RK2

May 30, 2021

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1.0.1

[1]:
```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
from pandas.plotting import scatter_matrix
import warnings
warnings.filterwarnings('ignore')
sns.set(style="ticks")
%matplotlib inline
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder
from sklearn.svm import SVC , LinearSVC
from sklearn.datasets.samples_generator import make_blobs
from sklearn.svm import SVR
from sklearn.model_selection import GridSearchCV
from matplotlib import pyplot as plt
```

[2]:
```
from sklearn.datasets import load_boston
boston = load_boston()
data = pd.DataFrame(boston.data, columns=boston.feature_names)
data['TARGET'] = boston.target
```

[3]:
```
data.head()
```

[3]:

	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	\
0	0.00632	18.0	2.31	0.0	0.538	6.575	65.2	4.0900	1.0	296.0	
1	0.02731	0.0	7.07	0.0	0.469	6.421	78.9	4.9671	2.0	242.0	
2	0.02729	0.0	7.07	0.0	0.469	7.185	61.1	4.9671	2.0	242.0	
3	0.03237	0.0	2.18	0.0	0.458	6.998	45.8	6.0622	3.0	222.0	
4	0.06905	0.0	2.18	0.0	0.458	7.147	54.2	6.0622	3.0	222.0	

	PTRATIO	B	LSTAT	TARGET
0	15.3	396.90	4.98	24.0
1	17.8	396.90	9.14	21.6

```
2     17.8  392.83   4.03    34.7
3     18.7  394.63   2.94    33.4
4     18.7  396.90   5.33    36.2
```

[4]:
```
data.dtypes
```

[4]:
```
CRIM       float64
ZN         float64
INDUS      float64
CHAS       float64
NOX        float64
RM         float64
AGE        float64
DIS        float64
RAD        float64
TAX        float64
PTRATIO    float64
B          float64
LSTAT      float64
TARGET     float64
dtype: object
```

[5]:
```
data.isnull().sum()
#
```

[5]:
```
CRIM       0
ZN         0
INDUS      0
CHAS       0
NOX        0
RM         0
AGE        0
DIS        0
RAD        0
TAX        0
PTRATIO    0
B          0
LSTAT      0
TARGET     0
dtype: int64
```

[6]:
```
data.drop(['CRIM','ZN','CHAS','DIS', 'PTRATIO'], axis = 1, inplace = True)
```

[7]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 506 entries, 0 to 505
```

```
Data columns (total 9 columns):
 #   Column  Non-Null Count  Dtype
---  ------  --------------  -----
 0   INDUS   506 non-null    float64
 1   NOX     506 non-null    float64
 2   RM      506 non-null    float64
 3   AGE     506 non-null    float64
 4   RAD     506 non-null    float64
 5   TAX     506 non-null    float64
 6   B       506 non-null    float64
 7   LSTAT   506 non-null    float64
 8   TARGET  506 non-null    float64
dtypes: float64(9)
memory usage: 35.7 KB
```

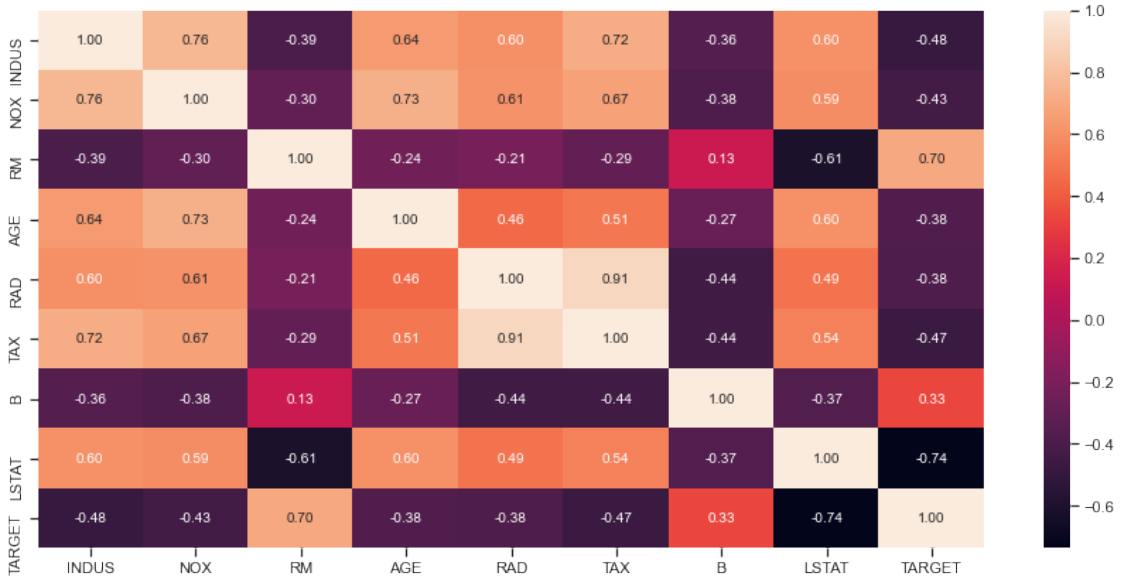
[8]:
```
data.head()
```

[8]:

	INDUS	NOX	RM	AGE	RAD	TAX	B	LSTAT	TARGET
0	2.31	0.538	6.575	65.2	1.0	296.0	396.90	4.98	24.0
1	7.07	0.469	6.421	78.9	2.0	242.0	396.90	9.14	21.6
2	7.07	0.469	7.185	61.1	2.0	242.0	392.83	4.03	34.7
3	2.18	0.458	6.998	45.8	3.0	222.0	394.63	2.94	33.4
4	2.18	0.458	7.147	54.2	3.0	222.0	396.90	5.33	36.2

[9]:
```
#
fig, ax = plt.subplots(figsize=(15,7))
sns.heatmap(data.corr(method='pearson'), ax=ax, annot=True, fmt='.2f')
```

[9]: <AxesSubplot:>



[10]:
```
X = data.drop(['TAX'], axis = 1)
Y = data.TAX
print('        :\n\n', X.head(), '\n\n         :\n\n', Y.head())
```

        :

```
    INDUS    NOX     RM   AGE  RAD       B  LSTAT  TARGET
0   2.31  0.538  6.575  65.2  1.0  396.90   4.98    24.0
1   7.07  0.469  6.421  78.9  2.0  396.90   9.14    21.6
2   7.07  0.469  7.185  61.1  2.0  392.83   4.03    34.7
3   2.18  0.458  6.998  45.8  3.0  394.63   2.94    33.4
4   2.18  0.458  7.147  54.2  3.0  396.90   5.33    36.2
```

         :

```
 0    296.0
1    242.0
2    242.0
3    222.0
4    222.0
Name: TAX, dtype: float64
```

[11]:
```
X_train,  X_test,  Y_train,  Y_test = train_test_split(X,  Y, random_state = 0,␣
 ↪test_size = 0.1)
print('                    :\n\n',X_train.head(), \
      '\n\n                    :\n\n', X_test.head(), \
      '\n\n                     :\n\n', Y_train.head(), \
      '\n\n                    :\n\n', Y_test.head())
```

                    :

```
      INDUS    NOX     RM   AGE  RAD       B  LSTAT  TARGET
495    9.69  0.585  5.670  28.8  6.0  393.29  17.60    23.1
230    6.20  0.504  5.981  68.1  8.0  378.35  11.65    24.3
253    5.86  0.431  8.259   8.4  7.0  396.90   3.54    42.8
134   21.89  0.624  5.757  98.4  4.0  262.76  17.31    15.6
12     7.87  0.524  5.889  39.0  5.0  390.50  15.71    21.7
```

                    :

```
      INDUS    NOX     RM    AGE   RAD       B  LSTAT  TARGET
329    3.24  0.460  6.333   17.2   4.0  375.21   7.34    22.6
371   18.10  0.631  6.216  100.0  24.0  366.15   9.53    50.0
219   13.89  0.550  6.373   92.4   5.0  393.74  10.50    23.0
403   18.10  0.693  5.349   96.0  24.0  396.90  19.77     8.3
78    12.83  0.437  6.232   53.7   5.0  386.40  12.34    21.2
```

:

```
 495    391.0
230    307.0
253    330.0
134    437.0
12     311.0
Name: TAX, dtype: float64
```

:

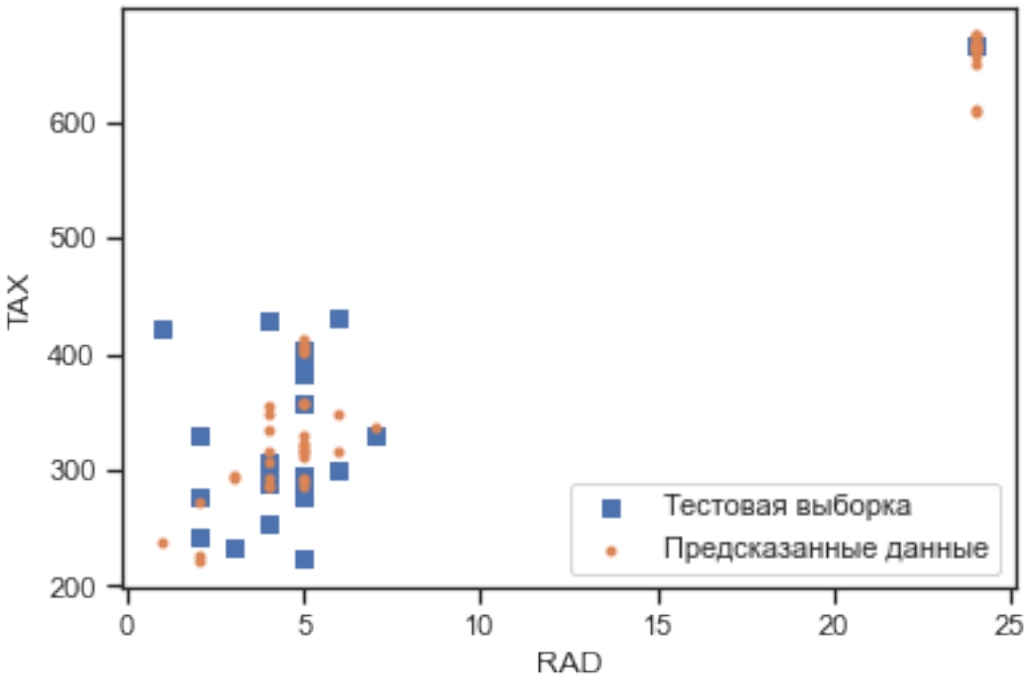
```
 329    430.0
371    666.0
219    276.0
403    666.0
78     398.0
Name: TAX, dtype: float64
```

[12]:
```
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_absolute_error, mean_squared_error, ␣
 ↪median_absolute_error, r2_score
from sklearn.svm import SVR
```

[13]:
```
Lin_Reg = LinearRegression().fit(X_train, Y_train)

lr_y_pred = Lin_Reg.predict(X_test)
```

[14]:
```
plt.scatter(X_test.RAD, Y_test,    marker = 's', label = '          ')
plt.scatter(X_test.RAD, lr_y_pred, marker = '.', label = '            ')
plt.legend (loc = 'lower right')
plt.xlabel ('RAD')
plt.ylabel ('TAX')
plt.show()
```



[15]:
```
from sklearn.ensemble import RandomForestRegressor
```

[16]:
```
forest_1 = RandomForestRegressor(n_estimators=5, oob_score=True,␣
 ↪random_state=10)
forest_1.fit(X, Y)
```

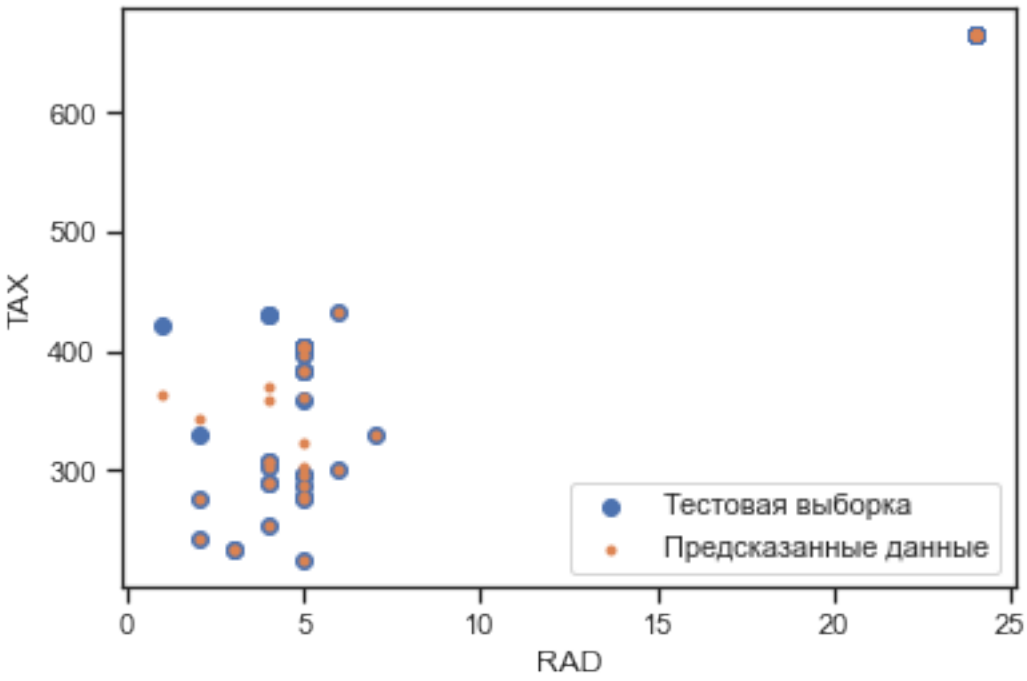
[16]:
```
RandomForestRegressor(n_estimators=5, oob_score=True, random_state=10)
```

[17]:
```
Y_predict = forest_1.predict(X_test)
print('              :',   mean_absolute_error(Y_test, Y_predict))
print('               :', mean_squared_error(Y_test, Y_predict))
print('Median absolute error:',       median_absolute_error(Y_test, Y_predict))
print('             :',    r2_score(Y_test, Y_predict))
```

```
              : 5.243137254901962
               : 273.555294117647
Median absolute error: 0.0
             : 0.9899469772829541
```

[18]:
```
plt.scatter(X_test.RAD, Y_test,    marker = 'o', label = '          ')
plt.scatter(X_test.RAD, Y_predict, marker = '.', label = '            ')
plt.legend(loc = 'lower right')
plt.xlabel('RAD')
plt.ylabel('TAX')
```

```
plt.show()
```


600
500
400
300
TAX
0
5
10
15
20
25
RAD
Тестовая выборка
Предсказанные данные