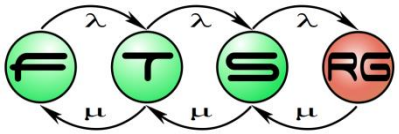
Visual analysis support in R

Visual Analysis of Measurement Data

László Gönczy

2018.10.25.

Budapest University of Technology and Economics
Fault Tolerant Systems Research Group



What is R?

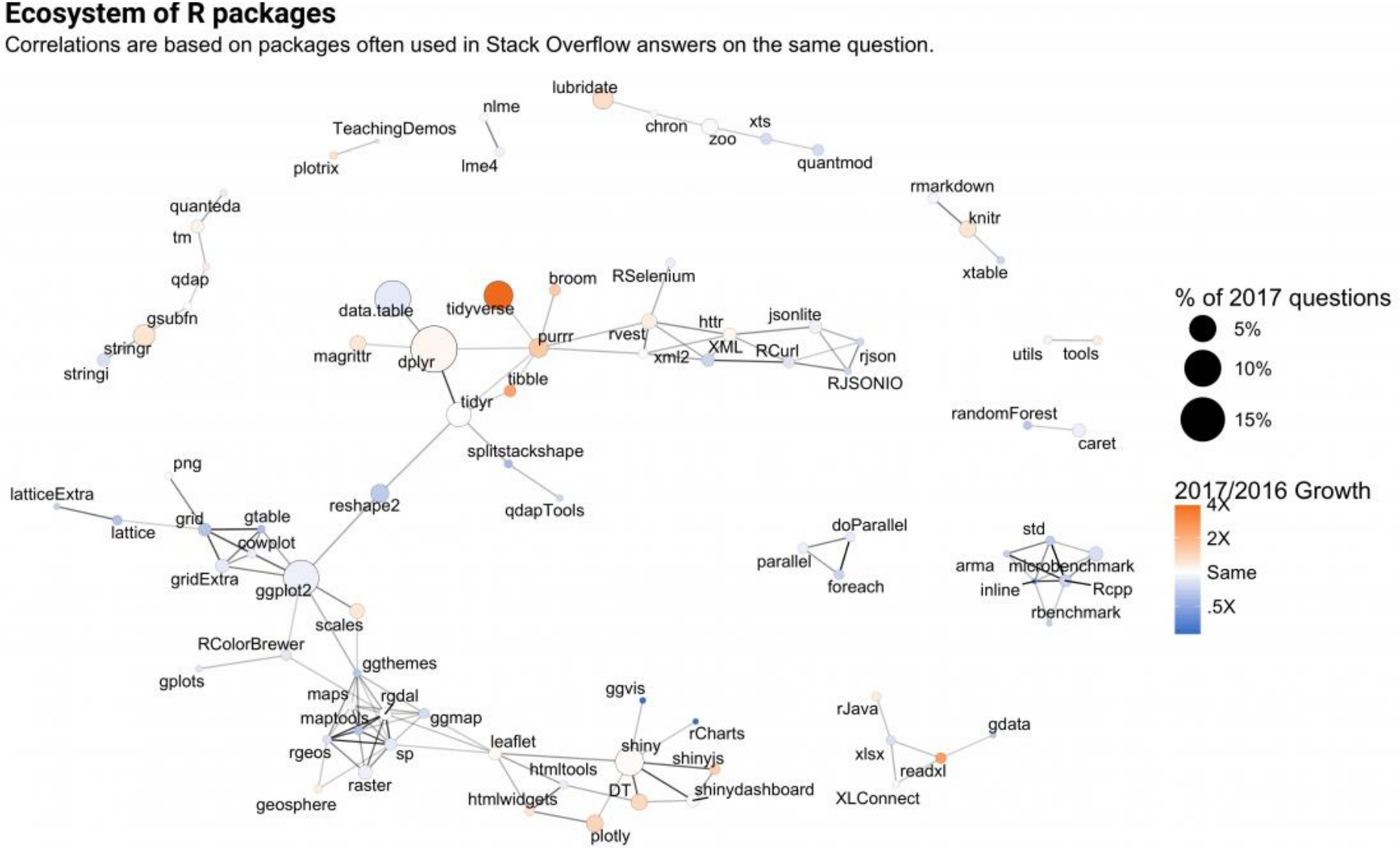
- „Statistical programing language”
  - Supported by R Foundation
  - Extension of S
  - Statistics + OO principles
  - Datavis + advanced analytics (+…)
  - Interpreted language with bytecode compiler (!)

Why R?

- Large number of supporting packages
- Growing community
- CRAN: package repository
  - Maintenance + testing
- R support in many statistical environments
  - (… also R execution on top of SQL)
- Reference: e.g.
  - Graphical Data Analysis with R, Antony Unwin

  http://www.gradaanwr.net/
  - http://uc-r.github.io/gda

R packages



https://stackoverflow.blog/2017/10/10/impressive-growth-r/

Basic plotting

- Basic plot tpyes (histrogram, boxplot, etc.) are supported in „plot”
  - Formatting can be difficult
  - Limited variety of plots
- E.g.
  - R Base Graphics: An Idiot's Guide http://rpubs.com/SusanEJohnston/7953

Lattice

- Static graphs
  - graph_type(formula, data=)
  - Easy handling of numeric / factor variables
- References
  - https://www.statmethods.net/advgraphs/trellis.html
  - Deepanyan Sarkar: Lattice: Multivariate Data Visualization with R

GGPLOT2

- „Grammar of Graphics”
- References
  - Garrett Grolemund Hadley Wickham. R for Data Science https://r4ds.had.co.nz/
  - https://ggplot2.tidyverse.org/reference/
  - Winston Chang. R Graphics Cookbook: Practical Recipes for Visualizing Data (2nd edition in Nov 2018) http://www.cookbook-r.com/Graphs/

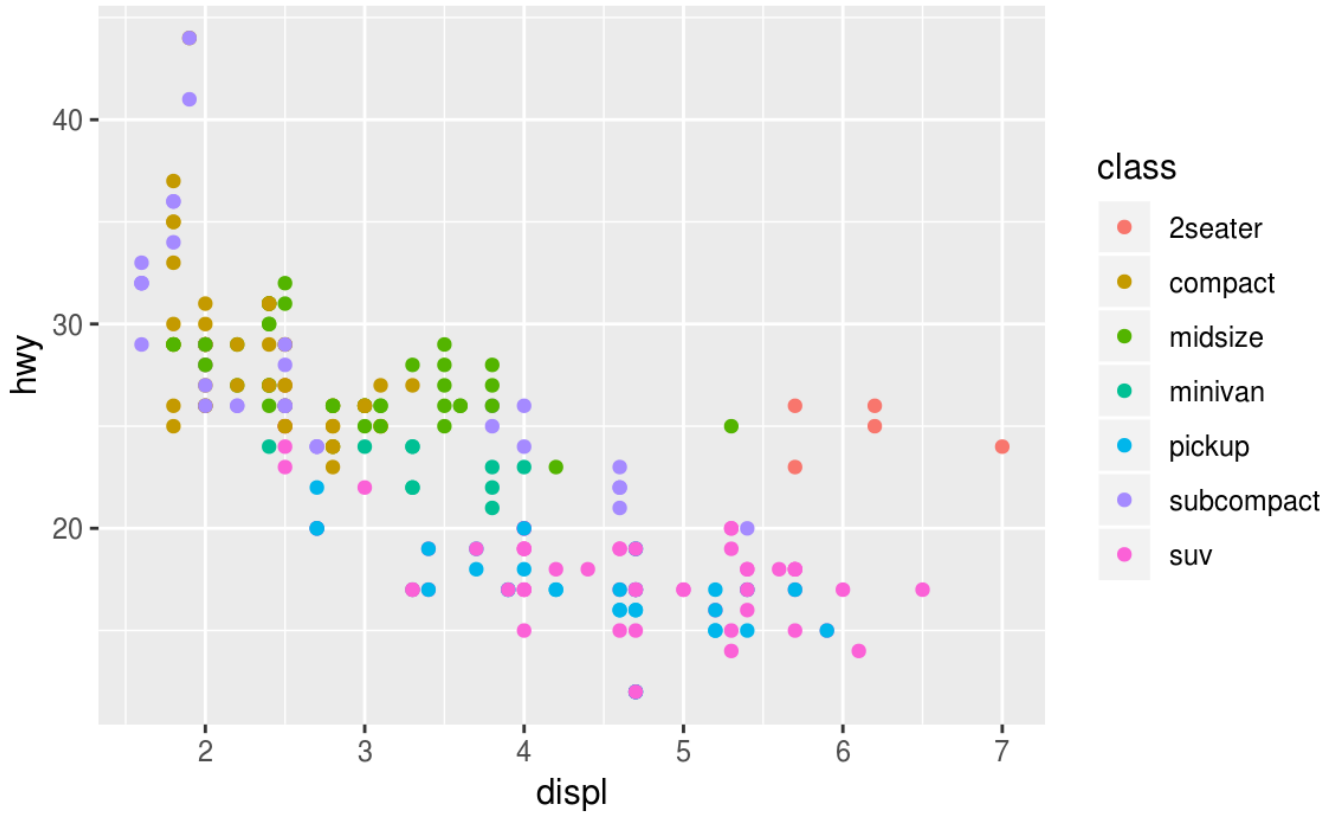
Ggplot2 synthax

- General schema

```
ggplot(data = <DATA>) +
  <GEOM_FUNCTION>(
     mapping = aes(<MAPPINGS>),
     stat = <STAT>,
     position = <POSITION>
  ) +
  <COORDINATE_FUNCTION> +
  <FACET_FUNCTION>
```

ggplot2 basic example

```
ggplot(data = mpg) +
  geom_point(mapping = aes(x = displ, y = hwy, color = class))
```



https://r4ds.had.co.nz/data-visualisation.html#aesthetic-mappings

GGPLOT2 example

1. Begin with the **`diamonds`** data set

2. Compute counts for each cut value with **`stat_count()`**.

carat	cut	color	clarity	depth	table	price	x	y	z
0.23	Ideal	E	SI2	61.5	55	326	3.95	3.98	2.43
0.21	Premium	E	SI1	59.8	61	326	3.89	3.84	2.31
0.23	Good	E	VS1	56.9	65	327	4.05	4.07	2.31
0.29	Premium	I	VS2	62.4	58	334	4.20	4.23	2.63
0.31	Good	J	SI2	63.3	58	335	4.34	4.35	2.75
…	…	…	…	…	…	…	…	…	…

cut	count	prop
Fair	1610	1
Good	4906	1
Very Good	12082	1
Premium	13791	1
Ideal	21551	1

https://r4ds.had.co.nz/data-visualisation.html#the-layered-grammar-of-graphics

Ggplot2 example 2.

3. Represent each observation with a bar.
4. Map the **`fill`** of each bar to the **`..count..`** variable.

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stat_count()

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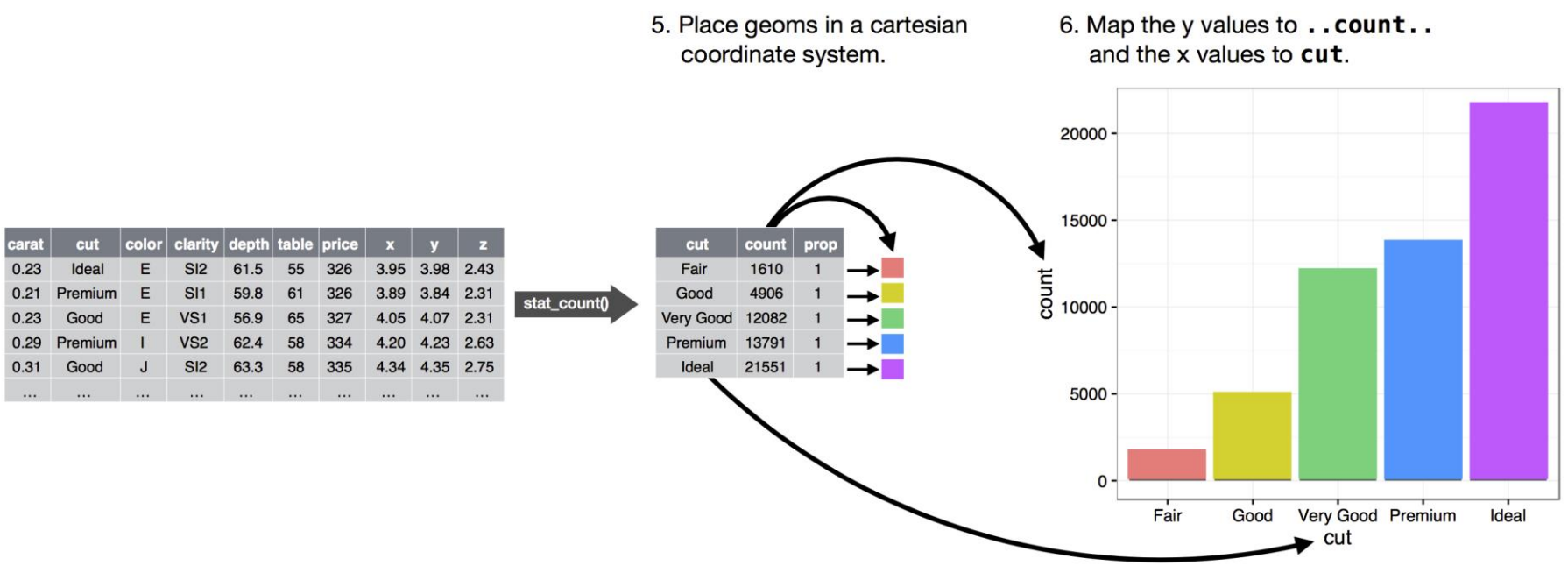
ggplot2 example



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htmlwidgets

- JS → R
- Create widgets which can be embedded into Shiny/RMarkdown
- Linked brushing (color brushing) is supported
- https://www.htmlwidgets.org/

PLOT.LY

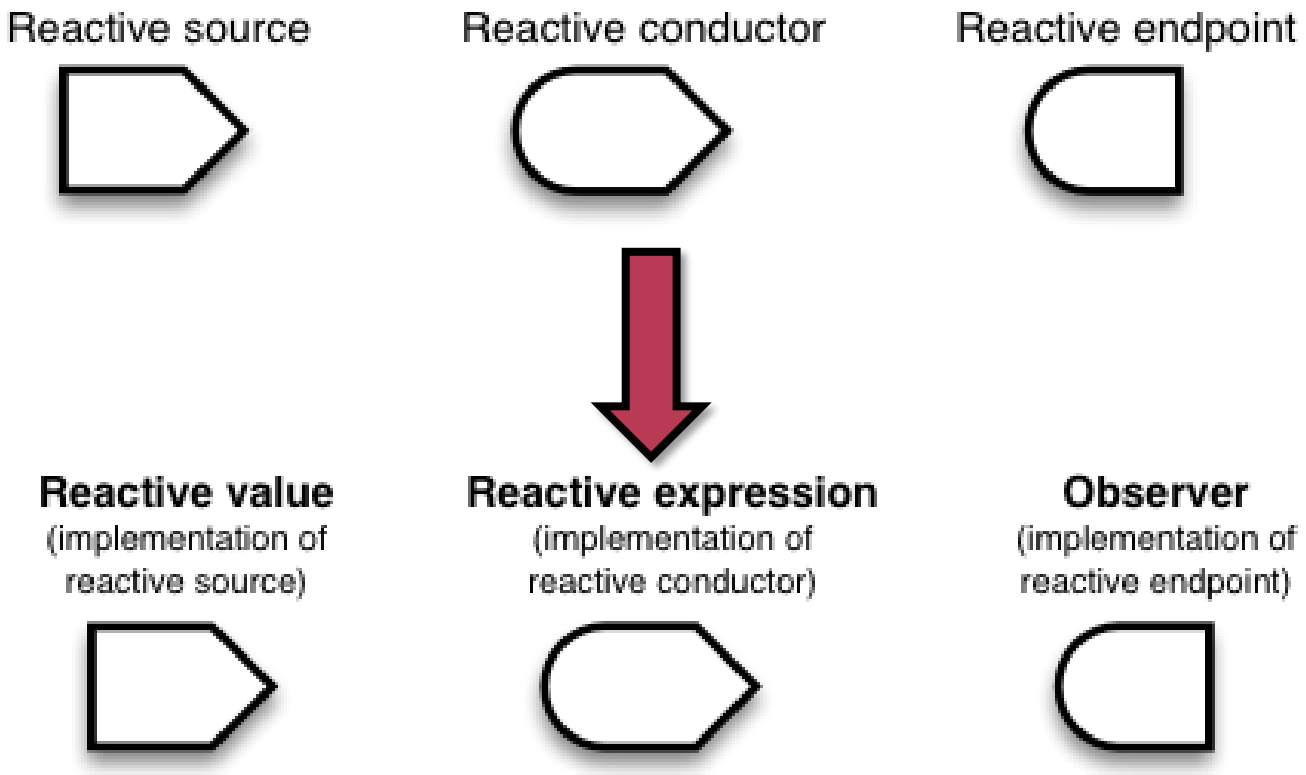
- JS frontend, includes a number of libraries (D3.js)
- Provides an API for statistical languages
  - E.g. Plotly for ggplot2
- See e.g.
  - Visual Data Analysis w/ R
  - https://rstudio-pubs-static.s3.amazonaws.com/187854_82b04e6b9c1a4d5f94424bfd56953870.html
- Dash: python dashboarding

EXAMPLE

Sample data in plotly

Shiny

- How to make R plot accessible on the web?
- „Reactive” programming paradigm



Basic elements

- ui.R: layout, control elements
- Server.R: „Reactive” logic
  - Function(input,output)

SHINY EXAMPLES

https://shiny.rstudio.com/gallery/

shinyapps.io

Shiny vs JavaScript

- JavaScript can be embedded
  - Quick&dirty solution
  - Hard to debug, no IDE support

```
ui <- fluidPage(
  tags$script(HTML(
    "document.body.style.backgroundColor = 'skyblue';"
  ))
)
```

- Add JavaScript as a separate file (/www)
  - Application specific code

Shiny vs. JavaScript

- Use `htmlDependency`
  - Like an R function

```
mypackageDependencies <- function() {
  htmlDependency(name = "mypackage-assets", version = "0.1",
    package = "mypackage",
    src = "assets",
    script = "js/myscript.js",
    stylesheet = c("css/reset.css", "css/mystyles.css")
  )
}
```

  - If an initialization code should be run only once on a single page
  - If JS code will be re-used in mulitple packages

When (not) use Shiny

- Shiny is good for
  - Fast prototyping
  - Easy communication/sharing of data
  - Collaborative work
  - Dashboarding/Dynamic webpages
  - Incorporate advanced stats/ML
- Shiny is weak at
  - Creating standalone reports
  - Data upload/manipulation, ETL
  - General purpose EDA
  - Implementing complex control logic

Shiny support

- Shinyproxy
  - Deployment support
  - Integration of LDAP
  - Docker-based scalability
  - Configuration…
- Hosted: e.g. shinyapps (RStudio)

RMarkdown

- Create static/parametrized content
  - Notebooks
  - Websites
  - Reports
  - Embed shiny
- Reproducible research
- „Short” summary
  - https://bookdown.org/yihui/rmarkdown/

GGVIS

- Interactive ggplot-like plots
- Based on shiny infrastructure
- Performance? Support?
- https://ggvis.rstudio.com/ggvis-basics.html
- https://ggvis.rstudio.com/cookbook.html

Outlook: „drag n drop” ggplot2

- Esquisse
  - https://github.com/dreamRs/esquisse
- Easy to start
  - Simple, static plots
  - Aesthetics is easy to set up
  - Complex calculations/configurations not supported

iPlots

- Interactive visualization (based on Java)
- Most frequent plot types
- Linked selection, color brushing
- „iset”: view on dataframe
- https://cran.r-project.org/web/packages/iplots/index.html
- http://rosuda.org/software/iPlots/

IPLOTS DEMO

https://www.r-exercises.com/2017/07/02/how-to-create-visualizations-with-iplots-package-in-r/