

Automatic vs Manual Transmission: miles per gallon criteria

Summary

The main purpose of this report is to give an answer to the question: "Is an automatic or manual transmission better for MPG". The conclusion is that Automatic transmission is better than Manual Transmission, and this characteristic is more clear in the 8 cylinders cars. One interesting detail is that this characteristic does not hold if we just consider similar cars that differ only in displacement and transmission. In order to support this conclusion, the MPG difference between automatic and manual transmissions were quantified with the coefficients of a simple regression model.

Exploratory Data Analyses

The first step is to look at the data plotting each variable against the order. This plot can be found at the beginning of the appendix. From the plots we can see:

1. Displacement and Weight have almost the same correlation with MPG (-0.848 and -0.868). And actually they have a strong positive correlation between each other (0.888).
2. QSec and Drat have a very strong positive correlation between each other 0.0912 .
3. V/S and AM transmission have almost the same effect in the MPG, except for an outlier in the V/S case.
4. Gear seems to have not much effect in the MPG.
5. When the amount of Cyl increases, the MPG decreases clearly.
6. When the amount of carburetors increases, the MPG decreases clearly.
7. When the transmission is automatic there is a clear effect of diminution of MPG.
8. In the data we have a big proportion of high cylinders automatic cars and a big proportion of low cylinders manual cars.
9. In the data we have sparse values of displacement for automatic cars and a concentration of low displacement for manual cars.

From the results above, it is possible to try some regression models:

- All variables.
- All variables minus the WT variable.
- All variables minus the VS variable.
- All variables minus the QSEC variable.
- All variables minus the GEAR variable.
- All variables minus the WT,VS,QSEC,GEAR variable.
 - o A simple first order polynomial approximation.
 - o A high order polynomial approximation (HOLM).

For those linear models we can plot the residuals. Those plots can be found at the second section of the appendix. There you are going to see residuals plots and the diagnostics plots for our HOLM. From that plots we can say that our high order polynomial approach have a good behaviour from a residual point of view because almost all of the residual points are 0 and the influence of the outliers is not so significant.

With the above results in mind, let's now take a look over the coefficients of our high order polynomial lineal model, specifically those coefficients that interacts with AM.

Coef	Estimate	Std. Error	t value	Pr(>
amM	-1753.245361	448.359240	-3.910358	0.01738857
cyl8:amM	-1763.261929	455.789835	-3.868585	0.01801514
displ:amM	10.837153	2.989712	3.624816	0.02226192
hp:amM	4.259352	2.029748	2.098464	0.10383323

From these coefficients we can say:

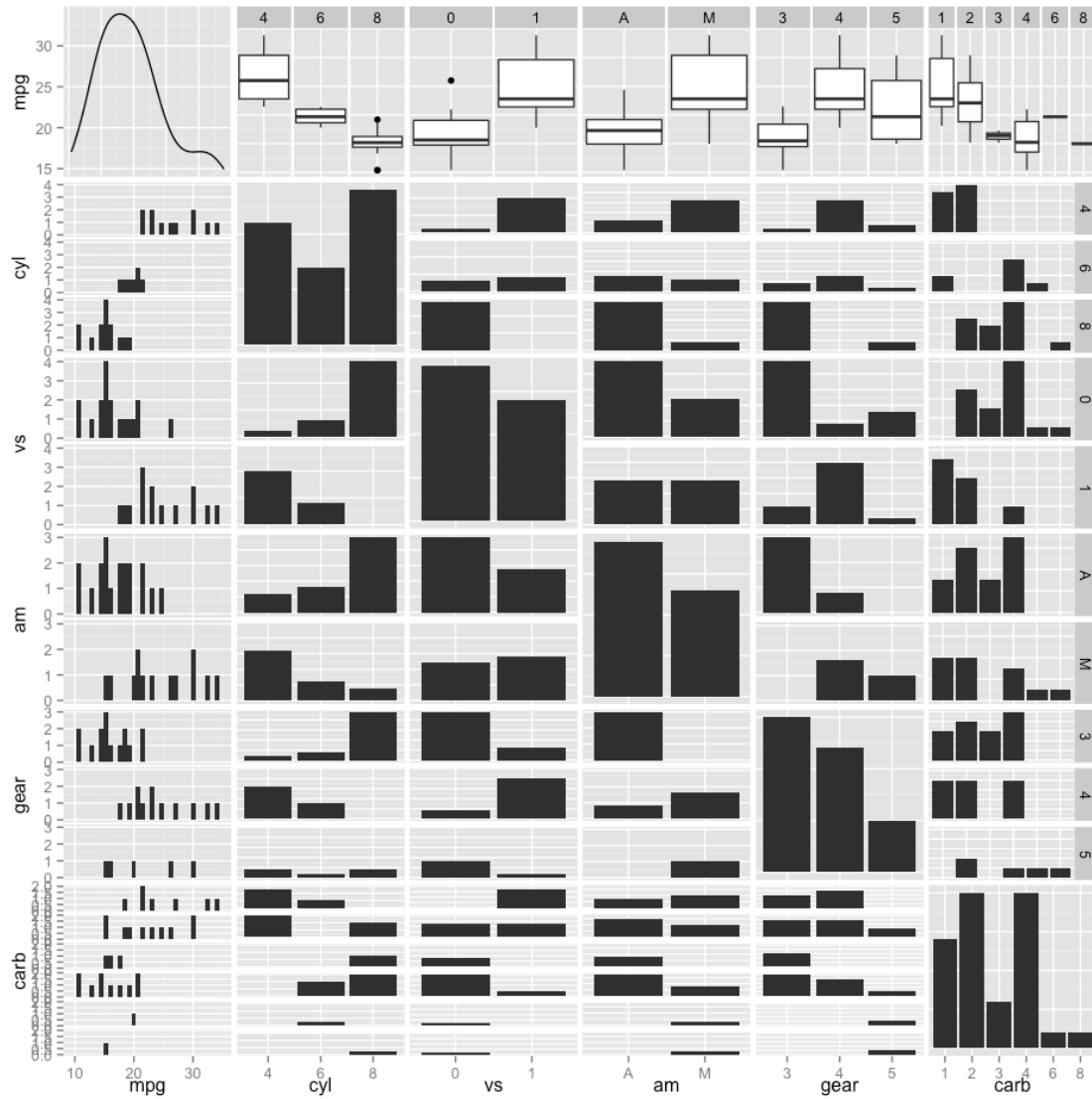
1. The impact that the Transmission has over 8 cylinder cars is clearly a diminution of MPG for automatic cars. We conclude this after compare our intercept with "cyl8:amM" coefficient which also has a t value not crossing 0 with P value less than 0.05.
2. The impact that the Transmission has is clearly a diminution of MPG for automatic cars. We conclude this after compare our intercept with "amM" coefficient which also has a t value not crossing 0 with P value less than 0.05.
3. The impact that the Transmission has over displacement is completely different, it is an increase of MPG for Manual cars. We conclude this after compare our intercept with "displ:amM" coefficient which also has a t value not crossing 0 with P value less than 0.05.

Conclusion

We can say that the conclusion of our coefficients have a clear difference with a first intuition at the data since the data at first glance seems to say that Automatic cars have less MPG. The explanation to this, it is the bias of the data. We have more 8 cylinders cars with automatic transmission and more 4 cylinders cars with manual transmission.

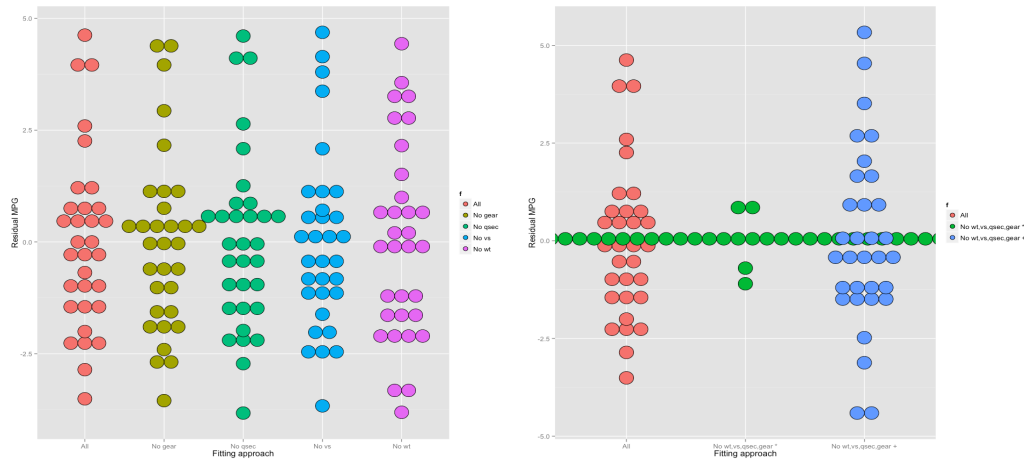
Appendix

Pair Plots

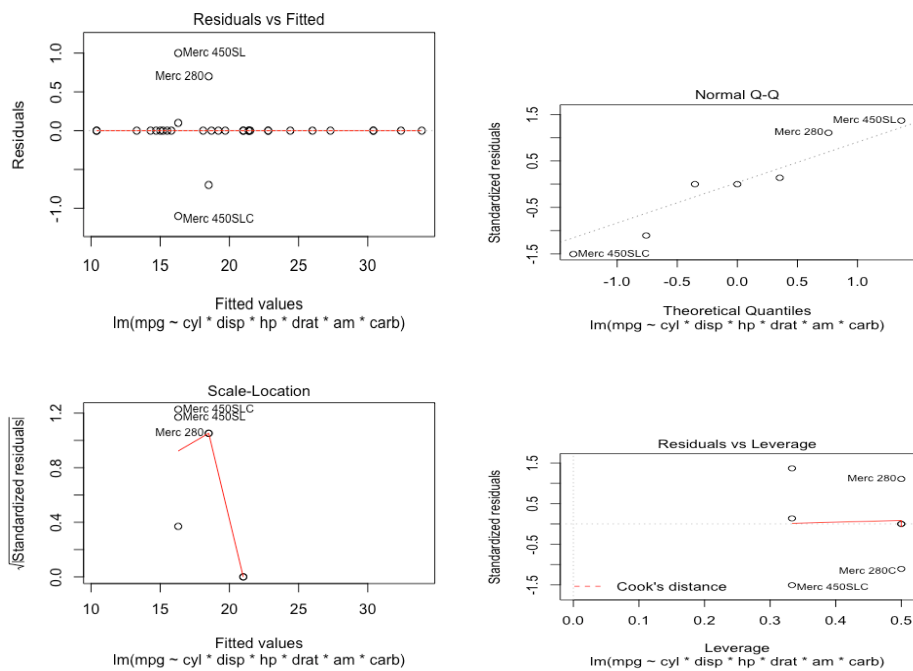


Linear models

Residuals



Diagnostics



Coefficients of HOLM

##		Estimate	Std. Error	t value	Pr(> t)
##	amM	-1753.245361	448.359240	-3.910358	0.01738857
##	cyl8:amM	-1763.261929	455.789835	-3.868585	0.01801514
##	disp:amM	10.837153	2.989712	3.624816	0.02226192
##	hp:amM	4.259352	2.029748	2.098464	0.10383323