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# Programming for Cognitive Science

Lecture 5 – Documentation for reproducibility and R web applications

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# Plan for today

01

## Data reproducibility

R markdown

02

## R web applications

Shiny



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# Part 1

## Data reproducibility



# Why bother with documentation?

## Reproducibility

Closeness of the agreement between the results of measurements of the same measurand carried out with same methodology described in the corresponding scientific evidence. The reproduced measurement may be based on the raw data and computer programs provided by researchers.

<https://en.wikipedia.org/wiki/Reproducibility>

# Session information

```
> sessionInfo()
```

```
R version 4.1.0 (2021-05-18)
```

```
Platform: x86_64-w64-mingw32/x64 (64-bit)
```

```
Running under: Windows 10 x64 (build 19043)
```

```
Matrix products: default
```

```
locale:
```

```
[1] LC_COLLATE=Polish_Poland.1250 LC_CTYPE=Polish_Poland.1250 LC_MONETARY=Polish_Poland.1250 LC_NUMERIC=C
```

```
[5] LC_TIME=Polish_Poland.1250
```

```
attached base packages:
```

```
[1] stats      graphics  grDevices  utils      datasets  methods   base
```

```
other attached packages:
```

```
[1] seqinr_4.2-16
```

```
loaded via a namespace (and not attached):
```

```
[1] MASS_7.3-54      compiler_4.1.0  tools_4.1.0     ade4_1.7-19
```



# knitr

R engine for dynamic report generation.  
The purpose of `knitr` is to allow reproducible research in R through the means of Literate Programming.



# knitr – R Markdown code chunks

```
```{r}  
print("Hello world!")  
```
```



# knitr - options

`eval=`

should the code be evaluated

`echo=`

should the code be shown

`fig.height=, fig.width=`

figure parameters

`results=`

result presentation mode

`warning=, message=`

should warnings/messages be suppressed



# knitr – report formats

The reports may be generated in one of the following formats:

- PDF
- MD
- DOC
- HTML
- PPTX
- ...

# knitr - examples

## Hello Material

Introduction

Including Plots

### Introduction

### R Markdown

This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see <http://rmarkdown.rstudio.com>.

When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

```
summary(cars)
```

| ##          | speed | dist           |
|-------------|-------|----------------|
| ## Min.     | : 4.0 | Min. : 2.00    |
| ## 1st Qu.: | 12.0  | 1st Qu.: 26.00 |
| ## Median : | 15.0  | Median : 36.00 |
| ## Mean :   | 15.4  | Mean : 42.98   |
| ## 3rd Qu.: | 19.0  | 3rd Qu.: 56.00 |
| ## Max. :   | 25.0  | Max. : 120.00  |

readthdown template example

Code and tables

Styling

Figures

### Code and tables

### Syntax highlighting

Here is a sample code chunk, just to show that syntax highlighting works as expected.

```
Hello, world!
```

### Verbatim

Here is the structure of the `penguins` dataset.

```
library(tibble)
tibble [344 x 8] (SS: tbl_df/tbl/data.frame)
 $ species: factor w/ 3 levels: "Adelie", "Chinstrap", ...: 1 1 1 1 1 1 1 1 1 ...
 $ island : factor w/ 3 levels: "Biscoe", "Dream", ...: 3 3 3 3 3 3 3 3 3 ...
 $ bill_length_mm: num [1:344] 39.1 39.5 40.3 NA 36.7 39.3 38.9 39.2 34.1 42 ...
 $ bill_depth_mm: num [1:344] 18.7 17.4 18 NA 19.3 20.6 17.8 19.6 18.1 20.2 ...
 $ flipper_length_mm: int [1:344] 181 186 193 NA 193 190 181 193 193 190 ...
 $ body_mass_g: int [1:344] 3750 3800 3250 NA 3450 3650 3625 4675 3475 4250 ...
 $ sex: factor w/ 2 levels: "female", "male": 2 1 1 NA 1 2 1 2 NA NA ...
 $ year: int [1:344] 2007 2007 2007 2007 2007 2007 2007 2007 2007 2007 ...
```

### Table

Sample table output.

Barnier, Julien. 2021. *Rmdformats: HTML Output Formats and Templates for Rmarkdown Documents*. <https://github.com/juba/rmdformats>.



— Let's move on to coding...



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# Part 2

## R web applications





# In the old days...

## Sharing R scripts

- + Open to modifications
- Only advanced users (programmers) had the ability to manage



## R Markdown report

- + Control over the analysis content and pipeline
- No possibility for others to interact with the results



— These days...



<https://shiny.rstudio.com/tutorial/>



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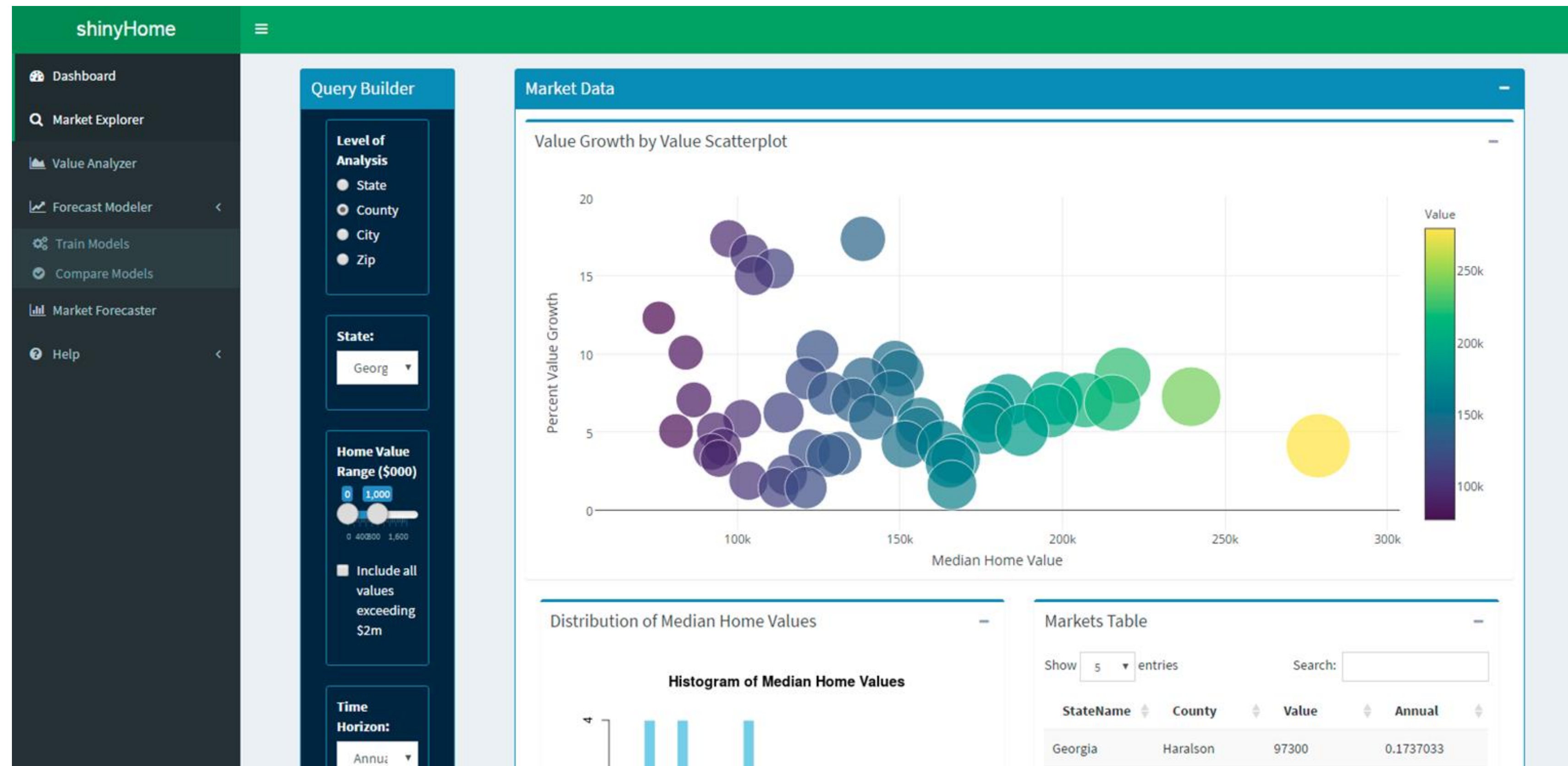
# Shiny

R package made for facilitating building interactive web apps from R.  
The possibilities include:

- Hosting standalone apps
- Embedding in R Markdown
- Building dashboards
- Extensions with CSS themes, htmlwidgets and JavaScript



# Examples



<https://jjames.shinyapps.io/shinyHome/>





# Examples

Fantasy League

Optimize Squad

Past Performance

Top Fantasy Team Stats

Fixture Difficulty Rating

Player's History


Fantasy Teams Stats

Current Club

Crystal Palace

Player

Connor Wickham



Top Fantasy Teams

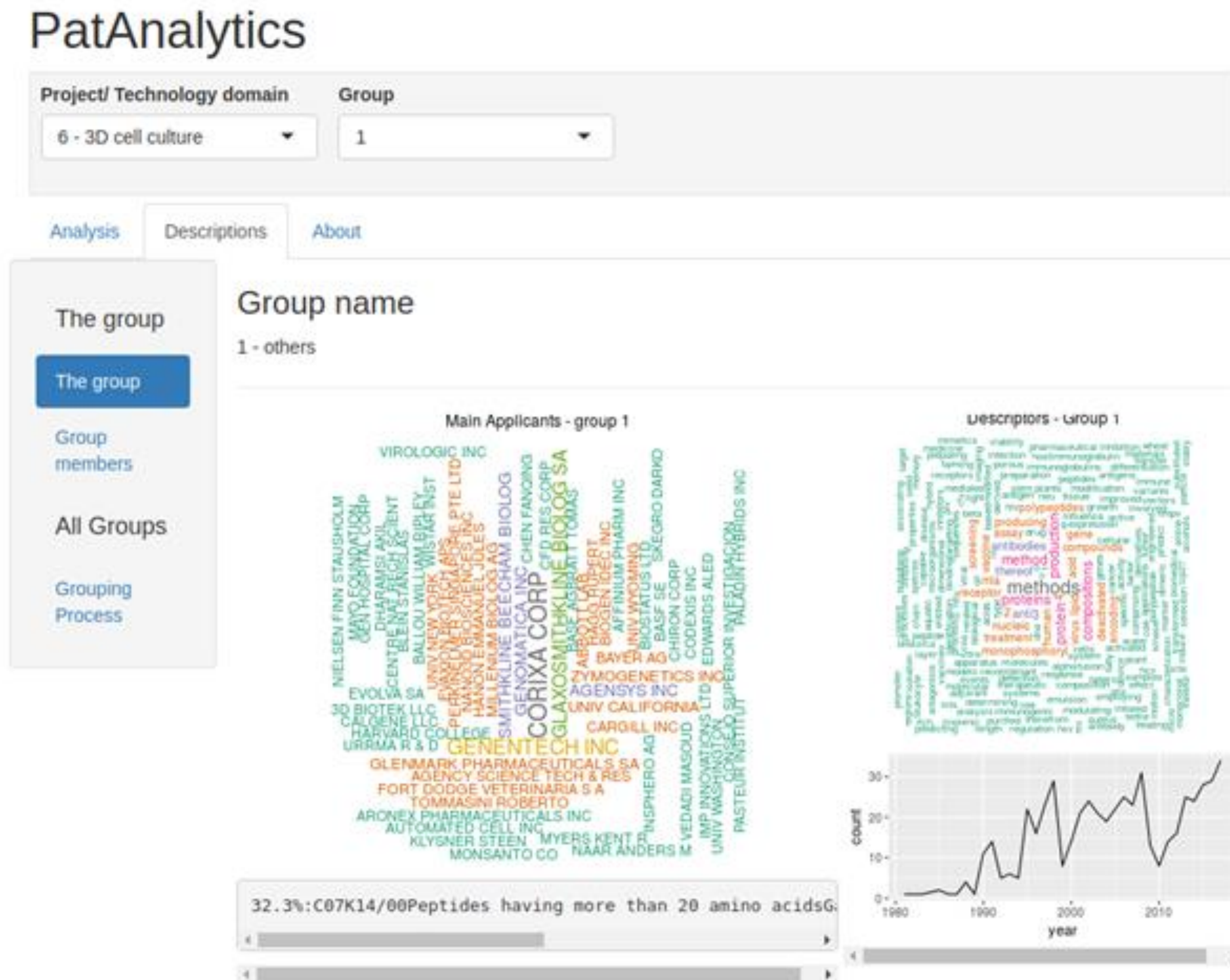
| season | season_name | start_cost | end_cost | total_pts | minutes | goals_scored | assists | clean |
|--------|-------------|------------|----------|-----------|---------|--------------|---------|-------|
| 11     | 2016/17     | 6          | 5.5      | 18        | 412     | 2            | 0       |       |
| 10     | 2015/16     | 6          | 5.4      | 70        | 1321    | 5            | 3       |       |
| 9      | 2014/15     | 6          | 5.6      | 85        | 2768    | 5            | 1       |       |
| 8      | 2013/14     | 5          | 4.9      | 58        | 847     | 5            | 2       |       |
| 7      | 2012/13     | 5.5        | 5        | 15        | 443     | 0            | 0       |       |
| 6      | 2011/12     | 6          | 5.6      | 24        | 532     | 1            | 0       |       |

Showing 1 to 6 of 6 entries

<https://karthiaru.com/shiny/epl-fantasy/>



# Examples



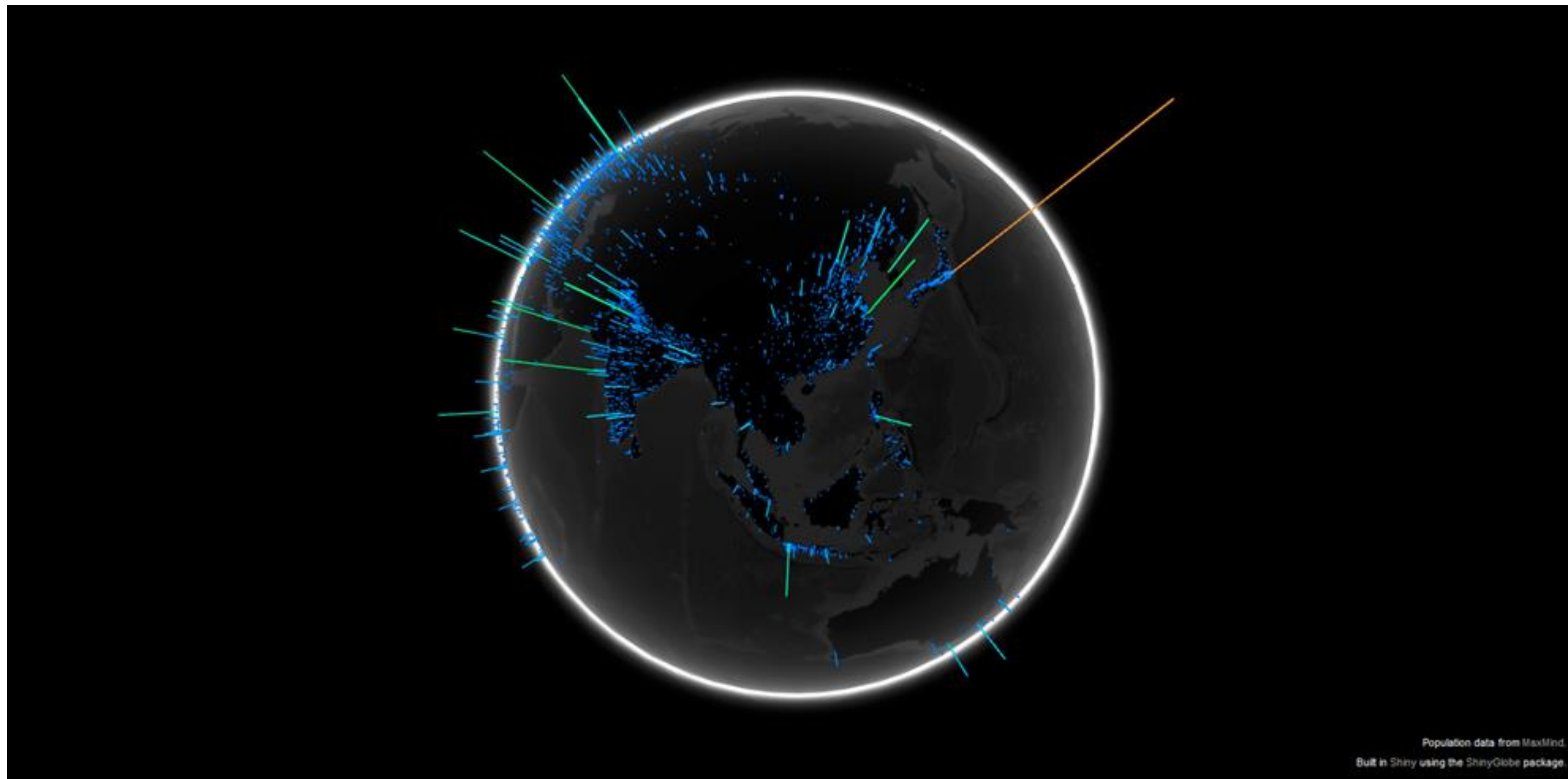
[https://hamagust.shinyapps.io/patAnalyticsM5\\_V/](https://hamagust.shinyapps.io/patAnalyticsM5_V/)



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# Examples



<http://spark.rstudio.com/trestletech/globePopulation>

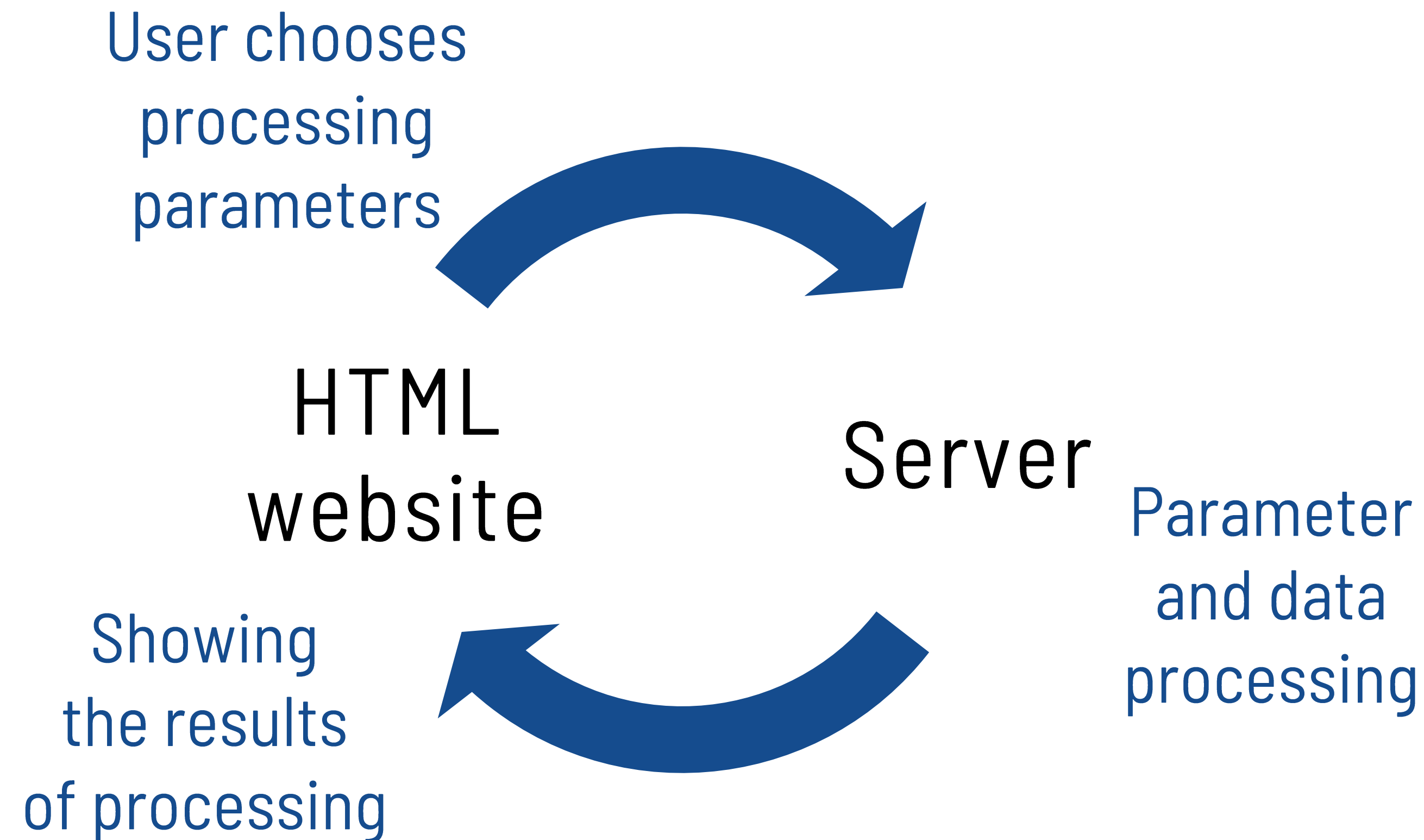


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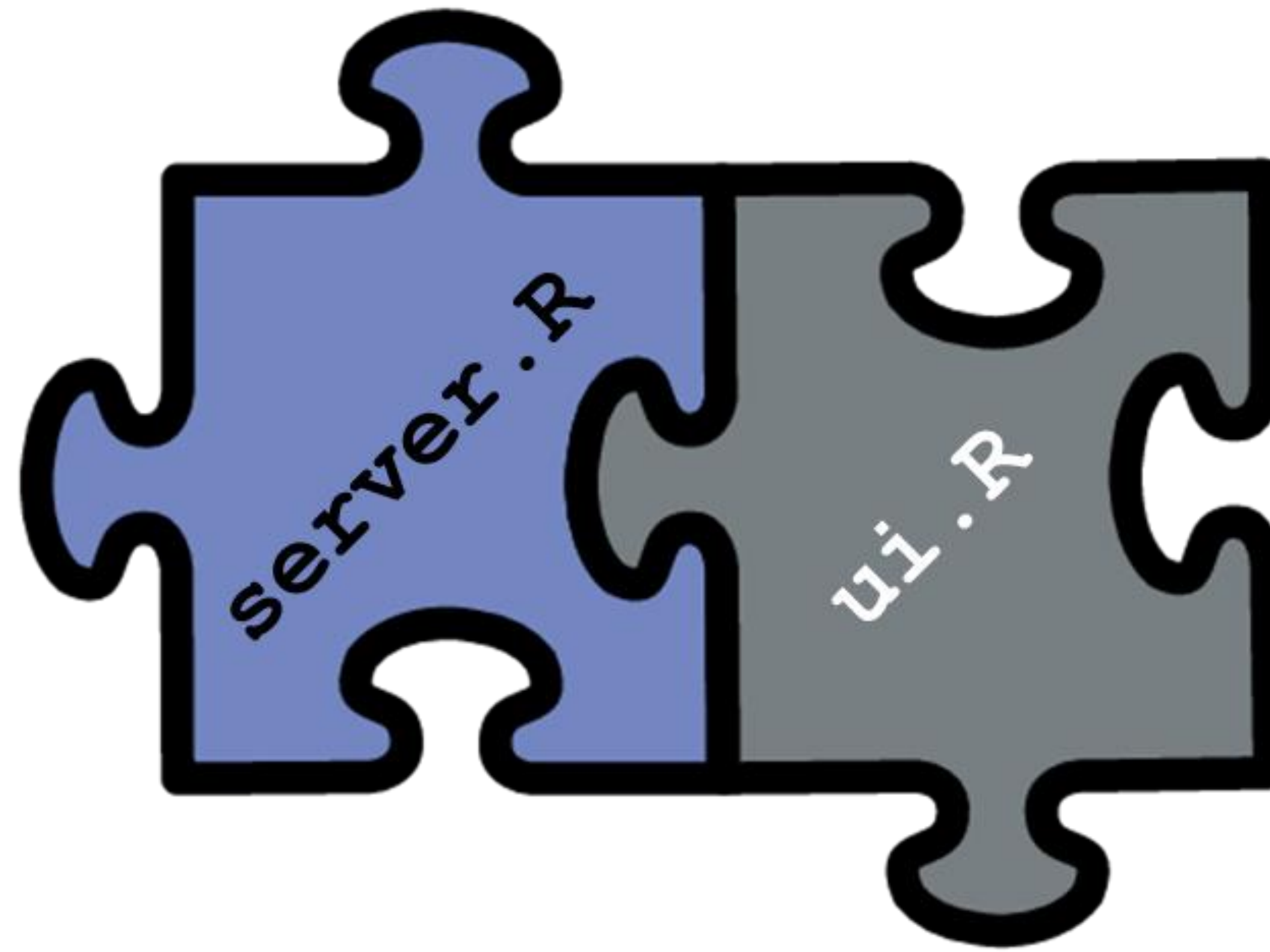
# Shiny applications



# Two pieces of a Shiny application

Two R files:

- Way of data processing description



- User interface description
- Layout of graphical elements



— Let's move on to coding...





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I APPRECIATE YOUR ATTENTION

