Regressions Models Practice

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Is an automatic or manual transmission better for MPG?

The first step is to do summary of the variables

```
summary(mtcars)
```

```
##       mpg             cyl             disp             hp       
##  Min.   :10.40   Min.   :4.000   Min.   : 71.1   Min.   : 52.0  
##  1st Qu.:15.43   1st Qu.:4.000   1st Qu.:120.8   1st Qu.: 96.5  
##  Median :19.20   Median :6.000   Median :196.3   Median :123.0  
##  Mean   :20.09   Mean   :6.188   Mean   :230.7   Mean   :146.7  
##  3rd Qu.:22.80   3rd Qu.:8.000   3rd Qu.:326.0   3rd Qu.:180.0  
##  Max.   :33.90   Max.   :8.000   Max.   :472.0   Max.   :335.0  
##       drat             wt             qsec             vs        
##  Min.   :2.760   Min.   :1.513   Min.   :14.50   Min.   :0.0000  
##  1st Qu.:3.080   1st Qu.:2.581   1st Qu.:16.89   1st Qu.:0.0000  
##  Median :3.695   Median :3.325   Median :17.71   Median :0.0000  
##  Mean   :3.597   Mean   :3.217   Mean   :17.85   Mean   :0.4375  
##  3rd Qu.:3.920   3rd Qu.:3.610   3rd Qu.:18.90   3rd Qu.:1.0000  
##  Max.   :4.930   Max.   :5.424   Max.   :22.90   Max.   :1.0000  
##        am              gear            carb      
##  Min.   :0.0000   Min.   :3.000   Min.   :1.000  
##  1st Qu.:0.0000   1st Qu.:3.000   1st Qu.:2.000  
##  Median :0.0000   Median :4.000   Median :2.000  
##  Mean   :0.4062   Mean   :3.688   Mean   :2.812  
##  3rd Qu.:1.0000   3rd Qu.:4.000   3rd Qu.:4.000  
##  Max.   :1.0000   Max.   :5.000   Max.   :8.000
```

Regression

Now let's start the regression analysis, with mpg as dependent variable and transmission (am) as independent variable. Beginning with the scatter plot and then with the regression analysis.

```
scatter.smooth(x = mtcars$am, y = mtcars$mpg, main = 'Scatter Plot')
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = FALSE, :
## pseudoinverse used at -0.005
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = FALSE, :
## neighborhood radius 1.005
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = FALSE, :
## reciprocal condition number 0
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric = FALSE, :
## There are other near singularities as well. 1.01
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```
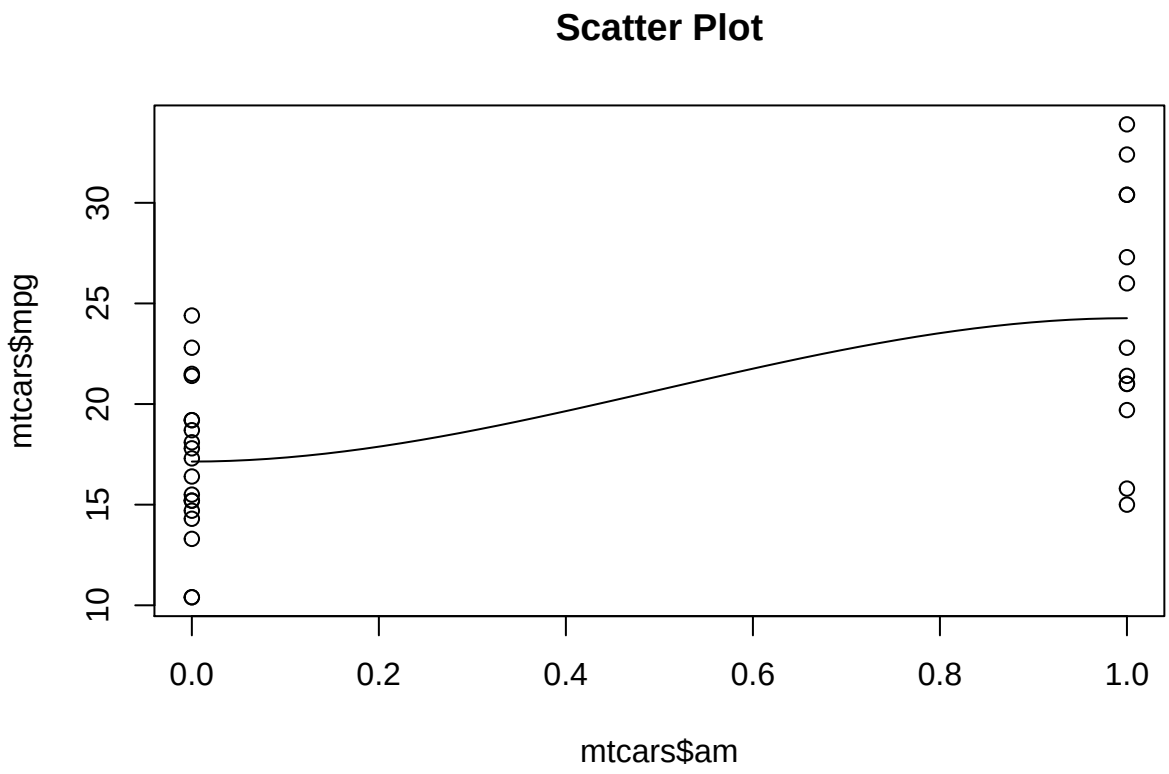




```
fit <- lm(mpg ~ factor(am), mtcars)
summary(fit)
```

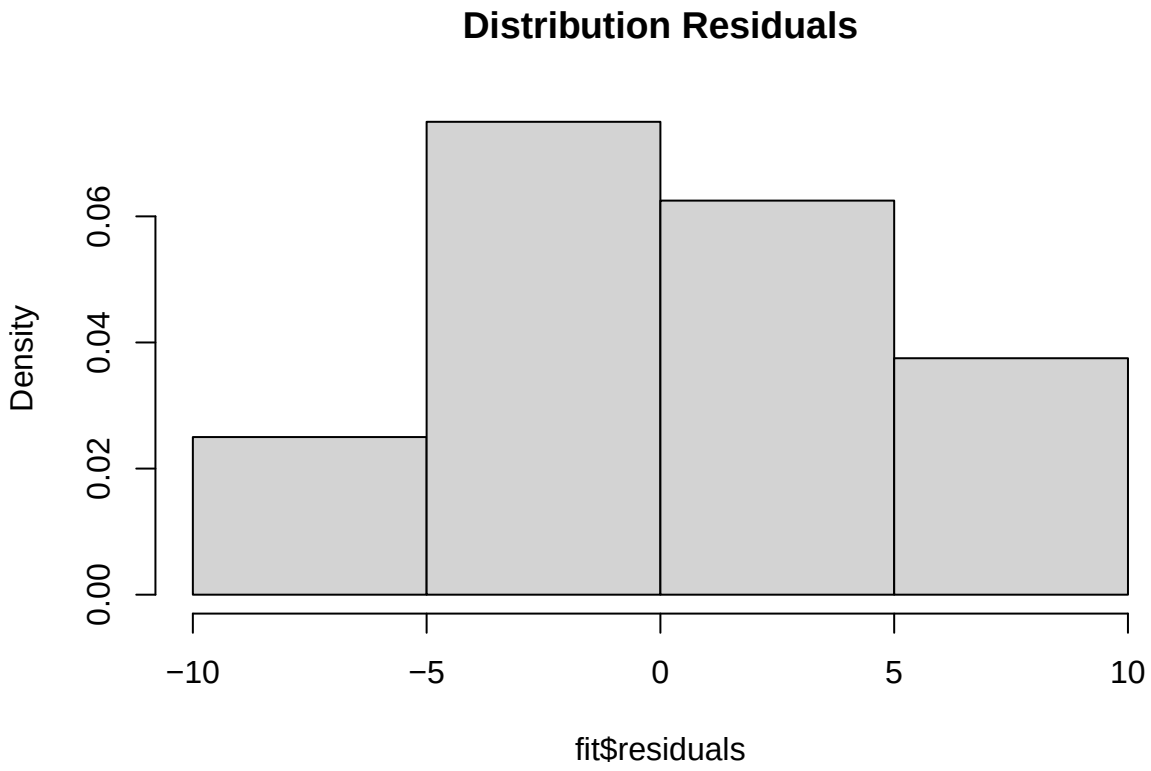
```
##
## Call:
## lm(formula = mpg ~ factor(am), data = mtcars)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -9.3923 -3.0923 -0.2974  3.2439  9.5077
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   17.147      1.125  15.247 1.13e-15 ***
## factor(am)1    7.245      1.764   4.106 0.000285 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.902 on 30 degrees of freedom
## Multiple R-squared:  0.3598, Adjusted R-squared:  0.3385
## F-statistic: 16.86 on 1 and 30 DF,  p-value: 0.000285
```

The 33.85% of the mpg is explained by the transmission, the other 66.15% depends of other variables. The model is statistical significant with a confidence level of 95% (p-value = 0.000285). According to the regression, a car with a manual transmission is more efficient than an automatic car, increasing the mpg in 7.245 miles/gallon.

RESIDUAL DIAGNOSTIC

Plot of Residuals

```
hist(fit$residuals,freq = FALSE,main = "Distribution Residuals")
```

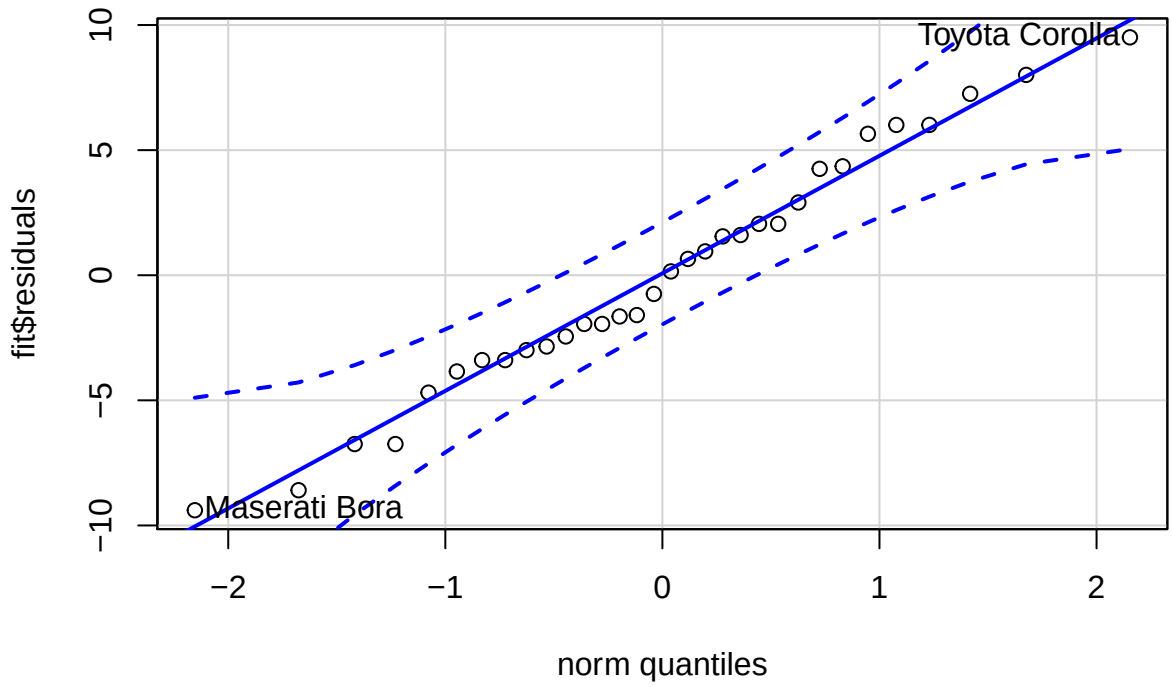


QQ-Plot

```
library(car)
```

```
## Loading required package: carData
```

```
qqPlot(fit$residuals)
```




```
## Toyota Corolla  Maserati Bora
##             20             31
```

There is statistical evidence that the residuals have a normal distribution.