

# HW1

October 16, 2019

## 1 Homework #1

### 1.1 Problem 1

Category low is between 9.0 and 17.0 mpg.

Category medium is between 17.0 and 22.5 mpg.

Category high is between 23.0 and 29.0 mpg.

Category very high is between 29.0 and 46.6 mpg.

### 1.2 Problem 2

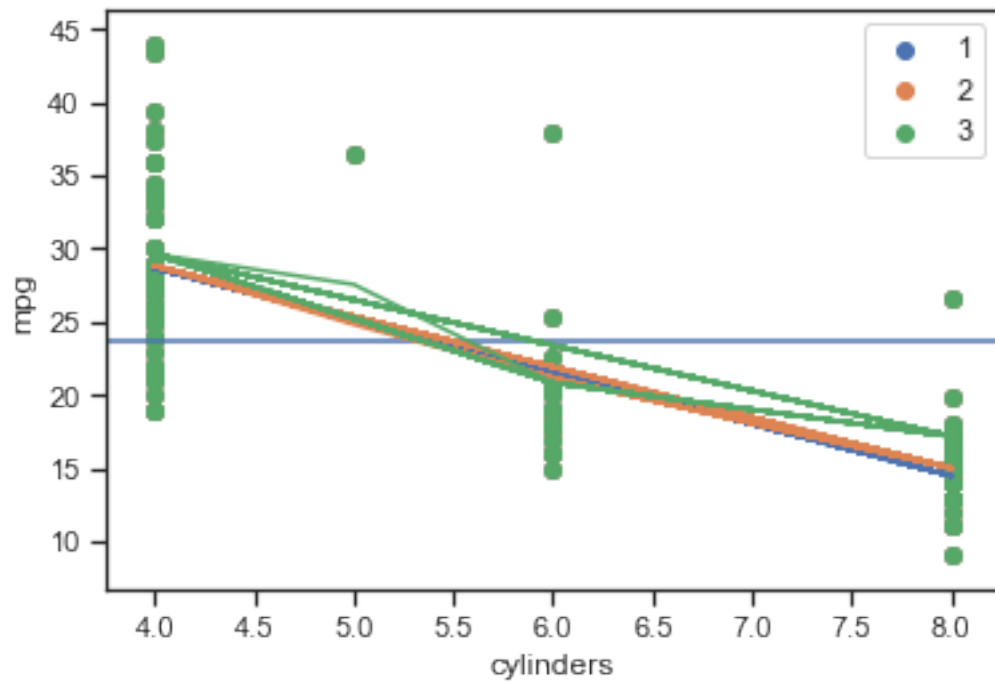
[4]: <seaborn.axisgrid.PairGrid at 0x11f93ab50>



The plots that are most informative, are the ones with clear clustering. Plots like (2,4), (3,6), (6,2) show good separation between clusters. Note: (row,col) points to the plot in ith row and jth column.

### 1.3 Problem 3

### 1.4 Problem 4



Testing MSE 0 deg: 66.17905999999999

Testing MSE 1 deg: 26.53

Testing MSE 2 deg: 26.27

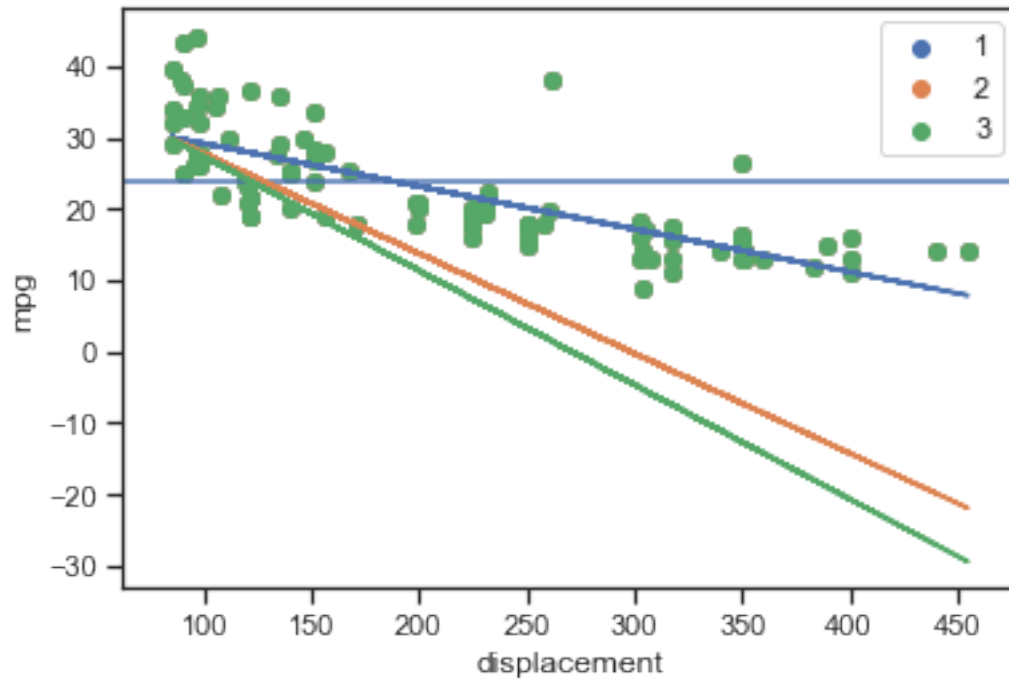
Testing MSE 3 deg: 27.47

Training MSE 0 deg: 59.04026438356164

Training MSE 1 deg: 23.16

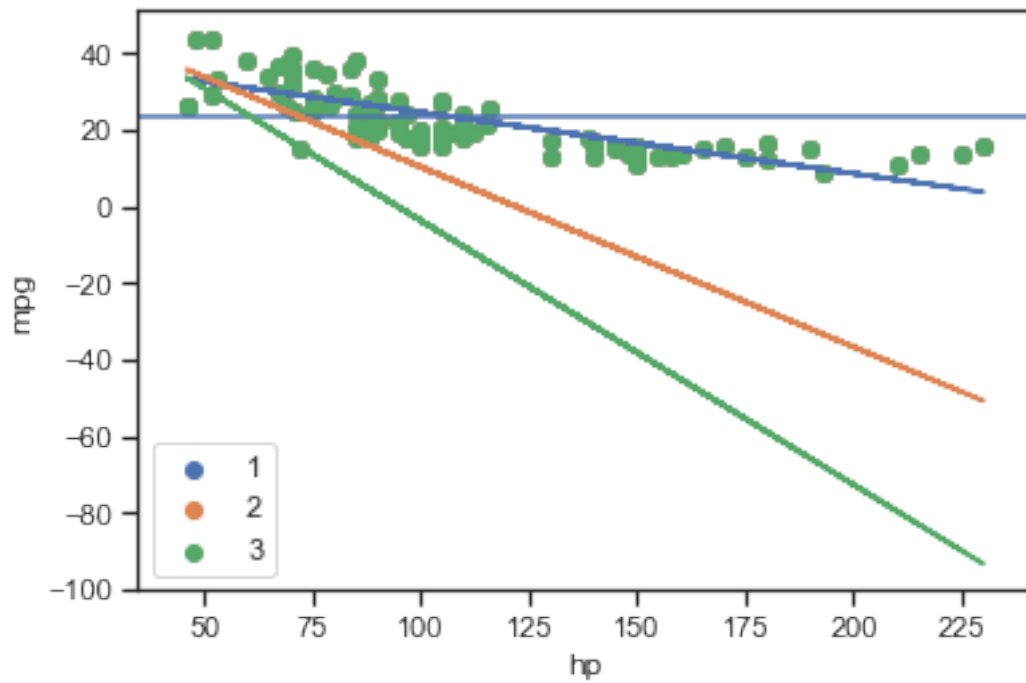
Training MSE 2 deg: 23.08

Training MSE 3 deg: 21.86



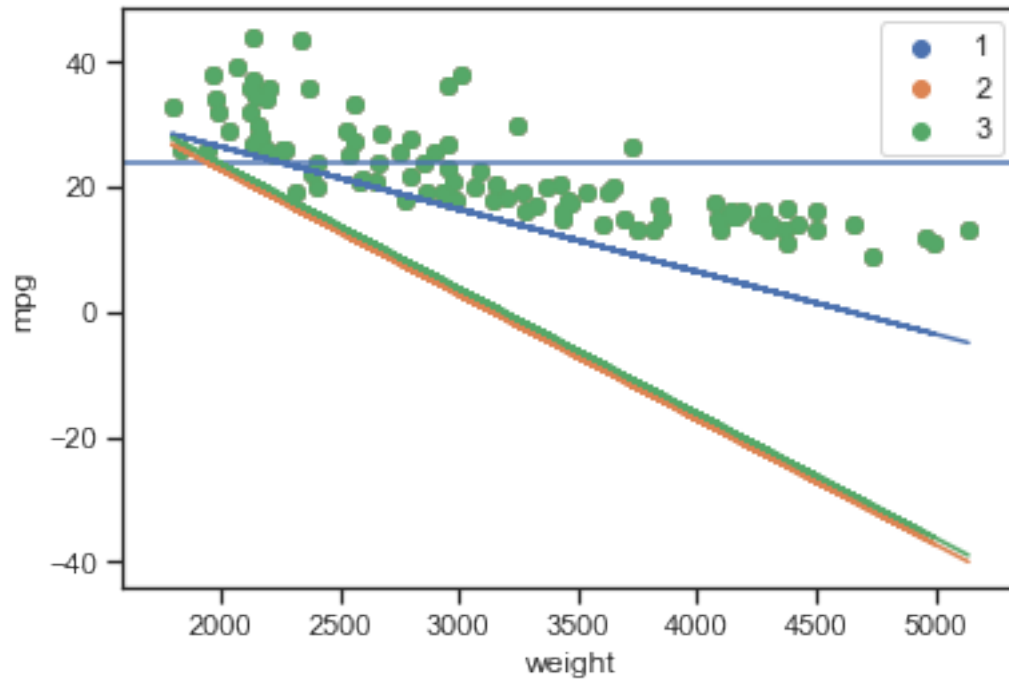
Testing MSE 0 deg: 66.17905999999999  
 Testing MSE 1 deg: 26.17  
 Testing MSE 2 deg: 198.86  
 Testing MSE 3 deg: 297.61

Training MSE 0 deg: 59.04026438356164  
 Training MSE 1 deg: 19.74  
 Training MSE 2 deg: 160.74  
 Training MSE 3 deg: 241.71



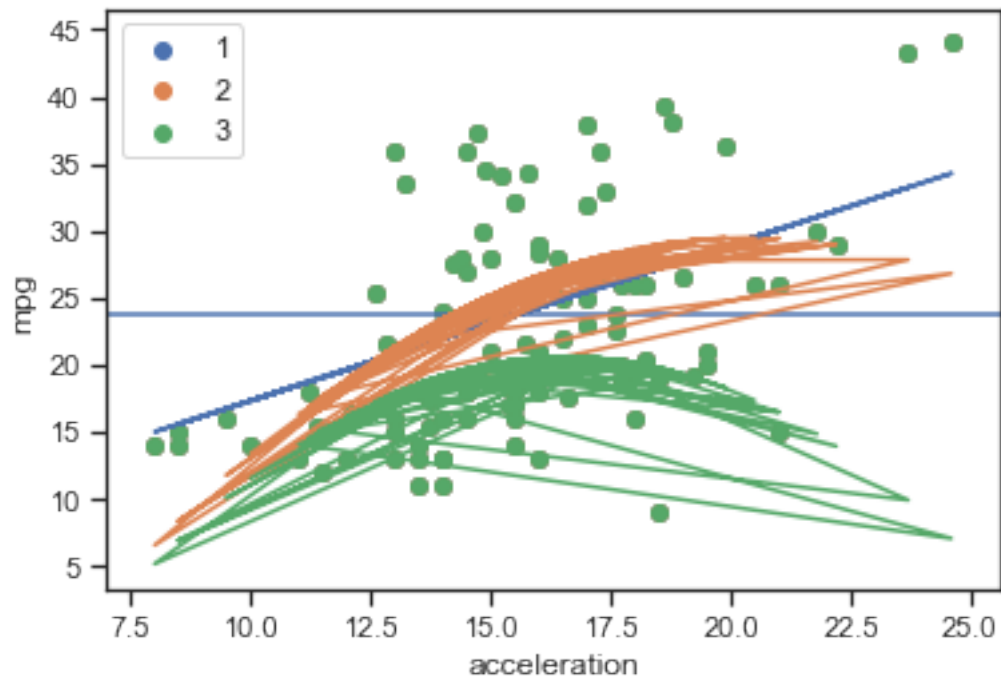
Testing MSE 0 deg: 66.17905999999999  
Testing MSE 1 deg: 28.97  
Testing MSE 2 deg: 474.2  
Testing MSE 3 deg: 1570.97

Training MSE 0 deg: 59.04026438356164  
Training MSE 1 deg: 22.47  
Training MSE 2 deg: 373.9  
Training MSE 3 deg: 1277.89



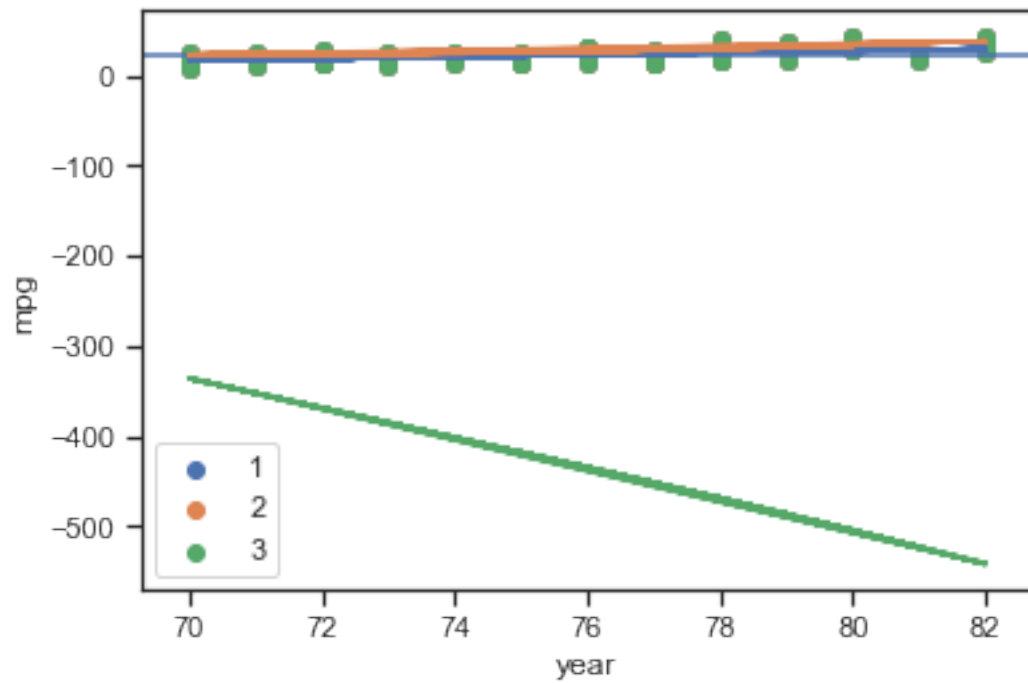
Testing MSE 0 deg: 66.17905999999999  
Testing MSE 1 deg: 82.81  
Testing MSE 2 deg: 639.75  
Testing MSE 3 deg: 593.94

Training MSE 0 deg: 59.04026438356164  
Training MSE 1 deg: 63.99  
Training MSE 2 deg: 504.3  
Training MSE 3 deg: 464.36



Testing MSE 0 deg: 66.17905999999999  
 Testing MSE 1 deg: 51.08  
 Testing MSE 2 deg: 60.84  
 Testing MSE 3 deg: 87.06

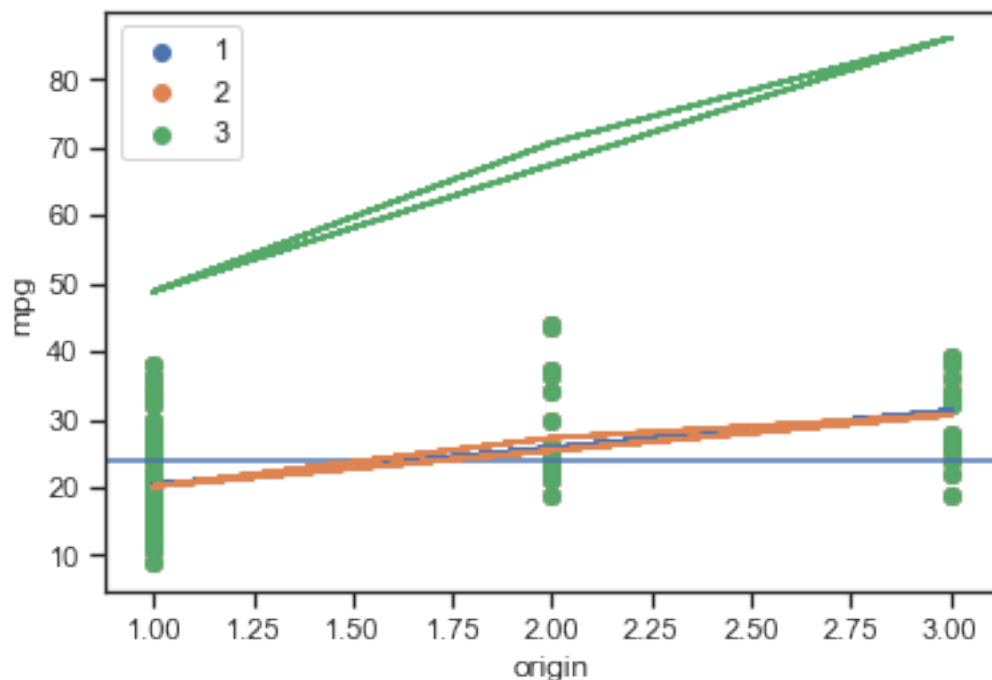
Training MSE 0 deg: 59.04026438356164  
 Training MSE 1 deg: 49.62  
 Training MSE 2 deg: 48.73  
 Training MSE 3 deg: 76.75



Testing MSE 0 deg: 66.17905999999999  
 Testing MSE 1 deg: 38.08  
 Testing MSE 2 deg: 66.62  
 Testing MSE 3 deg: 209061.8

Training MSE 0 deg: 59.04026438356164  
 Training MSE 1 deg: 41.2  
 Training MSE 2 deg: 63.35  
 Training MSE 3 deg: 218060.53





Testing MSE 0 deg: 66.17905999999999  
 Testing MSE 1 deg: 48.73  
 Testing MSE 2 deg: 47.32  
 Testing MSE 3 deg: 1369.37

Training MSE 0 deg: 59.04026438356164  
 Training MSE 1 deg: 38.83  
 Training MSE 2 deg: 38.34  
 Training MSE 3 deg: 1548.42

The 1st order performs best. The features that is most informative is “Acceleration”.

## 1.5 Problem 5

Training MSE 0 deg: 59.04  
 Training MSE 1 deg: 9.98  
 Training MSE 2 deg: 6.88

Testing MSE 0 deg: 66.18  
 Testing MSE 1 deg: 13.83  
 Testing MSE 2 deg: 9.08

## 1.6 Problem 6

/usr/local/lib/python3.7/site-packages/sklearn/linear\_model/logistic.py:947:  
 ConvergenceWarning: lbfgs failed to converge. Increase the number of iterations.

"of iterations.", ConvergenceWarning)

```
[12]: '          precision    recall  f1-score   support\n\n 0.61      0.64      0.62      22\n      low      0.96      0.87      0.92\n31\n 0.73      0.80      0.76      20\n      accuracy\n 0.77     100\n      macro avg      0.76      0.76      0.76     100\n      avg      0.78      0.77      0.77     100'
```

The testing precision is 87%.

## 1.7 Problem 7

/usr/local/lib/python3.7/site-packages/sklearn/metrics/classification.py:1437:  
UndefinedMetricWarning: Precision and F-score are ill-defined and being set to  
0.0 in labels with no predicted samples.

```
'precision', 'predicted', average, warn_for)
```

```
[13]: '          precision    recall  f1-score   support\n\n 0.00      0.00      0.00      22\n      low      0.31      1.00      0.47\n31\n 0.00      0.00      0.00      20\n      accuracy\n 0.31     100\n      macro avg      0.08      0.25      0.12     100\n      avg      0.10      0.31      0.15     100'
```

The testing precision has improved to 100%.

## 1.8 Problem 8

The predicted MPG is: 23.8 and it classified as: low