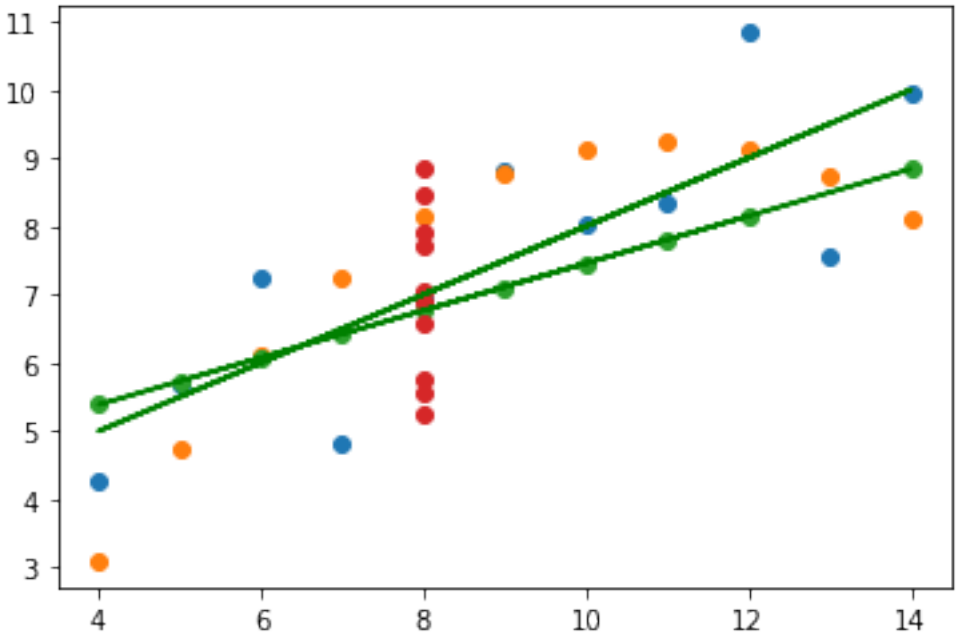
4. Löschen Sie einzelne Ausreißer und bewerten Sie erneut.

[11]:
```
dataSet1 = df.loc[df["dataset"]=='I']
dataSet2 = df.loc[df["dataset"]=='II']
dataSet3 = df.loc[df["dataset"]=='III'].drop(24, axis=0)
dataSet4 = df.loc[df["dataset"]=='IV'].drop(40)
```

[12]:
```
datasets_new = [dataSet1, dataSet2, dataSet3, dataSet4]

regs = []
reshaped_data = []

for ds in datasets_new:
    X = ds.iloc[:, 1].values.reshape(-1, 1)  # numpy!
    Y = ds.iloc[:, 2].values.reshape(-1, 1)

    reg = LinearRegression()
    reg.fit(X, Y)
```

```
    regs.append(reg)
    reshaped_data.append([X, Y])

print("{:12} | {:12} | {:12} | {:12} | {:12} | {:12} | {:12}".format("Score",␣
 ↪"MAE", "MSE", "RMSE", "MAPE", "R^2", "MAX"))
print("-"*100)

for i, reg in enumerate(regs):
    X = reshaped_data[i][0]
    Y = reshaped_data[i][1]

    Y_pred = reg.predict(X)

    plt.scatter(X, Y)
    plt.plot(X, Y_pred, color='green')

    print("{:1.10f} | {:1.10f} | {:1.10f} | {:1.10f} | {:1.10f} | {:1.10f} | {:
 ↪1.10f}".format(
        reg.score(X, Y),
        mean_absolute_error(Y, Y_pred),
        mean_squared_error(Y, Y_pred),
        math.sqrt(mean_squared_error(Y, Y_pred)),
        mean_absolute_percentage_error(Y, Y_pred),
        r2_score(Y, Y_pred),
        max_error(Y, Y_pred)
    ))

plt.show()
```

```
Score        | MAE          | MSE          | RMSE         | MAPE         | R^2
| MAX
-------------------------------------------------------------------------------
--------------------
0.6665424595 | 0.8374049587 | 1.2511536364 | 1.1185497916 | 0.1212578348 |
0.6665424595 | 1.9212727273
0.6662420337 | 0.9679338843 | 1.2523900826 | 1.1191023557 | 0.1569518620 |
0.6662420337 | 1.9009090909
0.9999931076 | 0.0023116883 | 0.0000075974 | 0.0027563386 | 0.0003469281 |
0.9999931076 | 0.0050649351
0.0000000000 | 0.9930000000 | 1.3742490000 | 1.1722836687 | 0.1482123351 |
0.0000000000 | 1.8390000000
```



5. Was ist das Trainings- und Testset in der Übung hier? Wie sollte es eigentlich sein?

Hier: Trainings- und Testset ist das gleiche Set
Eigentlich: Unterschiedliches Set für Training und Test mit 80/20 verteilung

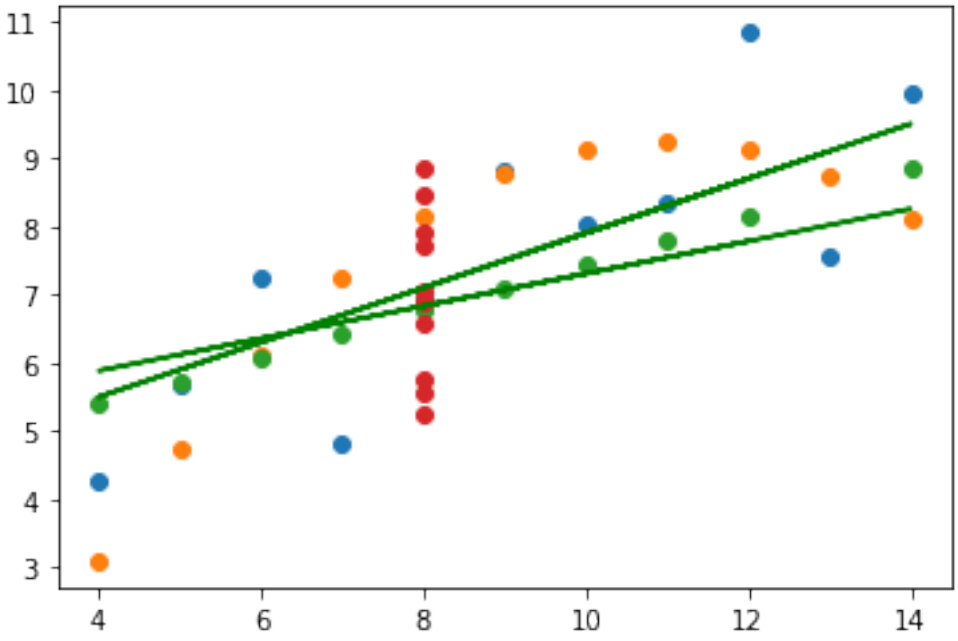
6. Verwenden Sie ein anderes Regressionsverfahren und prüfen Sie, ob es besser ist!

[13]:
```
from sklearn.linear_model import Lasso

regs_new = []
reshaped_data_new = []

for ds in datasets_new:
    X = ds.iloc[:, 1].values.reshape(-1, 1)  # numpy!
    Y = ds.iloc[:, 2].values.reshape(-1, 1)

    reg = Lasso()
    reg.fit(X, Y)
    regs_new.append(reg)
    reshaped_data_new.append([X, Y])
```

[14]:
```
print("{:12}|{:12}|{:12}|{:12}|{:12}|{:12}|{:12}".format("Score", "MAE", "MSE",␣
 ↪"RMSE", "MAPE", "R^2", "MAX"))
print("-"*90)

for i, reg in enumerate(regs_new):
    X = reshaped_data_new[i][0]
```

```
    Y = reshaped_data_new[i][1]

    Y_pred = reg.predict(X)

    plt.scatter(X, Y)
    plt.plot(X, Y_pred, color='green')

    print("{:1.10f}|{:1.10f}|{:1.10f}|{:1.10f}|{:1.10f}|{:1.10f}|{:1.10f}".
↪format(
        reg.score(X, Y),
        mean_absolute_error(Y, Y_pred),
        mean_squared_error(Y, Y_pred),
        math.sqrt(mean_squared_error(Y, Y_pred)),
        mean_absolute_percentage_error(Y, Y_pred),
        r2_score(Y, Y_pred),
        max_error(Y, Y_pred)
    ))

plt.show()
```

```
Score       |MAE         |MSE         |RMSE        |MAPE        |R^2
|MAX
-------------------------------------------------------------------------------
----------
0.6398904536|0.9116033058|1.3511536364|1.1623913439|0.1350050942|0.6398904536|2.
1388181818
0.6395923524|0.9990082645|1.3523900826|1.1629230768|0.1724582337|0.6395923524|2.
4009090909
0.9018105083|0.2813722944|0.1082327056|0.3289873943|0.0414025649|0.9018105083|0.
5833116883
0.0000000000|0.9930000000|1.3742490000|1.1722836687|0.1482123351|0.0000000000|1.
8390000000
```


11
10
9
8
7
6
5
4
3
4
6
8
10
12
14

[ ]: