

Part III: Visualizations in R

TMA4268 Statistical Learning V2019. Module 1: INTRODUCTION TO STATISTICAL LEARNING

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Introduction

For each of the plots (scatter plot, histogram, boxplot, area chart, heat map, correlogram) *explain what you see (including what is on the x- and y-axis) and try to transform what you see into insight about the data.* All except the correlogram use `ggplot2` for plotting. If you want to read more about the idea behind `ggplot2` (grammar of graphics) Chapter 3 of [R for Data Science](#) is a good read. Other resources are:

<http://t-redactyl.io/blog/2016/03/creating-plots-in-r-using-ggplot2-part-9-function-plots.html>

<https://ggplot2.tidyverse.org/reference/>

Packages needed

```
install.packages("car")
install.packages("faraway")
install.packages("ggplot2")
install.packages("GGally")
install.packages("reshape")
install.packages("corrplot")
install.packages("corrgram")
```

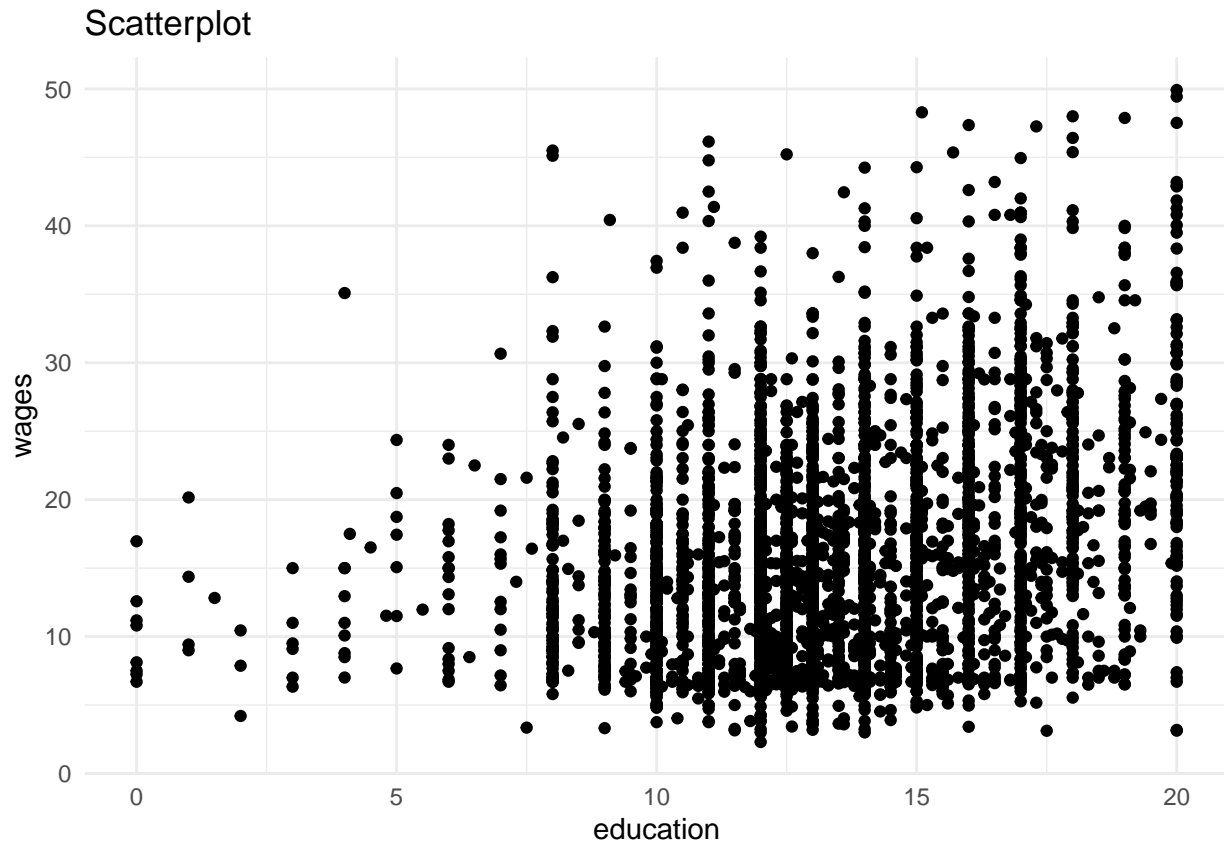
Data sets

Three different data sets are used - read descriptions in R:

- SLID: `?car::SLID`
- mtcars: `?datasets::mtcars`
- ozone: `?faraway::ozone`

Scatter Plot

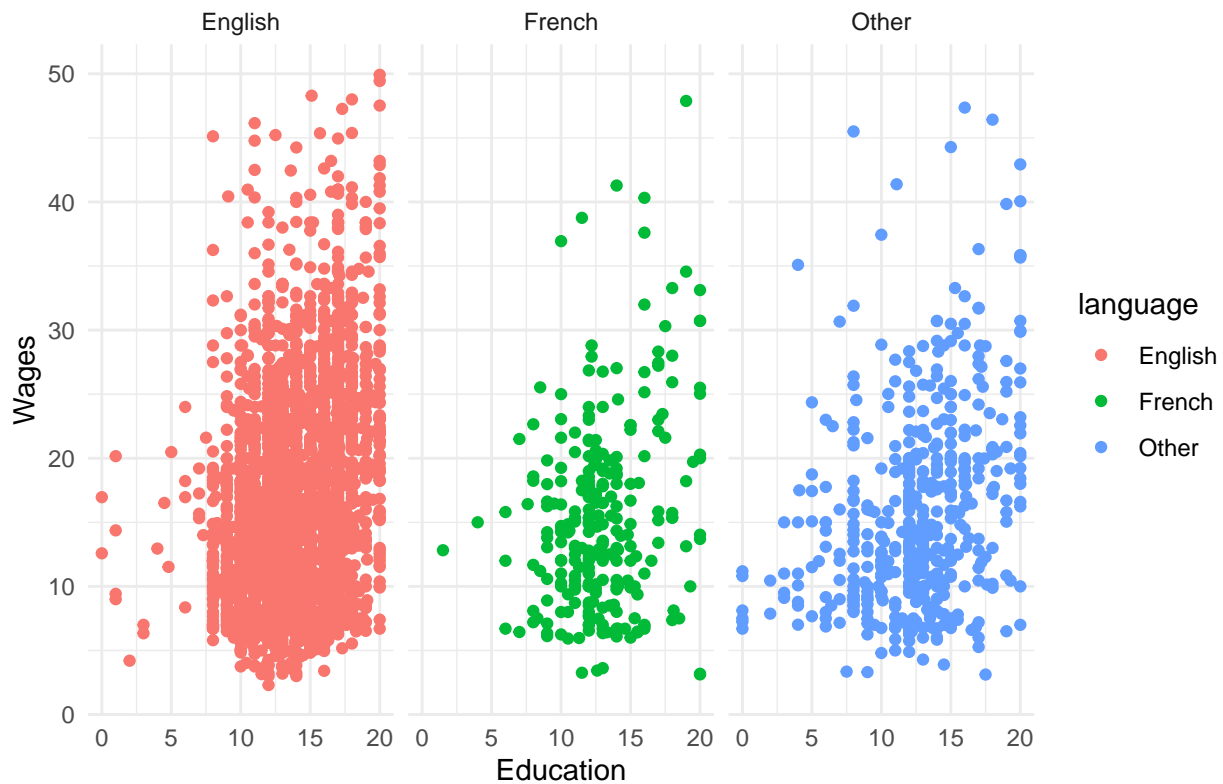
```
library(car)
library(ggplot2)
SLID = na.omit(SLID)
ggplot(SLID, aes(education, wages)) + geom_point() + labs(title = "Scatterplot") +
  theme_minimal()
```



Solution: The scatterplot shows that the people with the largest wages often are the people with the longest education. The plot also indicates that the variance increases as a function of education, i.e the expected wage vary less for a random person with 0-5 years of education compared to a person with 20 years of education.

```
ggplot(SLID, aes(education, wages)) + geom_point(aes(color = language)) + scale_x_continuous("Education") +  
  scale_y_continuous("Wages") + theme_bw() + labs(title = "Scatterplot") +  
  facet_wrap(~language) + theme_minimal()
```

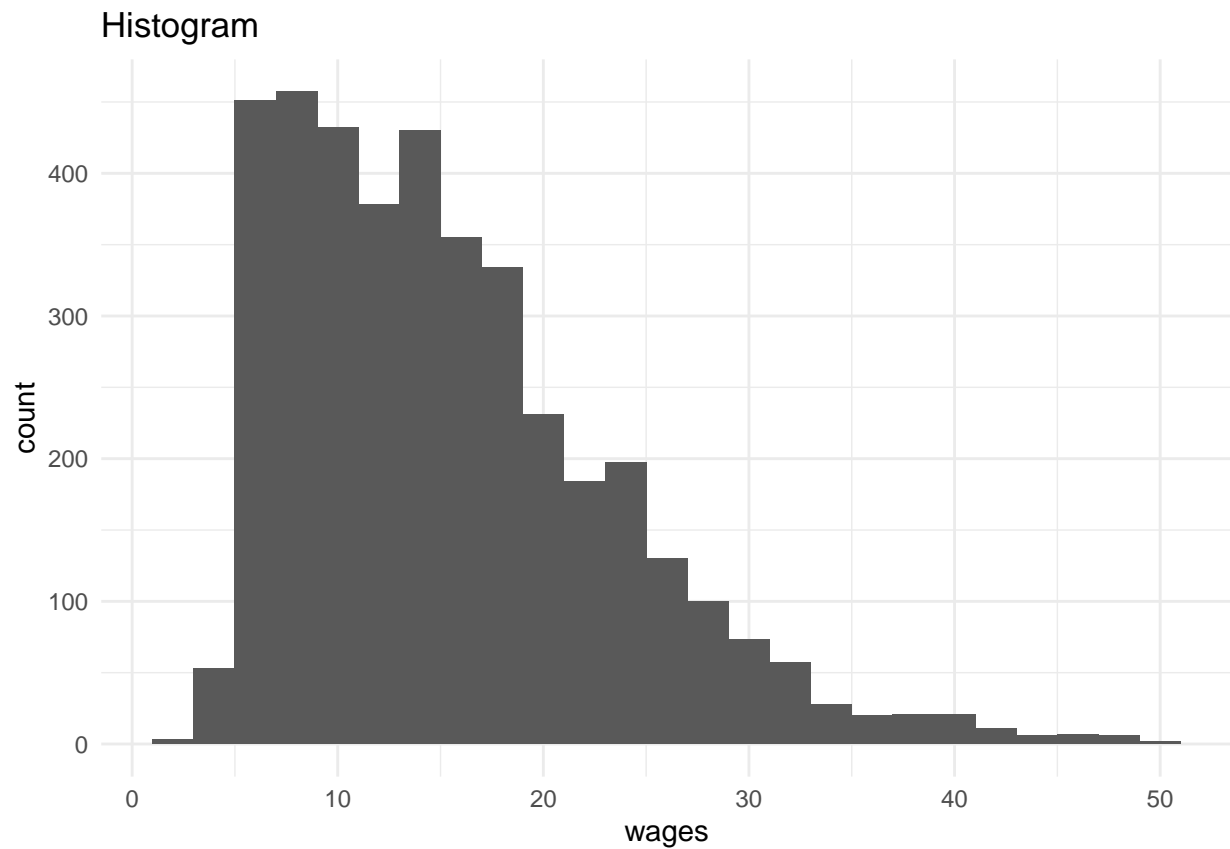
Scatterplot



Solution: From this plot we see that there are more english speaking people in the dataset. In general, the english speaking people have large education (relatively few people with education < 8 years). Among the people who speak other languages than french and english, there is a larger amount of people with low education.

Histogram

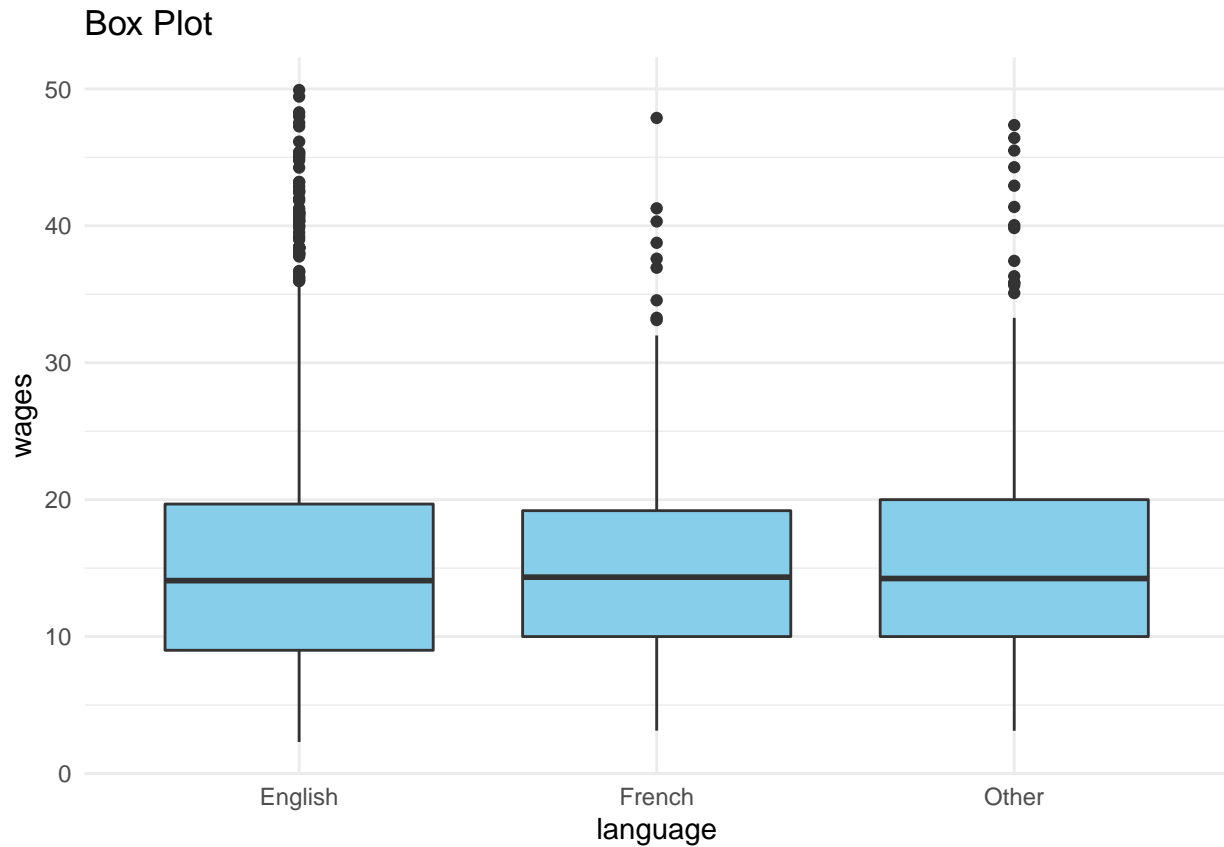
```
ggplot(SLID, aes(wages)) + geom_histogram(binwidth = 2) + labs(title = "Histogram") +  
  theme_minimal()
```



Solution: Shows the distributon of wages in the dataset.

Box-plot

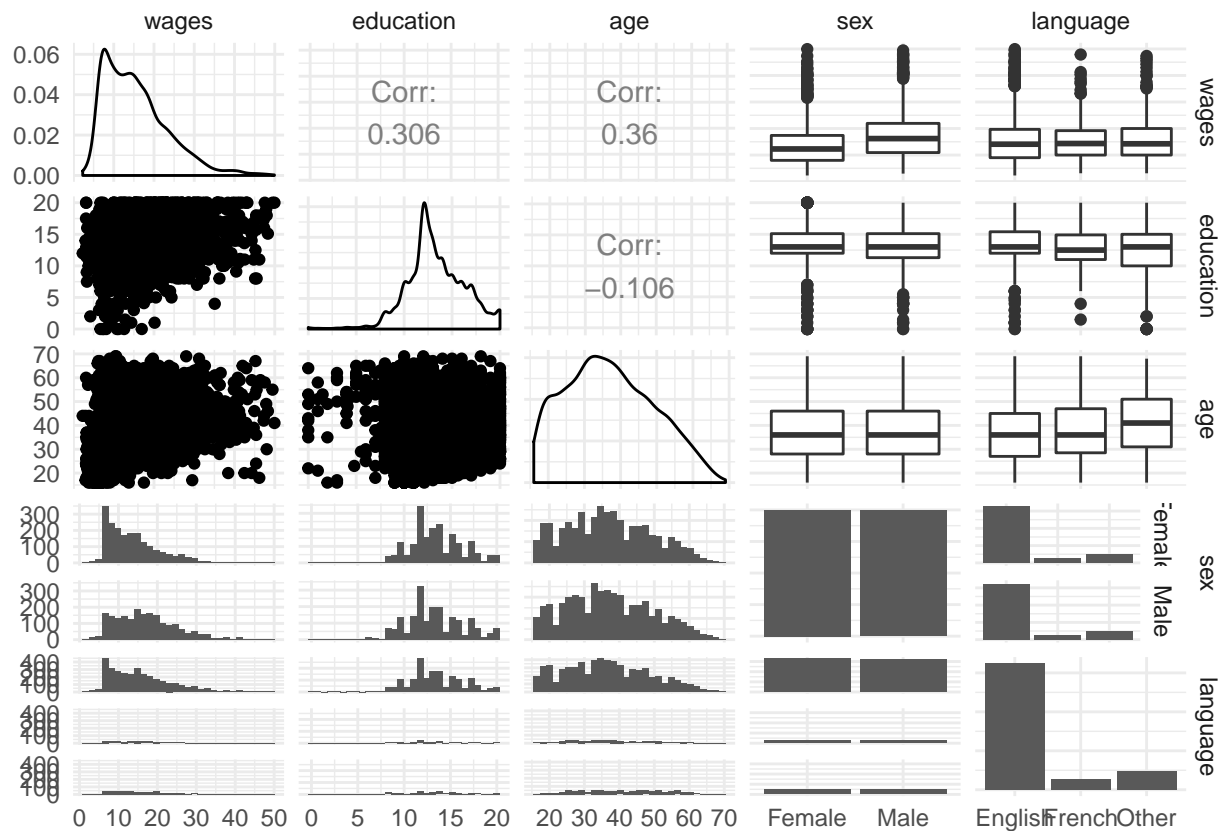
```
ggplot(SLID, aes(language, wages)) + geom_boxplot(fill = "skyblue") + labs(title = "Box Plot") +  
  theme_minimal()
```



Solution: The median wage is similar for people speaking english, french and other languages. The 25 and 75 % percentiles are also similar for the three boxplots. However, there are more outliers among the english speaking people: There are many people with wages that are larger than the upper 95 % percentile.

All pairs and different plots

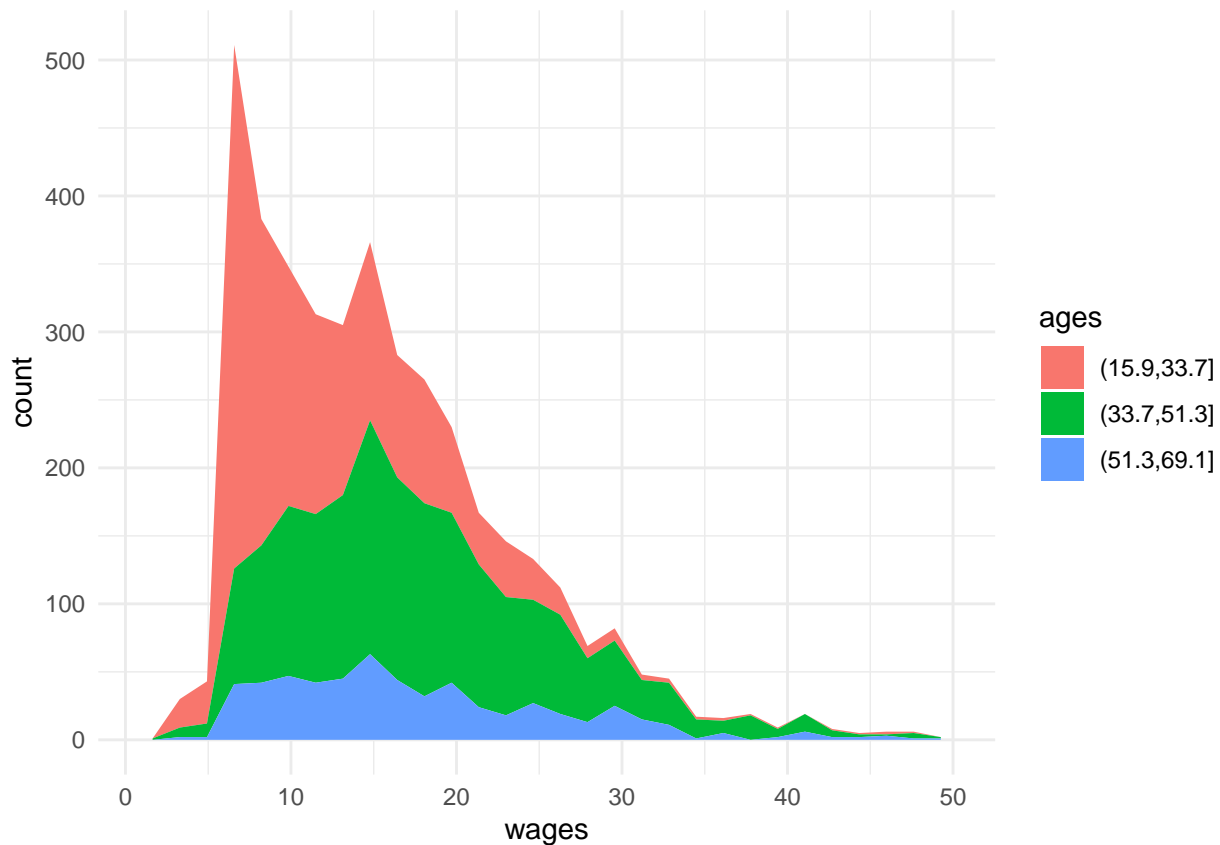
```
library(GGally)
ggpairs(SLID) + theme_minimal()
```



Solution: This plot gives us an overview of the dataset: * Correlation between different variables, e.g. $\text{cor}(\text{age}, \text{wage}) = 0.36$. * Distribution of wages in the dataset (upper left), education (row 1, column 2) and age (row 3, column 3). * Boxplots for different pairs of variables, e.g. boxplots for wage as a function of gender (row 1, column 4). We see that males have a median wage that is larger than for the females in the dataset. * Histograms showing the distribution of the different covariates, i.e. row 4, column 4 shows that there are approximately equally many males and females in the dataset. * Scatterplots indicating correlation between variables, e.g. scatterplot between wages and education in row 2, column 1.

Area chart

```
ages = cut(SLID$age, breaks = 3)
SLID2 = cbind(SLID, ages)
ggplot(SLID2, aes(x = wages, fill = ages)) + geom_area(stat = "bin") + theme_minimal()
```

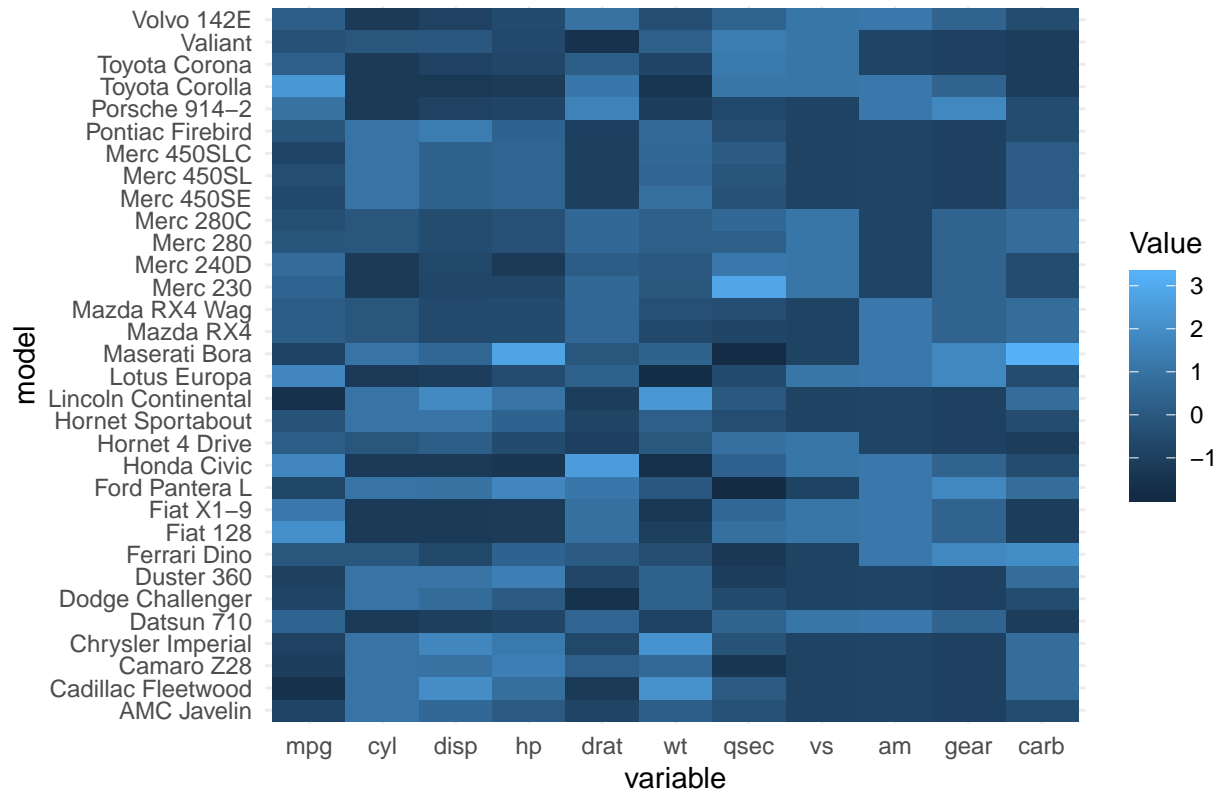


Solution: Compares the distribution of wages for different age groups. Young people (red) tend to have lower wages than older people between 31.7 and 51.3 years (green).

Heat map

```
library(reshape)
head(mtcars)
carsdf = data.frame(scale(mtcars))
carsdf$model = rownames(mtcars)
cars_melt = melt(carsdf, id.vars = "model")
ggplot(cars_melt, aes(x = variable, y = model)) + geom_raster(aes(fill = value)) +
  labs(title = "Heat Map") + scale_fill_continuous(name = "Value") + theme_minimal()
```

Heat Map



##		mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
##	Mazda RX4	21.0	6	160	110	3.90	2.620	16.46	0	1	4	4
##	Mazda RX4 Wag	21.0	6	160	110	3.90	2.875	17.02	0	1	4	4
##	Datsun 710	22.8	4	108	93	3.85	2.320	18.61	1	1	4	1
##	Hornet 4 Drive	21.4	6	258	110	3.08	3.215	19.44	1	0	3	1
##	Hornet Sportabout	18.7	8	360	175	3.15	3.440	17.02	0	0	3	2
##	Valiant	18.1	6	225	105	2.76	3.460	20.22	1	0	3	1

Solution: Visualization of the data. Shows the values of the different covariates (-1 to 3) for the different car models. Note that the covariates were centered and standardized to have a mean of 0 and a standard deviation of 1, thus it is possible to compare them more easily.

Acknowledgements

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