STAT 400 - Discussion 8

Colin Gibbons-Fly

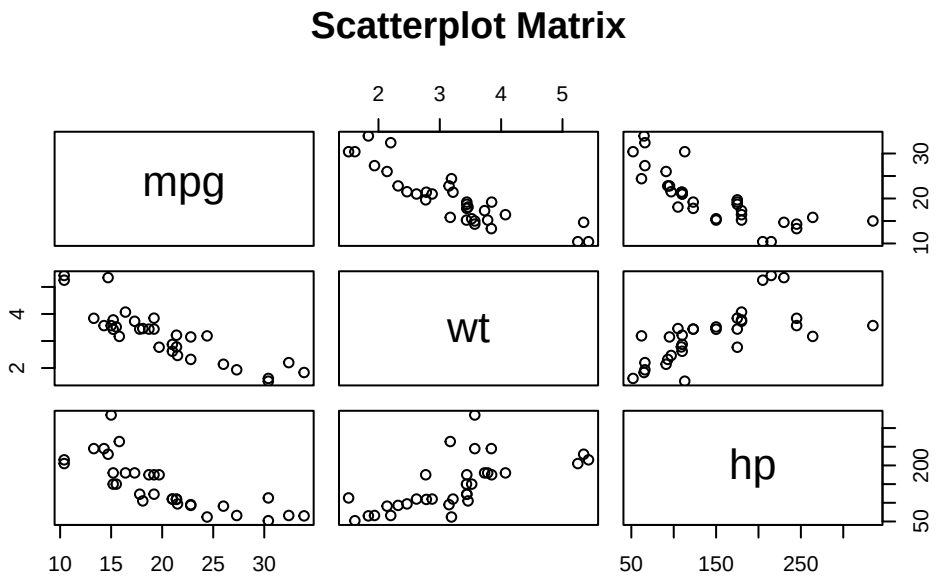
Import data and check for correlating variables

```
data(mtcars)

cor_matrix <- cor(mtcars[, c("mpg", "wt", "hp")])
print(cor_matrix)
```

```
           mpg         wt         hp
mpg  1.0000000 -0.8676594 -0.7761684
wt  -0.8676594  1.0000000  0.6587479
hp  -0.7761684  0.6587479  1.0000000
```

```
pairs(mtcars[, c("mpg", "wt", "hp")],
      main = "Scatterplot Matrix")
```



Here we can see that mpg is negatively impacted by both wt and hp suggesting that the heavier and more powerful the car, the more miles per gallon it will consume.

Build and Summarize Model

```r
model <- lm(mpg ~ wt + hp, data = mtcars)
summary(model)
```

```
Call:
lm(formula = mpg ~ wt + hp, data = mtcars)

Residuals:
   Min     1Q Median     3Q    Max
-3.941 -1.600 -0.182  1.050  5.854

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 37.22727    1.59879  23.285  < 2e-16 ***
wt          -3.87783    0.63273  -6.129 1.12e-06 ***
```

```
hp          -0.03177    0.00903  -3.519  0.00145 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 2.593 on 29 degrees of freedom
Multiple R-squared:  0.8268,    Adjusted R-squared:  0.8148
F-statistic: 69.21 on 2 and 29 DF,  p-value: 9.109e-12
```

Key Observations

1) The expected mpg when wt and hp are zero is 37.23

2) For every unit increase in wt, mpg decreases by 3.88 on average

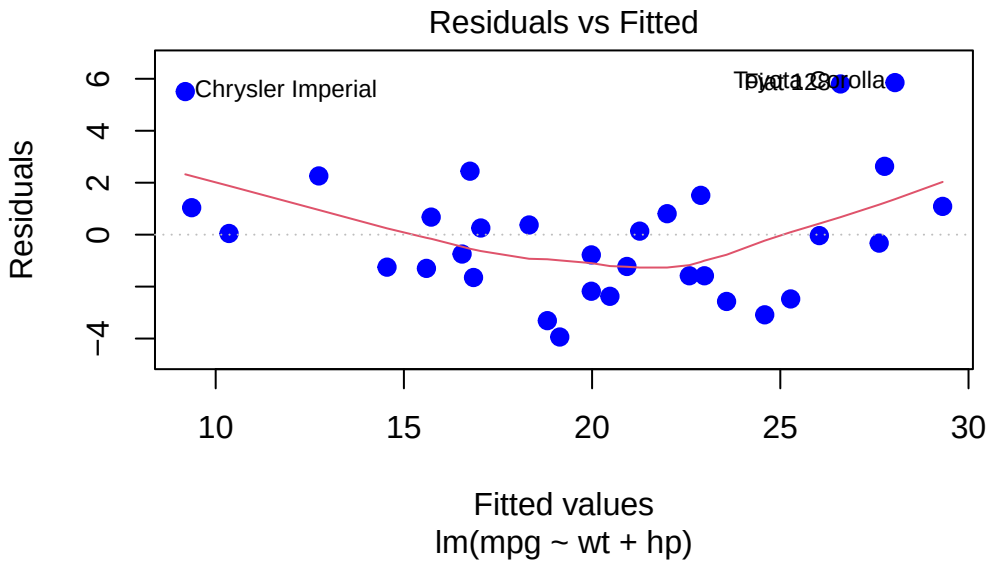
3)For every additional unit of horsepower, mpg decreases by 0.03 on average

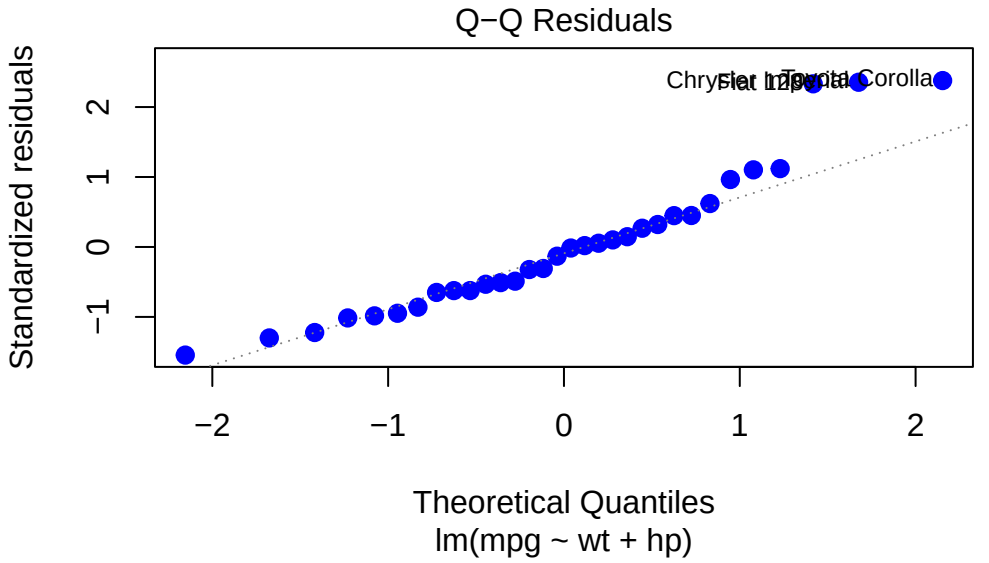
4) About 81% of the of the variation in mpg is explained by the model

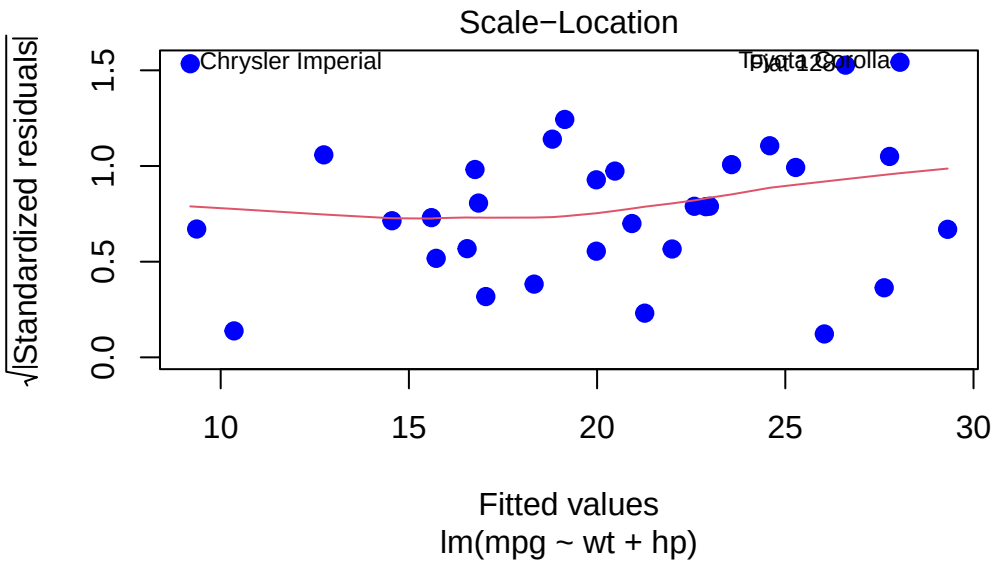
5) The model is significantly significant ($p<0.001$) Both wt and hp have significant p-values, showcasing their importance as predictors of mpg

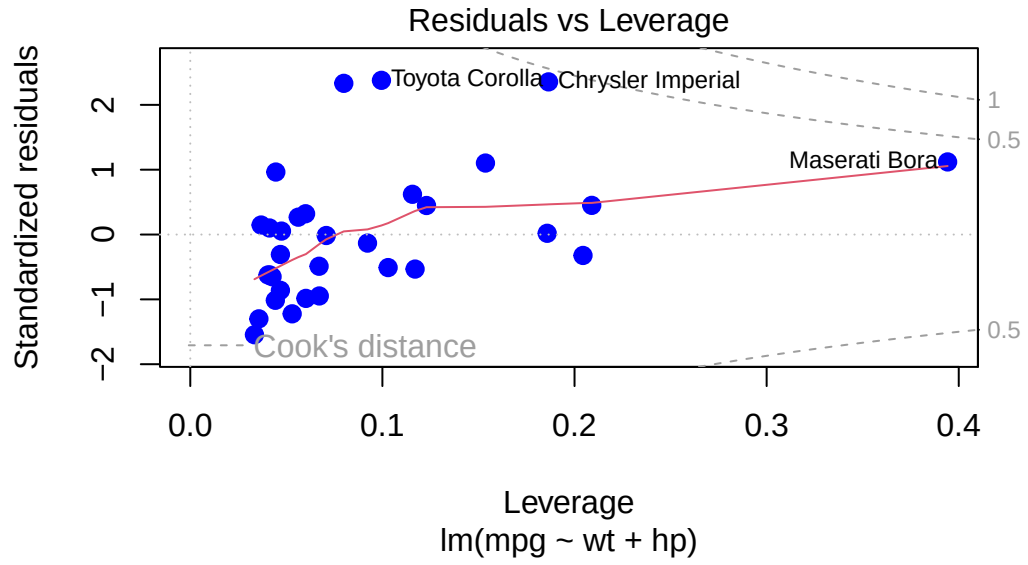
Plot Model

```r
plot(model,
     col = 'blue',
     pch = 19,
     cex = 1.2)
```


Residuals vs Fitted
Residuals
Chrysler Imperial
Toyota Corolla
Fiat 128
6
4
2
0
−4
10
15
20
25
30
Fitted values
lm(mpg ~ wt + hp)


Q−Q Residuals
Standardized residuals
Chrysler Imperial
Fiat 128
Toyota Corolla
2
1
0
−1
−2
−1
0
1
2
Theoretical Quantiles
lm(mpg ~ wt + hp)


Scale−Location
√|Standardized residuals|
Chrysler Imperial
Toyota Corolla
Fiat 128
0.0
0.5
1.0
1.5
10
15
20
25
30
Fitted values
lm(mpg ~ wt + hp)


Residuals vs Leverage
Standardized residuals
Toyota Corolla
Chrysler Imperial
Maserati Bora
1
0.5
0.5
Cook's distance
−2
−1
0
1
2
0.0
0.1
0.2
0.3
0.4
Leverage
lm(mpg ~ wt + hp)