

Logan Griffin

HW and PA 3

8/3/2025

EN.665.645.8VL.SU25

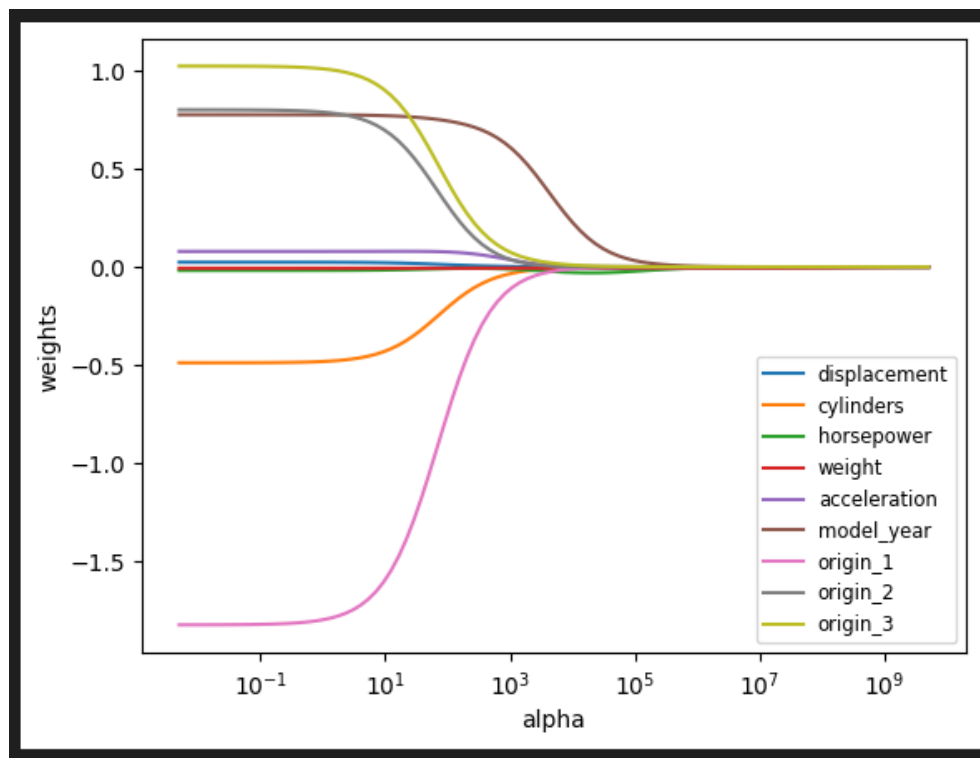
Artificial Intelligence for Robotics

Section 2: Ridge and Lasso Regression

The dataset I used for this section can be found at the following link:

<https://archive.ics.uci.edu/dataset/9/auto+mpg>. It has data on different car features such as number of cylinders, horsepower, country of origin, mpg, etc. The prediction scenario is determining which factors influence a car's gas mileage the most.

Plot from ridge regression:



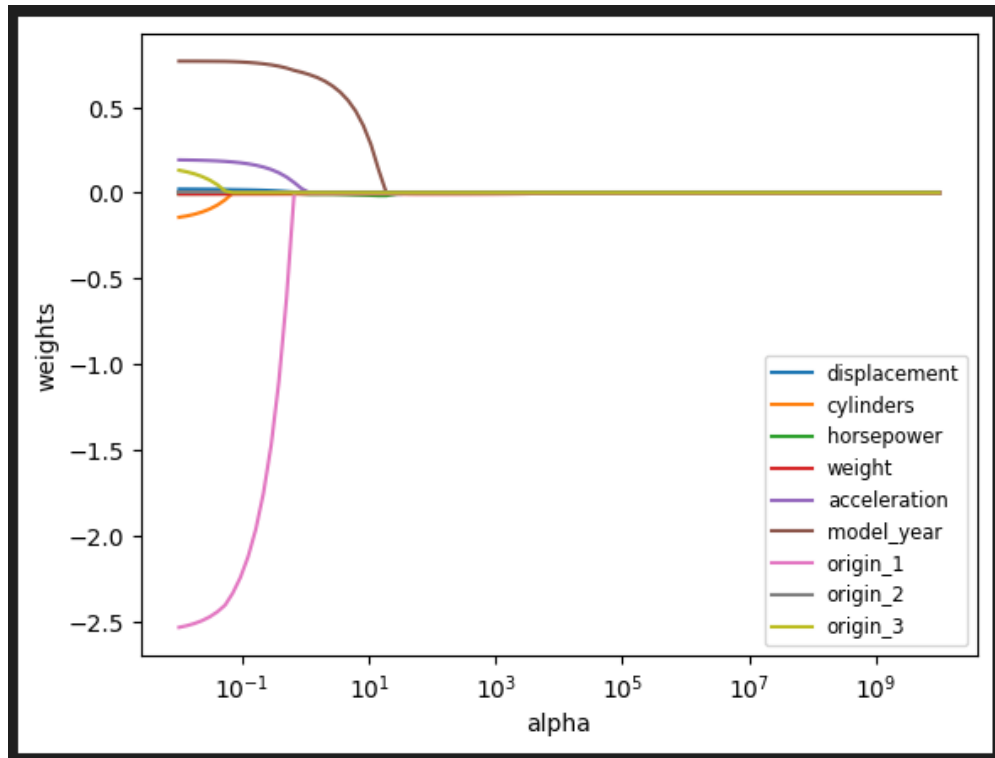
This plot shows that the main factors influencing gas mileage across alphas are if the car was made in the US (origin_1), if the car was made in Germany (origin_2), or if the car was made in Japan (origin_3). The other factor contributing the most at high alpha values is model year. This makes sense as older cars had much worse gas mileage than cars of today.

```
Alpha for smallest CV error is: 9.369087114301934
11.9403755755693

displacement    0.021443
cylinders       -0.433206
horsepower      -0.016072
weight          -0.006722
acceleration     0.079516
model_year      0.772415
origin_1        -1.609626
origin_2         0.701997
origin_3         0.907629
dtype: float64
```

The screenshot above shows the weights obtained from finding the smallest CV error. At that alpha value, the largest influence was being made in the US as it had the largest magnitude.

Plot from Lasso Regression:



The lasso regression made weights approach zero much faster than the ridge regression. However, the same factors seemed to influence gas mileage. The lasso regression again supported the fact that model year was the largest contributing factor to gas mileage.

```
15.432019066389046
```

```
displacement  -0.003089
cylinders      -0.000000
horsepower    -0.014518
weight        -0.006232
acceleration   0.000000
model_year     0.279942
origin_1      -0.000000
origin_2       0.000000
origin_3       0.000000
dtype: float64
```

The screenshot above shows the weight obtained from finding the smallest lasso CV error. . At that alpha value, the largest influence on gas mileage was model year. Almost all of the other factors had converged to a weight of zero.