04_exercise_solution

November 9, 2021

1 Exercise: Diabetes Model

In this exercise, we're going to take the knowledge we gained from the lesson and apply it to the Diabetes dataset. This well known dataset already has it's data cleaned and normalized, so no need to do any of those steps. The steps required to complete this exercise are as follows:

1. Load the diabetes dataset into a dataframe.
2. Check the table summary to show that indeed the mean is zero for all features.
3. Split the dataset into train, validation, and test sets
4. Use a linear regression `Ridge` model to fit and score:
    1. Fit and score on the whole dataset
    2. Fit on train, score on validation, using default model
    3. Fit on train, score on validation, using hyperparameters model
    4. Fit on train, score on test, using hyperparameterized model
5. Plot all scores in a bar graph

```
In [1]: import numpy as np
        import pandas as pd
        from sklearn import datasets
        from sklearn.model_selection import train_test_split
        from sklearn.linear_model import Ridge
```

```
In [2]: # Load in the diabetes dataset
        diabetes = datasets.load_diabetes()
```

```
In [3]: # Create the diabetes `data` dataset as a dataframe and name the columns with `feature_n
        df = pd.DataFrame(diabetes["data"], columns=diabetes["feature_names"])

        # Include the target as well
        df["target"] = diabetes["target"]
```

```
In [4]: df.head()
```

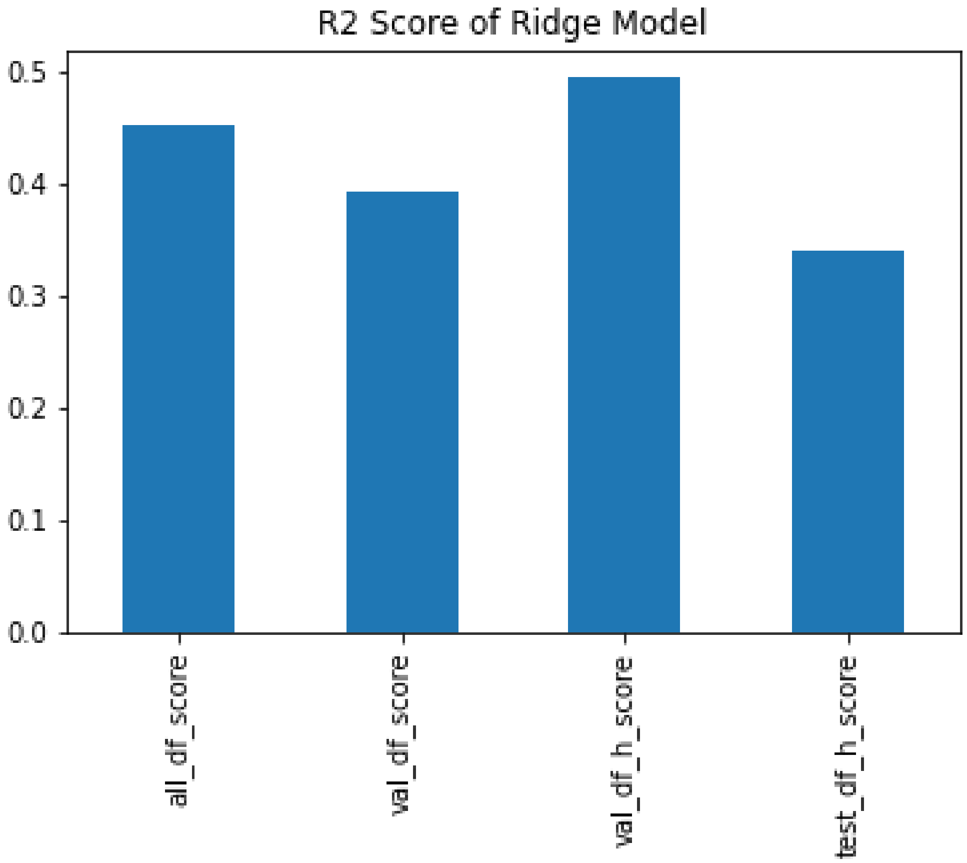
```
Out[4]:          age       sex       bmi        bp        s1        s2        s3  \
        0  0.038076  0.050680  0.061696  0.021872 -0.044223 -0.034821 -0.043401
        1 -0.001882 -0.044642 -0.051474 -0.026328 -0.008449 -0.019163  0.074412
        2  0.085299  0.050680  0.044451 -0.005671 -0.045599 -0.034194 -0.032356
        3 -0.089063 -0.044642 -0.011595 -0.036656  0.012191  0.024991 -0.036038
        4  0.005383 -0.044642 -0.036385  0.021872  0.003935  0.015596  0.008142

                 s4        s5        s6  target
        0 -0.002592  0.019908 -0.017646   151.0
        1 -0.039493 -0.068330 -0.092204    75.0
        2 -0.002592  0.002864 -0.025930   141.0
        3  0.034309  0.022692 -0.009362   206.0
        4 -0.002592 -0.031991 -0.046641   135.0
```

```
In [5]: # Describe df using table summary.
        # No need to normalize, near zero mean.
        df.describe()
```

```
Out[5]:                 age           sex           bmi            bp            s1  \
        count  4.420000e+02  4.420000e+02  4.420000e+02  4.420000e+02  4.420000e+02
        mean  -3.639623e-16  1.309912e-16 -8.013951e-16  1.289818e-16 -9.042540e-17
        std    4.761905e-02  4.761905e-02  4.761905e-02  4.761905e-02  4.761905e-02
        min   -1.072256e-01 -4.464164e-02 -9.027530e-02 -1.123996e-01 -1.267807e-01
        25%   -3.729927e-02 -4.464164e-02 -3.422907e-02 -3.665645e-02 -3.424784e-02
        50%    5.383060e-03 -4.464164e-02 -7.283766e-03 -5.670611e-03 -4.320866e-03
        75%    3.807591e-02  5.068012e-02  3.124802e-02  3.564384e-02  2.835801e-02
        max    1.107267e-01  5.068012e-02  1.705552e-01  1.320442e-01  1.539137e-01

                         s2            s3            s4            s5            s6  \
        count  4.420000e+02  4.420000e+02  4.420000e+02  4.420000e+02  4.420000e+02
        mean   1.301121e-16 -4.563971e-16  3.863174e-16 -3.848103e-16 -3.398488e-16
        std    4.761905e-02  4.761905e-02  4.761905e-02  4.761905e-02  4.761905e-02
        min   -1.156131e-01 -1.023071e-01 -7.639450e-02 -1.260974e-01 -1.377672e-01
        25%   -3.035840e-02 -3.511716e-02 -3.949338e-02 -3.324879e-02 -3.317903e-02
        50%   -3.819065e-03 -6.584468e-03 -2.592262e-03 -1.947634e-03 -1.077698e-03
        75%    2.984439e-02  2.931150e-02  3.430886e-02  3.243323e-02  2.791705e-02
        max    1.987880e-01  1.811791e-01  1.852344e-01  1.335990e-01  1.356118e-01

                   target
        count  442.000000
        mean   152.133484
        std     77.093005
        min     25.000000
        25%     87.000000
        50%    140.500000
        75%    211.500000
        max    346.000000
```

```
In [6]: # train: 0.8 | test: 0.2
        df_train, df_test = train_test_split(df, test_size=0.2, random_state=0)

        # train: 0.6 | validation: 0.2
```

```
          df_train, df_val = train_test_split(df_train, test_size=0.25, random_state=0)

          # Final dataset sizes: train: 0.6, validation: 0.2, text: 0.2

In [7]:   # How does the model perform on the entire dataset and default model parameters
          reg = Ridge().fit(df[diabetes["feature_names"]], df["target"])
          all_df_score = reg.score(df[diabetes["feature_names"]], df["target"])
          all_df_score

Out[7]:   0.4512313946799055

In [8]:   # How does the model perform on the training dataset and default model parameters
          # Remember we use the validation dataset score the model
          reg = Ridge().fit(df_train[diabetes["feature_names"]], df_train["target"])
          val_df_score = reg.score(df_val[diabetes["feature_names"]], df_val["target"])
          val_df_score

Out[8]:   0.3934444316580993

In [9]:   # How does the model perform on the training dataset and different model parameters
          # Change alpha, solver, and max_iter
          reg_h = Ridge(alpha=0.01, solver="saga", max_iter=10000).fit(
              df_train[diabetes["feature_names"]], df_train["target"]
          )
          val_df_h_score = reg_h.score(df_val[diabetes["feature_names"]], df_val["target"])
          val_df_h_score

Out[9]:   0.49381740194998924

In [10]:   # Use optimized data on the held out test dataset.
           test_df_h_score = reg_h.score(df_test[diabetes["feature_names"]], df_test["target"])
           test_df_h_score

Out[10]:   0.3399053725161949

In [39]:   # Bar plot of all scores from each model fit: all_df_score, val_df_score, val_df_h_scor
           pd.Series(
               {
                   "all_df_score": all_df_score,
                   "val_df_score": val_df_score,
                   "val_df_h_score": val_df_h_score,
                   "test_df_h_score": test_df_h_score,
               }
           ).plot(kind="bar", legend=False, title="R2 Score of Ridge Model")

Out[39]:   <AxesSubplot:title={'center':'R2 Score of Ridge Model'}>
```


R2 Score of Ridge Model
0.5
0.4
0.3
0.2
0.1
0.0
all_df_score
val_df_score
val_df_h_score
test_df_h_score

```
In [ ]:
```