Correlation Analysis

The correlation coefficient r measures the strength and direction of a linear relationship,

- 1 indicates a perfect positive correlation.
- -1 indicates a perfect negative correlation.
- 0 indicates that there is no relationship between the different variables.

Values between -1 and 1 denote the strength of the correlation, as shown in the example below.

In this tutorial, we will explain the different ways of executing correlation plots in R

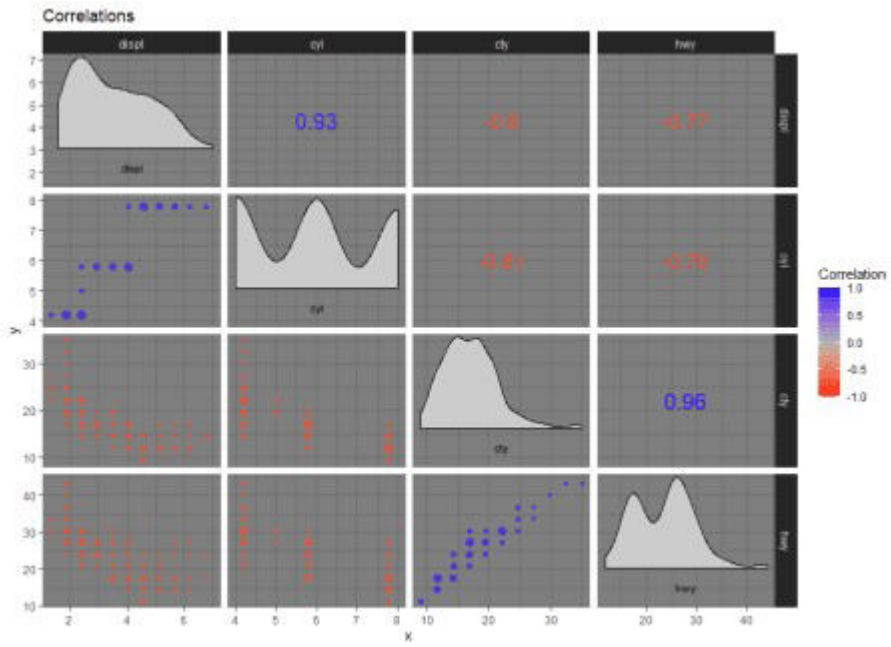
Cormorant Package

remotes::install_github("r-link/corrmorant")

```
library(corrmorant)
library(tidyverse)
library(dplyr)
```

We are selecting only quantitative variables for further analysis

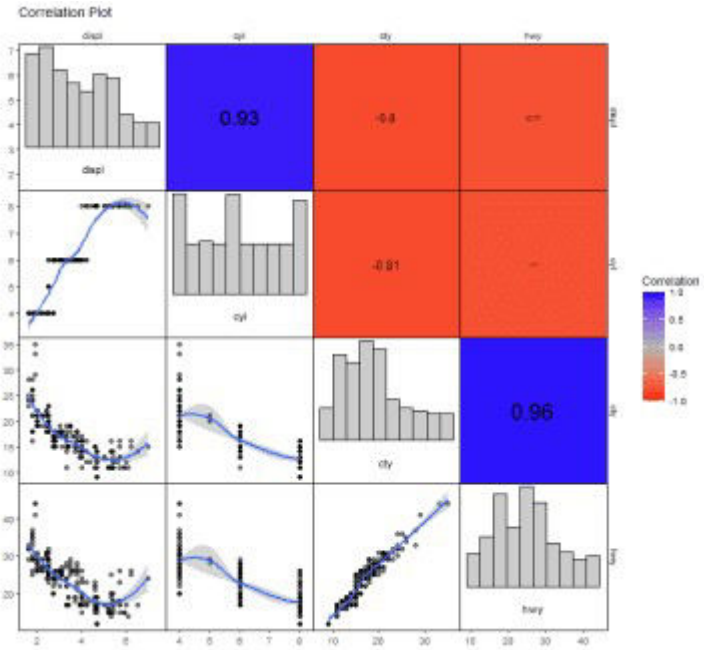
```
mpg<-select(mpg,displ,cyl,cty, hwy)
corrmorant(mpg, style = "binned") +
  theme_dark() +
  labs(title = "Correlations")
```



Customized Plot from ggcorrm

```
ggcorrm(data = mpg) +
  lotri(geom_point(alpha = 0.5)) +
  lotri(geom_smooth()) +
  utri_heatmap() +
  utri_corrtext() +
  dia_names(y_pos = 0.15, size = 3) +
```

```
dia_histogram(lower = 0.3, fill = "grey80", color = 1) +
scale_fill_corr() +
labs(title = "Correlation Plot")
```

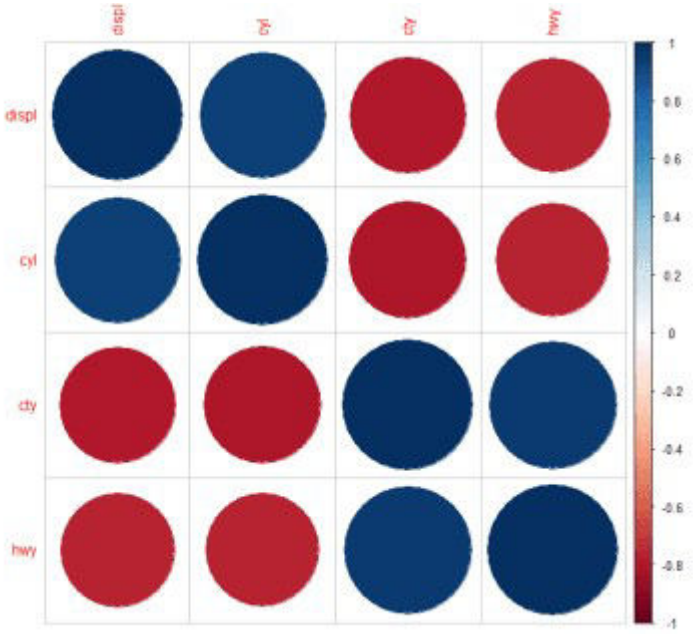


Visualize correlation matrix using corrplot

Following plots, correlation coefficients are colored according to the value. The correlation matrix can be also reordered according to the degree of association between variables.

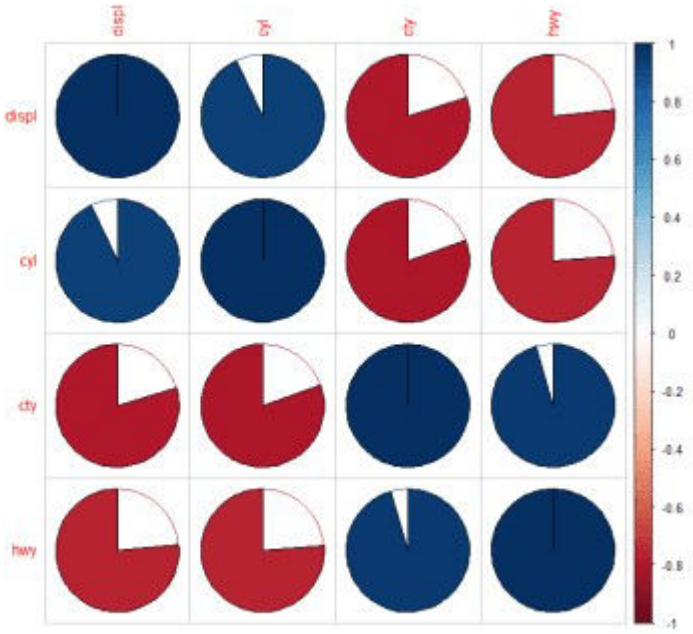
How to learn statistics?

```
library(corrplot)
library(RColorBrewer)
M <-cor(mpg)
corrplot(M, method="circle")
```

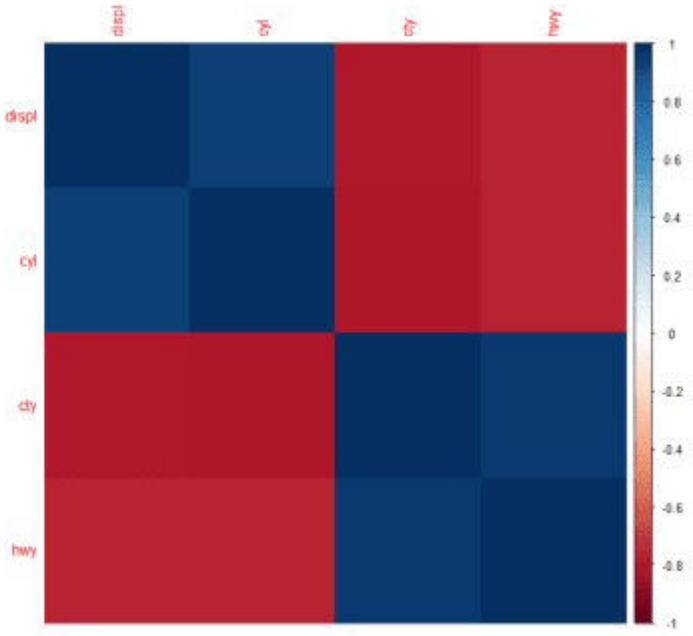



```
corrplot(M, method="pie")
```

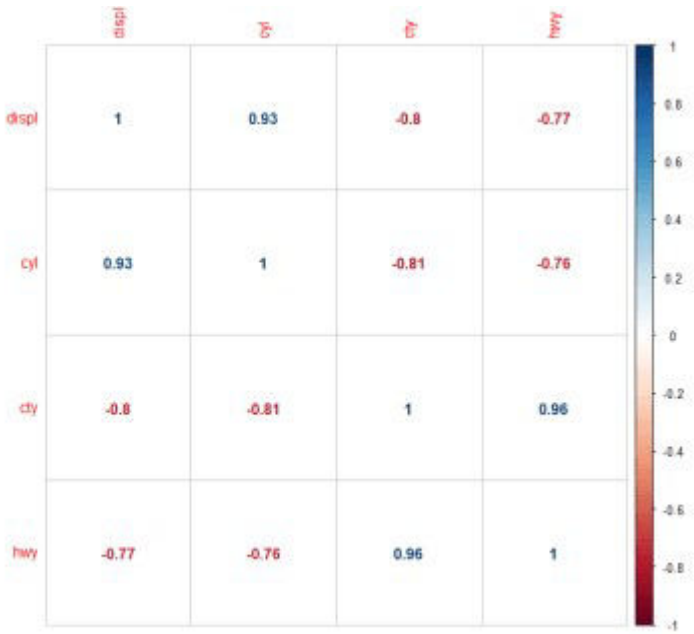
Difference between association and correlation




```
corrplot(M, method="color")
```



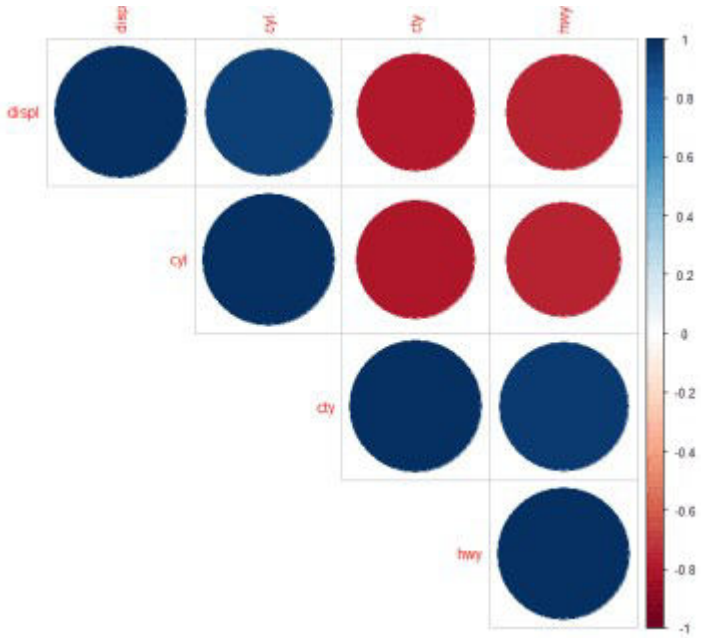

```
corrplot(M, method="number")
```



There are three types of layout :

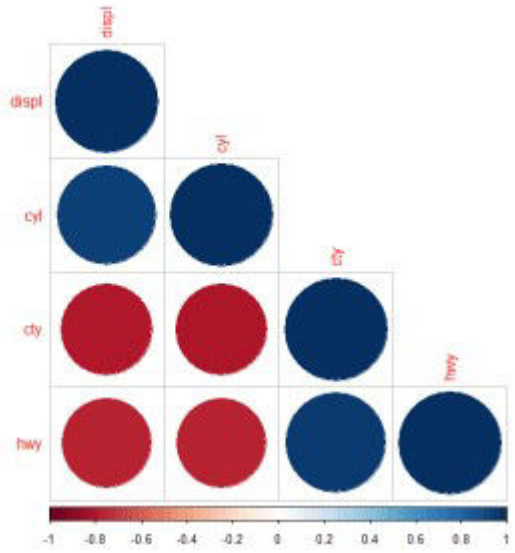
- “full” (default) : display full correlation matrix
- “upper”: display upper triangular of the correlation matrix
- “lower”: display lower triangular of the correlation matrix

```
corrplot(M, type="upper")
```

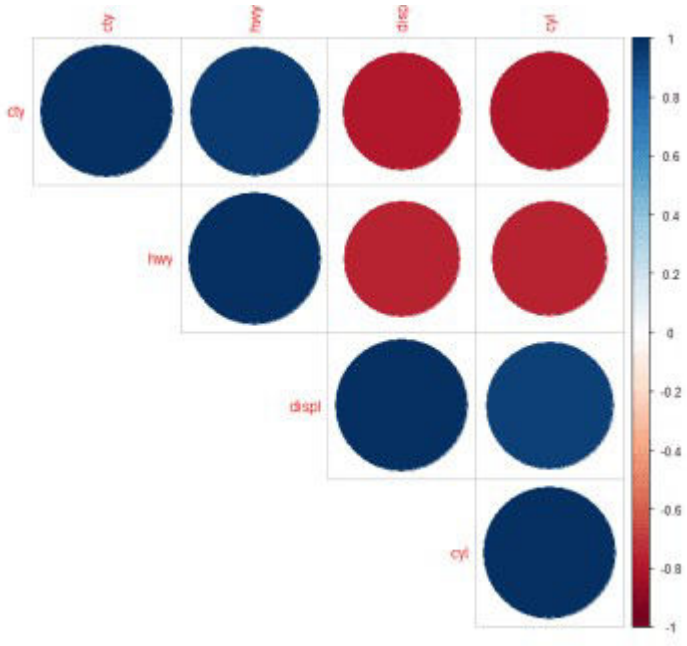



```
corrplot(M, type="lower")
```

Types of data visualization charts



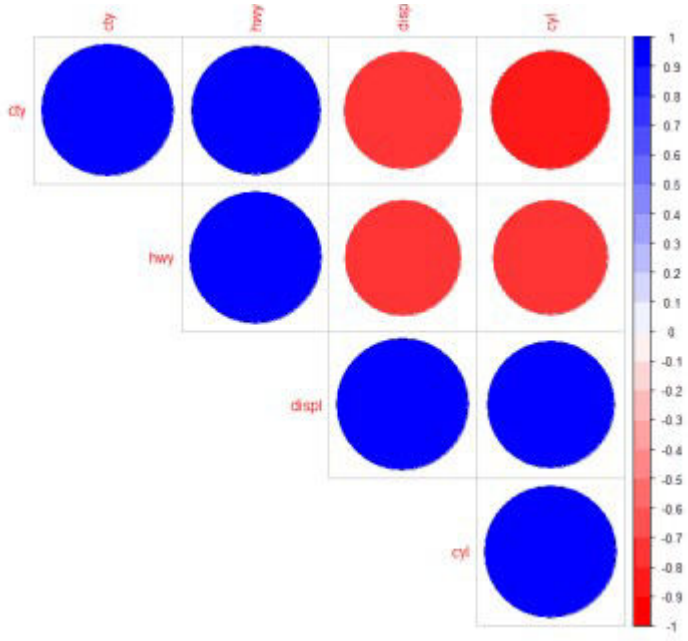

```
corrplot(M, type="upper", order="hclust")
```



Using different color spectrum

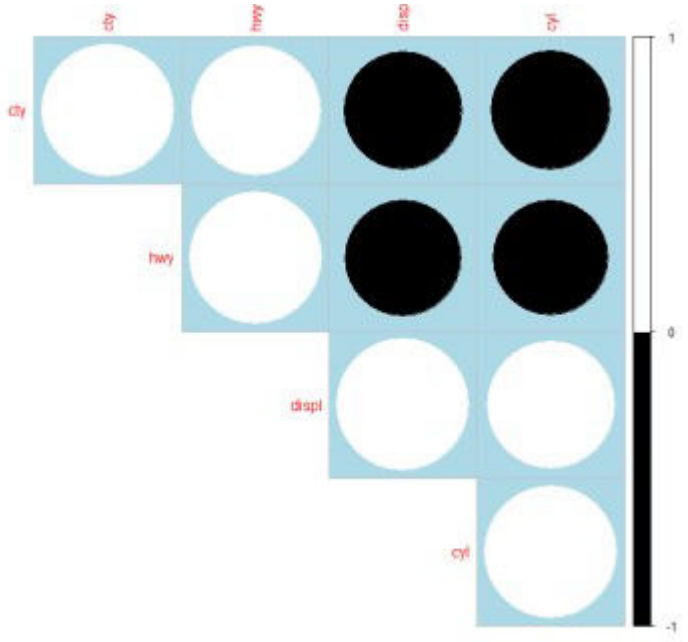
Sample size calculation in R

```
col<- colorRampPalette(c("red", "white", "blue"))(20)
corrplot(M, type="upper", order="hclust", col=col)
```



Change background color to lightblue

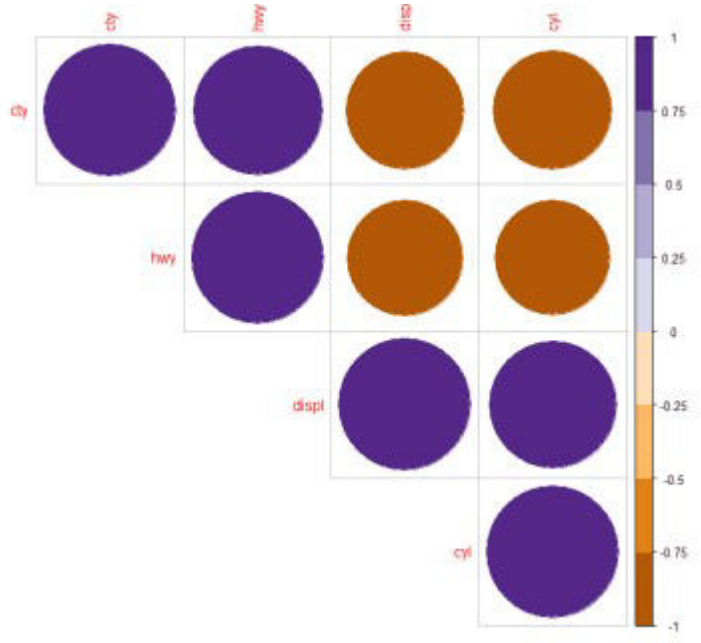
```
corrplot(M, type="upper", order="hclust", col=c("black", "white"),
         bg="lightblue")
```



Changing the color of the plot

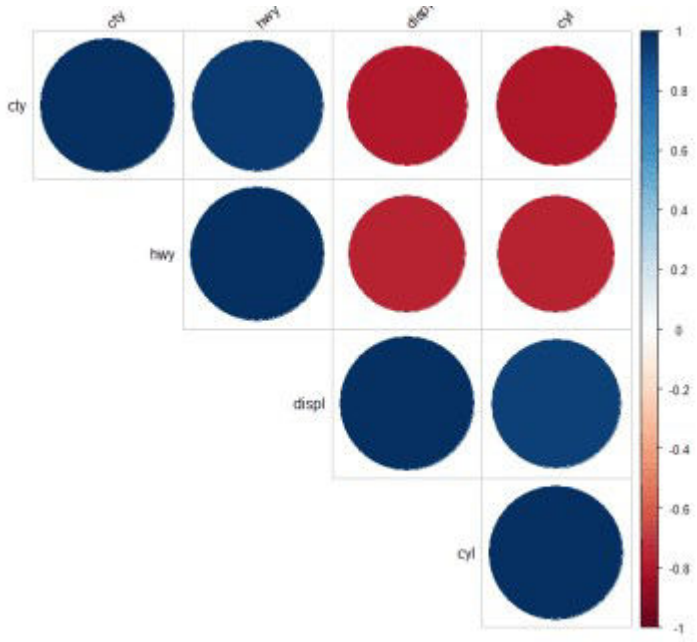
Random Forest Feature selection in R

```
corrplot(M, type="upper", order="hclust",
         col=brewer.pal(n=8, name="PuOr"))
```



Changing the color and the rotation of text labels

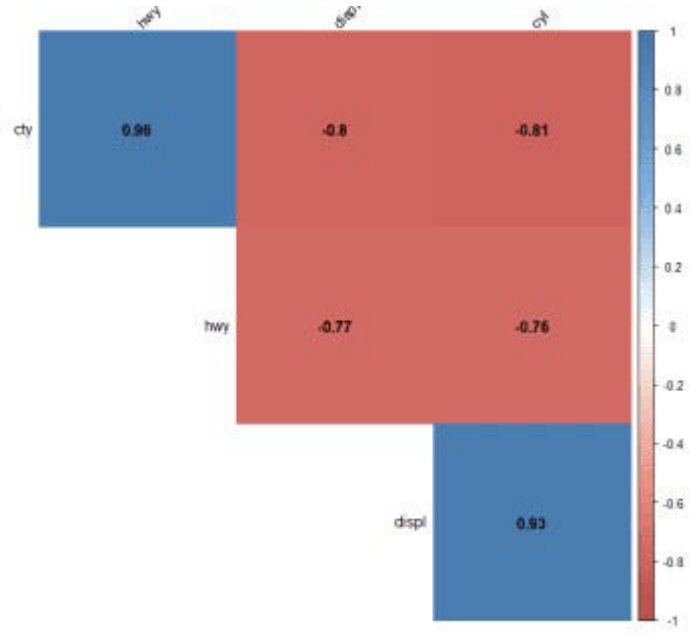
```
corrplot(M, type="upper", order="hclust", tl.col="black", tl.srt=45)
```



Customize the corrplot

Handling Imbalanced data in R

```
col <- colorRampPalette(c("#BB4444", "#EE9988", "#FFFFFF", "#77AADD",
"#4477AA"))
Specialized the insignificant value according to the significant level
corrplot(M, type="upper", order="hclust",
         p.mat = p.mat, sig.level = 0.01)
corrplot(M, method="color", col=col(200),
         type="upper", order="hclust",
         addCoef.col = "black", # Add coefficient of correlation
         tl.col="black", tl.srt=45, #Text label color and rotation
```



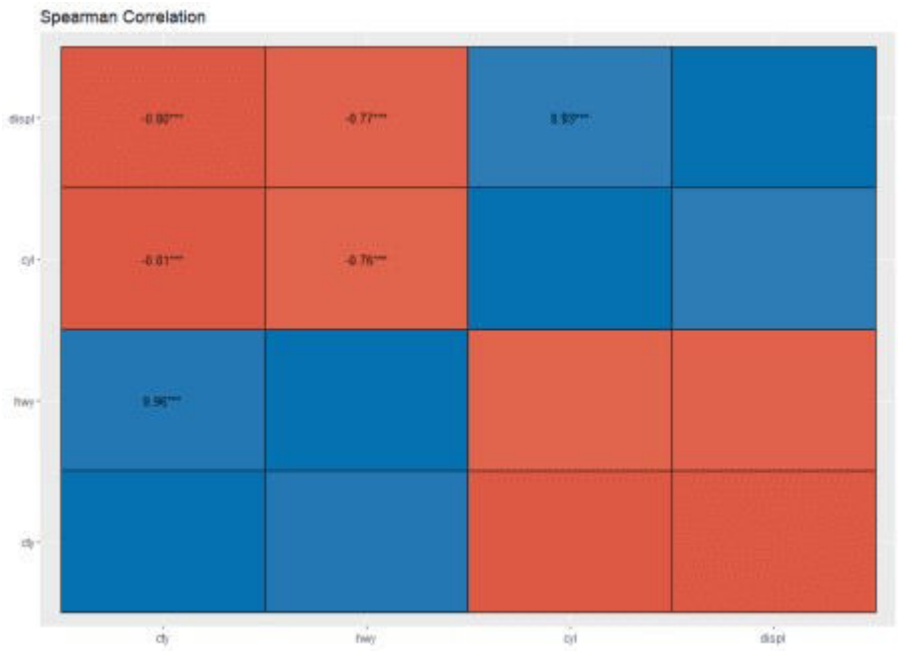
sjPlot Package

```
sjp.corr( data, title = NULL, axis.labels = NULL, sort.corr = TRUE, decimals = 3, na.deletion = c("listwise", "pairwise"), corr.method = c("pearson", "spearman", "kendall"), geom.colors = "RdBu", wrap.title = 50, wrap.labels = 20,sjp.corr 65 show.legend = FALSE, legend.title = NULL, show.values = TRUE, show.p = TRUE, p.numeric = FALSE )
```

sjplot is very useful for small number of variables.

ggside in R

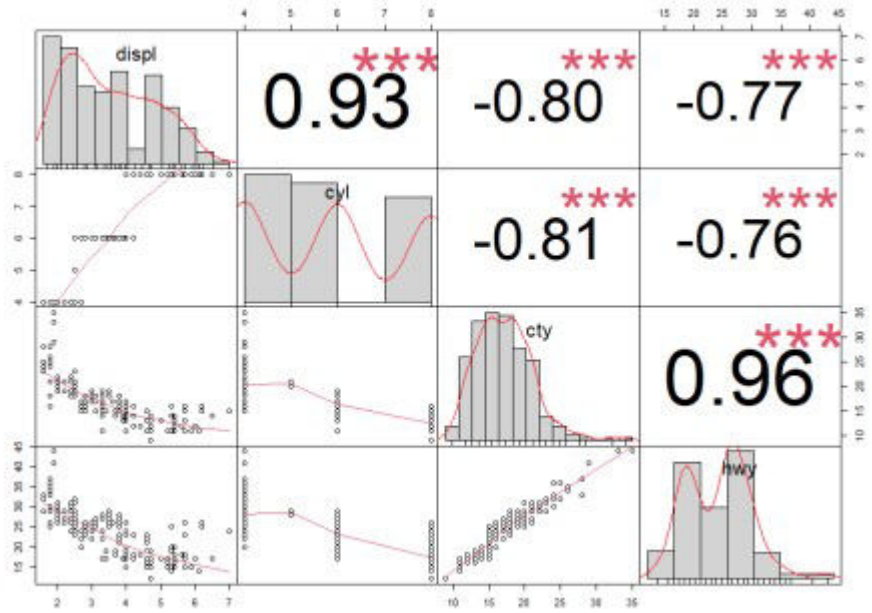
```
library(sjPlot)
sjp.corr(mpg,title ="Spearman Correlation",decimals =2)
```



PerformanceAnalytics Package

```
library(PerformanceAnalytics)
```

```
chart.Correlation(mpg, histogram=TRUE, pch="+")
```



Correlation plots are the best way to show the pattern and relationship.