Lab3

May 31, 2021

0.0.1 3

[1]:
```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
from sklearn.impute import SimpleImputer
from sklearn.model_selection import train_test_split
```

[2]:
```
import numpy as np
import pandas as pd
from typing import Dict, Tuple
from scipy import stats
from sklearn.datasets import load_iris, load_boston
from sklearn.model_selection import train_test_split
from sklearn.neighbors import KNeighborsRegressor, KNeighborsClassifier
from sklearn.metrics import accuracy_score, balanced_accuracy_score
from sklearn.metrics import plot_confusion_matrix
from sklearn.metrics import precision_score, recall_score, f1_score,␣
 ↪classification_report
from sklearn.metrics import confusion_matrix
from sklearn.metrics import mean_absolute_error, mean_squared_error,␣
 ↪mean_squared_log_error, median_absolute_error, r2_score
from sklearn.metrics import roc_curve, roc_auc_score
import seaborn as sns
from sklearn.model_selection import learning_curve
from sklearn.model_selection import KFold, RepeatedKFold, LeaveOneOut,␣
 ↪LeavePOut, ShuffleSplit, StratifiedKFold
from sklearn.model_selection import train_test_split
import matplotlib.pyplot as plt
%matplotlib inline
sns.set(style="ticks")
```

[3]:
```
#
data = pd.read_csv('train.csv')
```

[4]:
```
#                    ,
data.drop(['Name','Sex','Ticket','Embarked','Cabin','PassengerId', 'Parch'],␣
 ↪axis = 1, inplace = True)
data
```

[4]:
```
     Survived  Pclass   Age  SibSp     Fare
0           0       3  22.0      1   7.2500
1           1       1  38.0      1  71.2833
2           1       3  26.0      0   7.9250
3           1       1  35.0      1  53.1000
4           0       3  35.0      0   8.0500
..        …       …     …    …       …
886         0       2  27.0      0  13.0000
887         1       1  19.0      0  30.0000
888         0       3   NaN      1  23.4500
889         1       1  26.0      0  30.0000
890         0       3  32.0      0   7.7500

[891 rows x 5 columns]
```

[5]:
```
#       NaN          1
data = data.fillna(1)
data
```

[5]:
```
     Survived  Pclass   Age  SibSp     Fare
0           0       3  22.0      1   7.2500
1           1       1  38.0      1  71.2833
2           1       3  26.0      0   7.9250
3           1       1  35.0      1  53.1000
4           0       3  35.0      0   8.0500
..        …       …     …    …       …
886         0       2  27.0      0  13.0000
887         1       1  19.0      0  30.0000
888         0       3   1.0      1  23.4500
889         1       1  26.0      0  30.0000
890         0       3  32.0      0   7.7500

[891 rows x 5 columns]
```

[6]:
```
parts = np.split(data, [4,5], axis=1)
X = parts[0]
Y = parts[1]
print('        :\n\n', X.head(), '\n\n         :\n\n', Y.head())
```

```
        :

    Survived  Pclass   Age  SibSp
```

```
0        0.0      3.0   22.0     1.0
1        1.0      1.0   38.0     1.0
2        1.0      3.0   26.0     0.0
3        1.0      1.0   35.0     1.0
4        0.0      3.0   35.0     0.0

         :

      Fare
0   7.2500
1  71.2833
2   7.9250
3  53.1000
4   8.0500
```

0.1

[7]:
```
X_train,  X_test,  Y_train,  Y_test = train_test_split(X,  Y, test_size=0.03)
```

[8]:
```
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())
```

```
                    :

     Survived  Pclass   Age  SibSp
796       1.0     1.0  49.0    0.0
222       0.0     3.0  51.0    0.0
370       1.0     1.0  25.0    1.0
71        0.0     3.0  16.0    5.0
391       1.0     3.0  21.0    0.0

                    :

     Survived  Pclass   Age  SibSp
373       0.0     1.0  22.0    0.0
296       0.0     3.0  23.5    0.0
166       1.0     1.0   1.0    0.0
40        0.0     3.0  40.0    1.0
32        1.0     3.0   1.0    0.0

                     :

        Fare
796  25.9292
222   8.0500
370  55.4417
```

```
71   46.9000
391   7.7958
```

:

```
          Fare
373  135.6333
296    7.2292
166   55.0000
40     9.4750
32     7.7500
```

[9]:
```python
#                                     .                  .
print(X_train.shape)
print(X_test.shape)
print(Y_train.shape)
print(Y_test.shape)
```

```
(864, 4)
(27, 4)
(864, 1)
(27, 1)
```

1   K

[10]:
```python
from sklearn.neighbors import KNeighborsRegressor
```

[11]:
```python
#                    2, 5   10
Regressor_2NN = KNeighborsRegressor(n_neighbors = 2)
Regressor_5NN = KNeighborsRegressor(n_neighbors = 5)
Regressor_10NN = KNeighborsRegressor(n_neighbors = 10)
print('        :\n\n', Regressor_10NN)
```

:

```
 KNeighborsRegressor(n_neighbors=10)
```

[12]:
```python
Regressor_2NN.fit(X_train, Y_train)
Regressor_5NN.fit(X_train, Y_train)
Regressor_10NN.fit(X_train, Y_train)

target_2NN = Regressor_2NN.predict(X_test)
target_5NN = Regressor_5NN.predict(X_test)
target_10NN = Regressor_10NN.predict(X_test)

print('                          2           :\n\n', target_2NN[:5], '\n ...')
print('                          5           :\n\n', target_5NN[:5], '\n ...')
print('                    10          :\n\n', target_10NN[:5], '\n ...')
```

```
                   2           :

 [[66.14375]
 [ 8.5604 ]
 [68.71665]
 [21.7    ]
 [ 7.75   ]]
…
                   5           :

 [[82.25916]
 [ 8.19   ]
 [46.52666]
 [17.95916]
 [ 7.77834]]
…
                   10           :

 [[58.78958]
 [ 8.16416]
 [59.75791]
 [22.77208]
 [ 7.66751]]
…
```

1.1   (   )

[13]:
```
from sklearn.metrics import mean_absolute_error, mean_squared_error,␣
↪median_absolute_error, r2_score , accuracy_score
```

[14]:
```
#
print('                  2          :',mean_absolute_error(Y_test,
target_2NN))
print('                  5          :',mean_absolute_error(Y_test,
target_5NN))
print('                  10          :',mean_absolute_error(Y_test,
target_10NN))
```

```
                 2          : 12.907707407407408
                 5          : 12.011633333333336
                 10          : 12.275924814814815
```

[15]:
```
#
print('                   2          :',mean_squared_error(Y_test,
target_2NN))
```

```
print('                    5           :',mean_squared_error(Y_test,
target_5NN))
print('                    10           :',mean_squared_error(Y_test
, target_10NN))
```

```
                  2           : 901.9070041387037
                  5           : 418.9014621938815
                  10           : 472.013474794248
```

[16]:
```
#
print('                2           :',r2_score(Y_test, target_2NN))
print('                5           :',r2_score(Y_test, target_5NN))
print('                10           :',r2_score(Y_test, target_10NN
))
```

```
                2           : 0.2839500393110812
                5           : 0.6674220577509455
                10           : 0.625254900427536
```

1.2

1.3 GridSearch

1 100, . 10 .

[17]:
```
from sklearn.model_selection import GridSearchCV, RandomizedSearchCV
```

[18]:
```
n_range = np.array(range(1, 101, 1))
tuned_parameters = [{'n_neighbors': n_range}]
gs = GridSearchCV(KNeighborsRegressor(), tuned_parameters, cv=10,␣
 ↪scoring='neg_mean_squared_error')
gs.fit(X_train, Y_train)
```

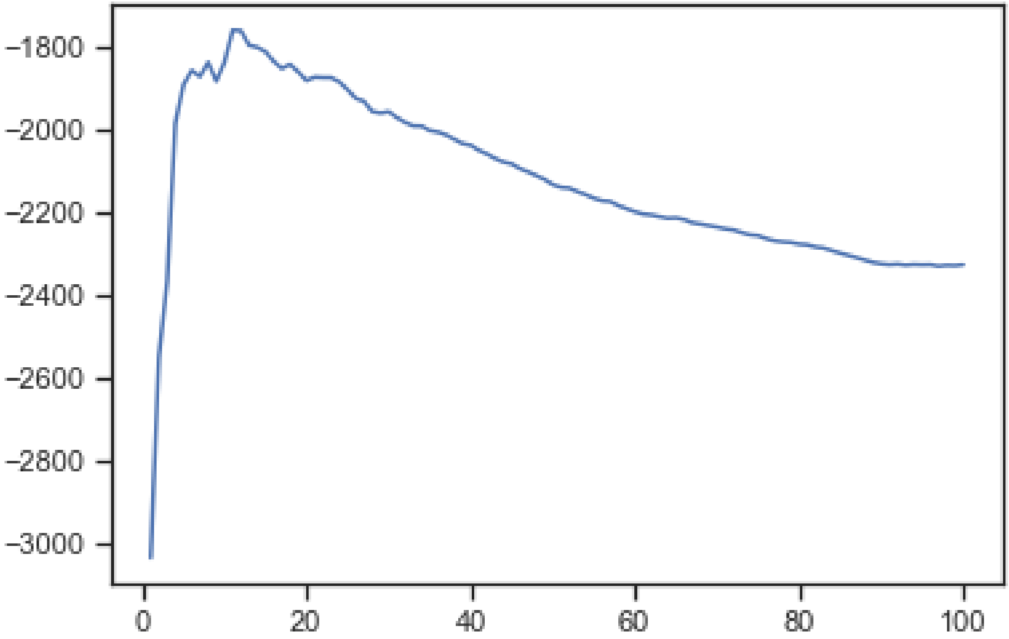
[18]:
```
GridSearchCV(cv=10, estimator=KNeighborsRegressor(),
             param_grid=[{'n_neighbors': array([  1,   2,   3,   4,   5,   6,
7,   8,   9,  10,  11,  12,  13,
        14,  15,  16,  17,  18,  19,  20,  21,  22,  23,  24,  25,  26,
        27,  28,  29,  30,  31,  32,  33,  34,  35,  36,  37,  38,  39,
        40,  41,  42,  43,  44,  45,  46,  47,  48,  49,  50,  51,  52,
        53,  54,  55,  56,  57,  58,  59,  60,  61,  62,  63,  64,  65,
        66,  67,  68,  69,  70,  71,  72,  73,  74,  75,  76,  77,  78,
        79,  80,  81,  82,  83,  84,  85,  86,  87,  88,  89,  90,  91,
        92,  93,  94,  95,  96,  97,  98,  99, 100])}],
             scoring='neg_mean_squared_error')
```

[19]:
```
print('        :\n\n', gs.best_estimator_)
print('\n                    :\n\n',gs.best_params_)
print('\n                           :\n\n',gs.best_score_)
```

```
      :

KNeighborsRegressor(n_neighbors=11)

                :

{'n_neighbors': 11}

                       :

-1761.5508936591825
```

```
[20]: print('                                 -      :\n')
      plt.plot(n_range, gs.cv_results_['mean_test_score'])
```

```
                                -      :


[20]: [<matplotlib.lines.Line2D at 0x7fa7945ca850>]
```



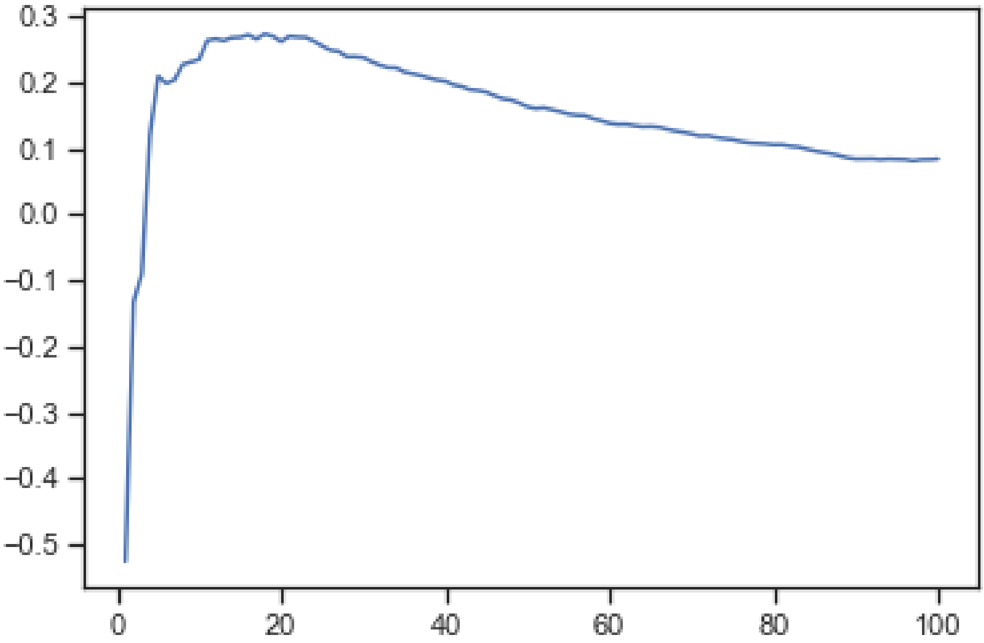
1.4 GridSearch

```
[21]: gs_det = GridSearchCV(KNeighborsRegressor(), tuned_parameters, cv=10,␣
       ↪scoring='r2')
      gs_det.fit(X_train, Y_train)
```

```
print('       :\n\n', gs_det.best_estimator_)
print('\n                 :\n\n',gs_det.best_params_)
print('\n                       :\n\n',gs_det.best_score_)
print('\n                                 -      :\n')
plt.plot(n_range, gs_det.cv_results_['mean_test_score'])
```

```
       :

KNeighborsRegressor(n_neighbors=18)

                 :

{'n_neighbors': 18}

                       :

0.27330085735322024

                                 -      :

```

```
[21]: [<matplotlib.lines.Line2D at 0x7fa794353430>]
```



1.5 -

```
[22]: from sklearn.model_selection import cross_val_score
```

```
[23]: scores_2NN = cross_val_score(KNeighborsRegressor(n_neighbors = 2), X, Y, cv=5,␣
       ↪scoring= 'r2')
      scores_5NN = cross_val_score(KNeighborsRegressor(n_neighbors = 5), X, Y, cv=5,␣
       ↪scoring= 'r2')
      scores_10NN = cross_val_score(KNeighborsRegressor(n_neighbors = 10), X, Y,␣
       ↪cv=5, scoring = 'r2')
      scores_50NN = cross_val_score(KNeighborsRegressor(n_neighbors = 50), X, Y,␣
       ↪cv=5, scoring = 'r2')
      scores_100NN = cross_val_score(KNeighborsRegressor(n_neighbors = 100), X, Y,␣
       ↪cv=5, scoring = 'r2')

      print('            .           5            2           : \n', scores_2NN,␣
       ↪'\n\n')
      print('            .           5            5           : \n', scores_5NN,␣
       ↪'\n\n')
      print('            .           5            10           : \n', scores_10NN,␣
       ↪'\n\n')
      print('            .           5            50           : \n', scores_50NN,␣
       ↪'\n\n')
      print('            .           5            100           : \n', scores_100NN,␣
       ↪'\n\n')

      print('                             :\n')
      print('- 2          :', np.mean(scores_2NN), '\n')
      print('- 5          :', np.mean(scores_5NN), '\n')
      print('- 10          :', np.mean(scores_10NN), '\n')
      print('- 50          :', np.mean(scores_50NN), '\n')
      print('- 100          :', np.mean(scores_100NN), '\n')
```

```
           .           5            2           :
[ 0.30830813  0.51102966  0.11351227 -0.20637581  0.2082538 ]



           .           5            5           :
[0.28711235 0.33867249 0.10880284 0.08465877 0.3581599 ]



           .           5            10           :
[0.34166201 0.38655715 0.14117213 0.28452217 0.2883947 ]



           .           5            50           :
[0.14346117 0.1248418  0.14231074 0.12316471 0.14296374]
```

```
            .           5            100
    :
 [0.04099073 0.03945595 0.07795575 0.05336465 0.08227155]


                             :

- 2           : 0.18694561138232885

- 5           : 0.23548126907370337

- 10           : 0.28846163209364245

- 50           : 0.13534843218545478

- 100           : 0.05880772437701802
```