FannyLo_BayesianRidge

April 10, 2023

[1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import sys
```

[2]:
```
dataset=pd.read_csv('Volumetric_features.csv')
dataset = dataset.drop('S.No', axis = 1)
dataset
```

[2]:

	Left-Lateral-Ventricle	Left-Inf-Lat-Vent	Left-Cerebellum-White-Matter	\
0	22916.9	982.7	15196.7	
1	22953.2	984.5	15289.7	
2	23320.4	1062.1	15382.1	
3	24360.0	1000.5	14805.4	
4	25769.4	1124.4	16331.1	
...	...	...	...	
4221	27065.6	532.4	12425.1	
4222	28408.8	912.7	14024.8	
4223	34467.9	1659.6	12744.5	
4224	31627.5	1334.4	15883.2	
4225	14879.4	704.2	11346.6	

	Left-Cerebellum-Cortex	Left-Thalamus	Left-Caudate	Left-Putamen	\
0	55796.4	6855.5	2956.4	4240.7	
1	55778.6	6835.1	3064.2	4498.6	
2	55551.2	7566.0	3231.7	4456.2	
3	54041.8	8004.6	3137.3	4262.2	
4	54108.6	6677.4	2964.4	4204.6	
...	...	...	...	...	
4221	51042.9	6354.8	3822.6	4490.5	
4222	43103.5	6060.7	3114.2	3731.0	
4223	54924.8	6256.7	3573.4	3526.6	
4224	57148.2	6982.4	4475.8	4464.4	
4225	50468.5	6935.4	3258.5	3751.5	

	Left-Pallidum	3rd-Ventricle	4th-Ventricle	...	\

```
0           2223.9         2034.4         1572.5  ...
1           2354.1         1927.1         1650.5  ...
2           1995.4         2064.7         1522.1  ...
3           1983.4         2017.7         1570.3  ...
4           2409.7         2251.8         1601.1  ...
...            ...            ...            ...  ...
4221        2019.4         1256.2         2037.6  ...
4222        1937.4         1669.9         2124.9  ...
4223        2189.9         3063.1         2511.9  ...
4224        2317.8         3809.0         3133.5  ...
4225        2226.5         1898.4         2505.5  ...

      rh_supramarginal_thickness  rh_frontalpole_thickness  \
0                          2.408                     2.629
1                          2.417                     2.640
2                          2.374                     2.601
3                          2.366                     2.639
4                          2.381                     2.555
...                          ...                       ...
4221                       2.505                     2.666
4222                       2.385                     3.008
4223                       2.028                     2.995
4224                       2.491                     2.865
4225                       2.474                     3.150

      rh_temporalpole_thickness  rh_transversetemporal_thickness  \
0                         3.519                            2.009
1                         3.488                            2.111
2                         3.342                            2.146
3                         3.361                            2.056
4                         3.450                            2.052
...                         ...                              ...
4221                      2.915                            2.243
4222                      3.572                            2.040
4223                      3.706                            1.928
4224                      3.456                            2.317
4225                      3.691                            2.337

      rh_insula_thickness  rh_MeanThickness_thickness  BrainSegVolNotVent.2  \
0                   2.825                     2.33635                1093846
1                   2.720                     2.34202                1099876
2                   2.684                     2.31982                1097999
3                   2.700                     2.29215                1070117
4                   2.574                     2.30397                1075926
...                   ...                         ...                    ...
4221                2.683                     2.29264                1108782
4222                2.866                     2.30156                 960586
```

```
4223                2.610                     2.19622                1033357
4224                2.900                     2.43580                1073339
4225                2.787                     2.43420                 992086

           eTIV.1  Age  dataset
0     1619602.965   85        1
1     1624755.130   85        1
2     1622609.518   86        1
3     1583854.236   87        1
4     1617375.362   89        1
...           ...  ...      ...
4221  1561822.106   79        9
4222  1530179.480   79        9
4223  1604323.353   84        9
4224  1620891.799   80        9
4225  1513076.040   86        9

[4226 rows x 140 columns]
```

[3]:
```
y=dataset['Age']
X=dataset.loc[:,dataset.columns!="Age"]
X
```

[3]:
```
      Left-Lateral-Ventricle  Left-Inf-Lat-Vent  Left-Cerebellum-White-Matter  \
0                    22916.9              982.7                       15196.7
1                    22953.2              984.5                       15289.7
2                    23320.4             1062.1                       15382.1
3                    24360.0             1000.5                       14805.4
4                    25769.4             1124.4                       16331.1
...                      ...                ...                           ...
4221                 27065.6              532.4                       12425.1
4222                 28408.8              912.7                       14024.8
4223                 34467.9             1659.6                       12744.5
4224                 31627.5             1334.4                       15883.2
4225                 14879.4              704.2                       11346.6

      Left-Cerebellum-Cortex  Left-Thalamus  Left-Caudate  Left-Putamen  \
0                    55796.4         6855.5        2956.4        4240.7
1                    55778.6         6835.1        3064.2        4498.6
2                    55551.2         7566.0        3231.7        4456.2
3                    54041.8         8004.6        3137.3        4262.2
4                    54108.6         6677.4        2964.4        4204.6
...                      ...            ...           ...           ...
4221                 51042.9         6354.8        3822.6        4490.5
4222                 43103.5         6060.7        3114.2        3731.0
4223                 54924.8         6256.7        3573.4        3526.6
4224                 57148.2         6982.4        4475.8        4464.4
```

```
4225                50468.5         6935.4        3258.5        3751.5

      Left-Pallidum  3rd-Ventricle  4th-Ventricle  ...  \
0            2223.9         2034.4         1572.5  ...
1            2354.1         1927.1         1650.5  ...
2            1995.4         2064.7         1522.1  ...
3            1983.4         2017.7         1570.3  ...
4            2409.7         2251.8         1601.1  ...
...             ...            ...            ...  ...
4221         2019.4         1256.2         2037.6  ...
4222         1937.4         1669.9         2124.9  ...
4223         2189.9         3063.1         2511.9  ...
4224         2317.8         3809.0         3133.5  ...
4225         2226.5         1898.4         2505.5  ...

      rh_superiortemporal_thickness  rh_supramarginal_thickness  \
0                             2.648                       2.408
1                             2.660                       2.417
2                             2.597                       2.374
3                             2.604                       2.366
4                             2.597                       2.381
...                             ...                         ...
4221                          2.457                       2.505
4222                          2.497                       2.385
4223                          2.407                       2.028
4224                          2.700                       2.491
4225                          2.746                       2.474

      rh_frontalpole_thickness  rh_temporalpole_thickness  \
0                        2.629                      3.519
1                        2.640                      3.488
2                        2.601                      3.342
3                        2.639                      3.361
4                        2.555                      3.450
...                        ...                        ...
4221                     2.666                      2.915
4222                     3.008                      3.572
4223                     2.995                      3.706
4224                     2.865                      3.456
4225                     3.150                      3.691

      rh_transversetemporal_thickness  rh_insula_thickness  \
0                               2.009                2.825
1                               2.111                2.720
2                               2.146                2.684
3                               2.056                2.700
4                               2.052                2.574
```

```
...                                ...                ...
4221                           2.243              2.683
4222                           2.040              2.866
4223                           1.928              2.610
4224                           2.317              2.900
4225                           2.337              2.787

      rh_MeanThickness_thickness  BrainSegVolNotVent.2       eTIV.1  dataset
0                        2.33635               1093846  1619602.965        1
1                        2.34202               1099876  1624755.130        1
2                        2.31982               1097999  1622609.518        1
3                        2.29215               1070117  1583854.236        1
4                        2.30397               1075926  1617375.362        1
...                          ...                   ...          ...      ...
4221                     2.29264               1108782  1561822.106        9
4222                     2.30156                960586  1530179.480        9
4223                     2.19622               1033357  1604323.353        9
4224                     2.43580               1073339  1620891.799        9
4225                     2.43420                992086  1513076.040        9

[4226 rows x 139 columns]
```

[4]:
```
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test = train_test_split(X,y,test_size=0.2,␣
 ↪random_state=142)
y_test
```

[4]:
```
3598    28
1988    62
429     78
3113    56
819     74
        ..
576     84
2122    66
824     80
3272    24
3384    49
Name: Age, Length: 846, dtype: int64
```

[5]:
```
from sklearn.linear_model import BayesianRidge
ridge= BayesianRidge()
    # 29.69004577239488,-1.2201350332268701
# nn = MLPRegressor(hidden_layer_sizes=(4,2), activation='relu', solver='sgd',␣
 ↪max_iter=500,
#                     momentum=0.9, verbose=True, learning_rate_init = 0.005)
    #same outpu3
```

```
# nn = MLPClassifier(hidden_layer_sizes=(8,8,8), activation='relu',␣
 ↪solver='adam', max_iter=500)
ridge.fit(x_train,y_train)
y_pred_train = ridge.predict(x_train)
y_pred_test = ridge.predict(x_test)
y_pred_test
```

[5]:
```
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52.09109247])
```
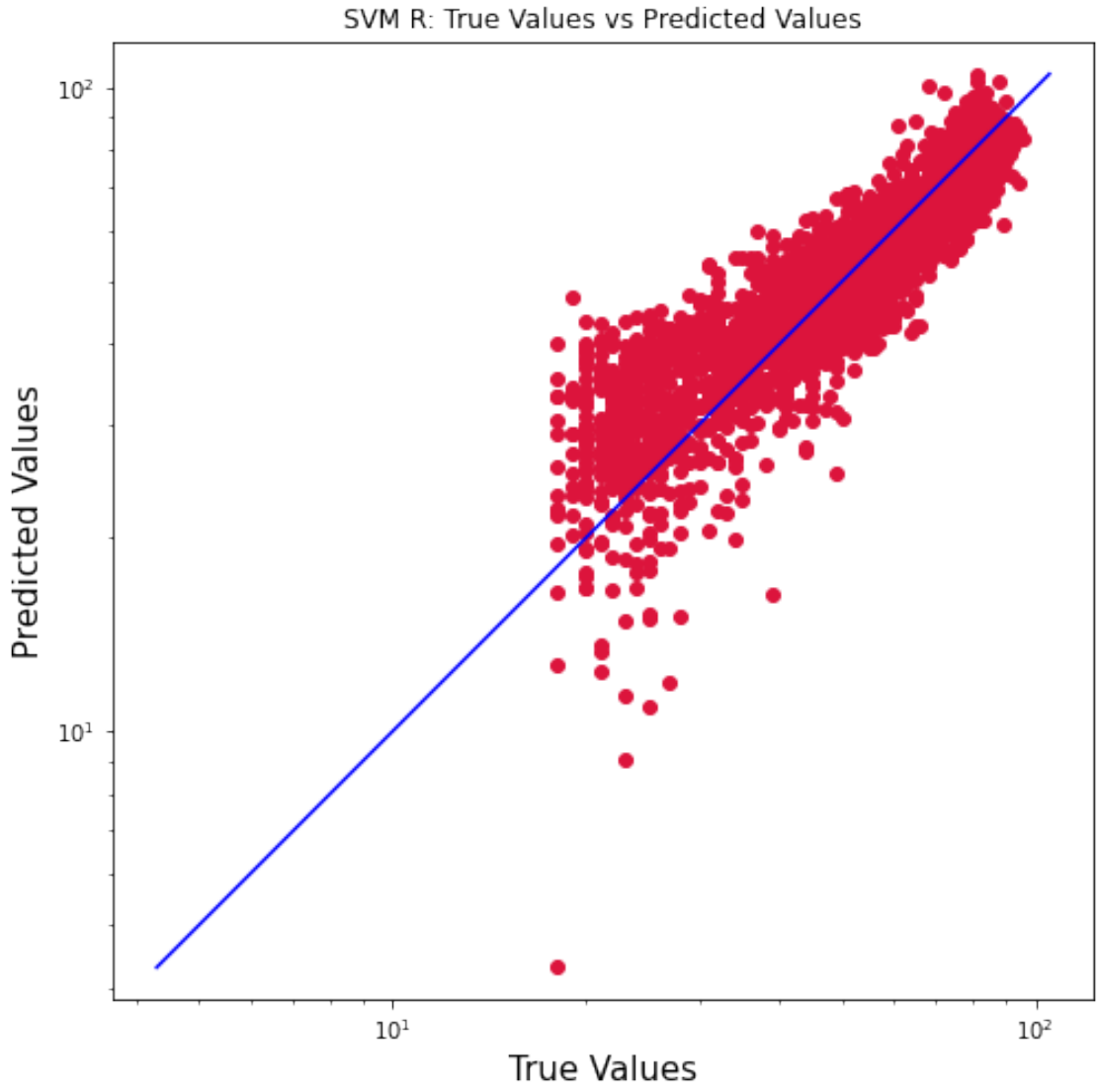

[6]:
```
from sklearn.model_selection import cross_val_predict  # For K-Fold Cross␣
↪Validation
from sklearn.metrics import r2_score  # For find accuracy with R2 Score
from sklearn.metrics import mean_squared_error  # For MSE
from math import sqrt  # For squareroot operation

accuracy_train = r2_score(y_train, y_pred_train)
print("Training R2 for Regression Model: ", accuracy_train)

accuracy_test = r2_score(y_test, y_pred_test)
```

```
print("Testing R2 for  Regression Model: ", accuracy_test)

RMSE_train = sqrt(mean_squared_error(y_train, y_pred_train))
print("RMSE for Training Data: ", RMSE_train)

RMSE_test = sqrt(mean_squared_error(y_test, y_pred_test))
print("RMSE for Testing Data: ", RMSE_test)
```

```
Training R2 for Regression Model:  0.8575145872661027
Testing R2 for  Regression Model:  0.8482255963863519
RMSE for Training Data:  7.585137137017816
RMSE for Testing Data:  7.762836508515179
```

[7]:
```
true_val = y_train
pred_val = y_pred_train
```

[8]:
```
plt.figure(figsize=(8,8))
plt.scatter(true_val, pred_val, c='crimson')
plt.yscale('log')
plt.xscale('log')

p1 = max(max(pred_val), max(true_val))
p2 = min(min(pred_val), min(true_val))
plt.plot([p1, p2], [p1, p2], 'b-')
plt.xlabel('True Values', fontsize=15)
plt.ylabel('Predicted Values', fontsize=15)
plt.title("SVM R: True Values vs Predicted Values")
plt.axis('equal')
plt.show()
```


SVM R: True Values vs Predicted Values
Predicted Values
True Values
10^2
10^1
10^1
10^2

[ ]: