

Regression Models Course Project

Vsevolod Velichko

18.12.2014

Abstract

The impact of transmission type on MPG was studied. There was a linear regression model built, with 5 variables having impact on the MPG. It was shown that the manual transmission gives the average increase of 2.7 MPG, however in the 95% confidence interval it can give a slight decrease up to 0.59 MPG, which can be avoided by choosing a bit smaller interval.

Preparation

All factor variables in *mtcars* were factorized.

Model lookup

The first check was naive assumption that there's a straight dependency between transmission type and mpg (Figure 1). It was found that manual transmission increases average mpg by 7.2449393.

Next it was necessary to find out if there are any other models better than the naive one. The *am* factor is never excluded, so we have only 9 variables what gives us $2^9 = 512$ different possible models.

This brute force manner allows us to check every single model without interactions between variables.

Quick check has shown, that none of the models found have any significant p-value.

Here are the top models sorted by adjusted R^2 score in decreasing order:

##	Model	r2.adjusted	p.value
## 1	mpg ~ cyl + hp + wt + vs + am	0.842	5.06e-10
## 2	mpg ~ cyl + hp + wt + qsec + am	0.841	5.20e-10
## 3	mpg ~ cyl + hp + wt + am	0.840	1.51e-10
## 4	mpg ~ disp + hp + wt + qsec + am	0.838	1.84e-10
## 5	mpg ~ cyl + hp + wt + qsec + vs + am	0.838	2.34e-09
## 6	mpg ~ hp + wt + qsec + am	0.837	4.59e-11

So the best model we found is the **mpg ~ cyl + hp + wt + vs + am**.

Unfortunately there's no way to check every single model with interactions, so this one will be considered the best available.

Model investigation

The coefficients for the model used:

##		Estimate	Std. Error	t value	Pr(> t)
##	(Intercept)	31.2000	3.4200	9.1200	2.00e-09
##	cyl16	-2.0900	1.6300	-1.2800	2.11e-01
##	cyl8	0.2910	3.1400	0.0926	9.27e-01
##	hp	-0.0348	0.0138	-2.5100	1.87e-02
##	wt	-2.3700	0.8880	-2.6700	1.30e-02
##	vs1	1.9900	1.7600	1.1300	2.69e-01
##	am1	2.7000	1.6000	1.6900	1.03e-01

The switch from the average car with automatic transmission to the average car with manual one gives average increase in 2.7 MPG.

95% confidence interval for profit from switching to manual transmission is from -0.5883304 to 5.9960193 MPG, that means in some cases manual transmission can make even a negative effect on MPG, which can be probably caused by some other factors (it isn't confirmed, since interactions weren't studied, so the model assumes that it's transmission factor itself). The negative effect is absent in 89.68% confidence interval (from 2.14×10^{-4} to 5.41).

Residuals of the model are rather normally distributed (Figure 2), so the model is supposed to be adequate.

Appendix

Figure 1. Influence of transmission on MPG

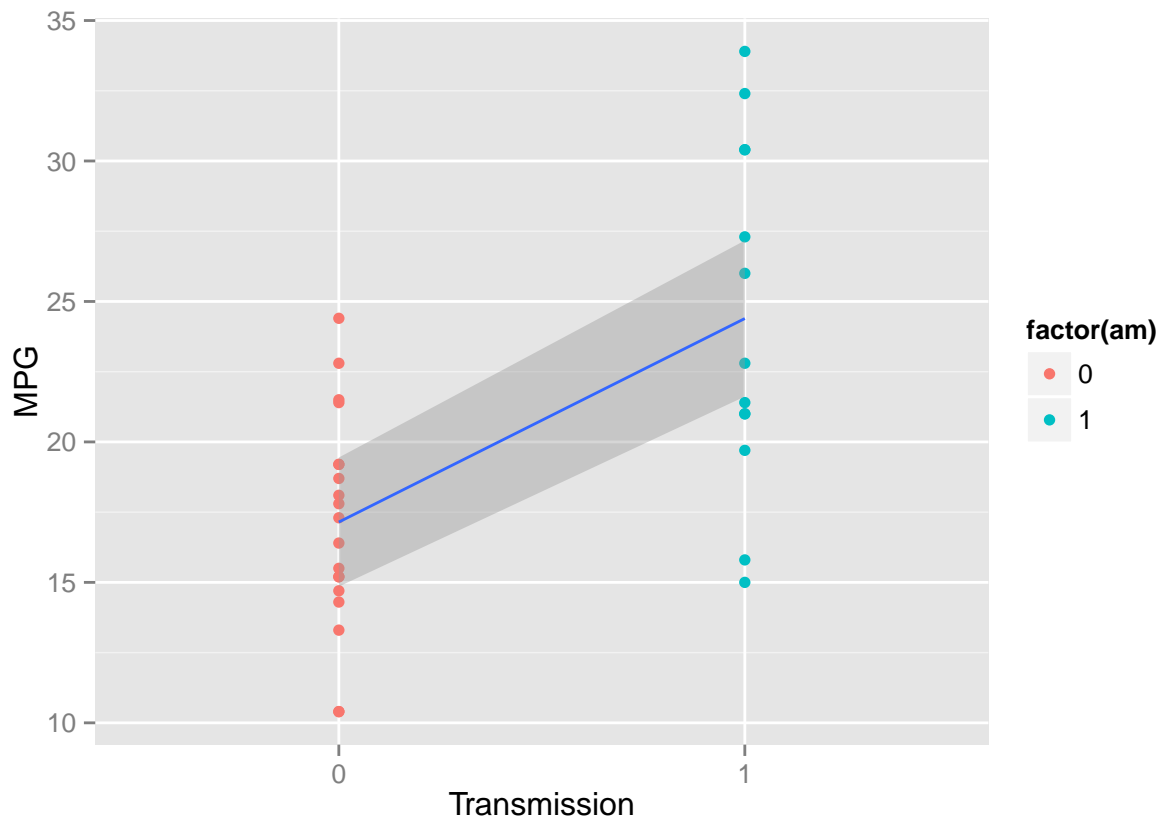


Figure 2. Model properties plots

