R Shiny

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2021-10-14

Contents

1 Introduction

1.1 Summary

1. Introduction
2. Starting with Rstudio
3. Interactivity and communication
4. Inputs & outputs

5. Organizing the page
6. Interactive charts
7. HTML / CSS
8. More

1.2 Shiny: defining web applications with R

Shiny is a **R** package that makes it easy to build interactive web applications with **R**

- does not require web expertise
- combine datascience power of **R** with web interactivity
- create local applications
- or deploy applications for other users: **shiny-server**, **shinyapps.io**, **shinyproxy**

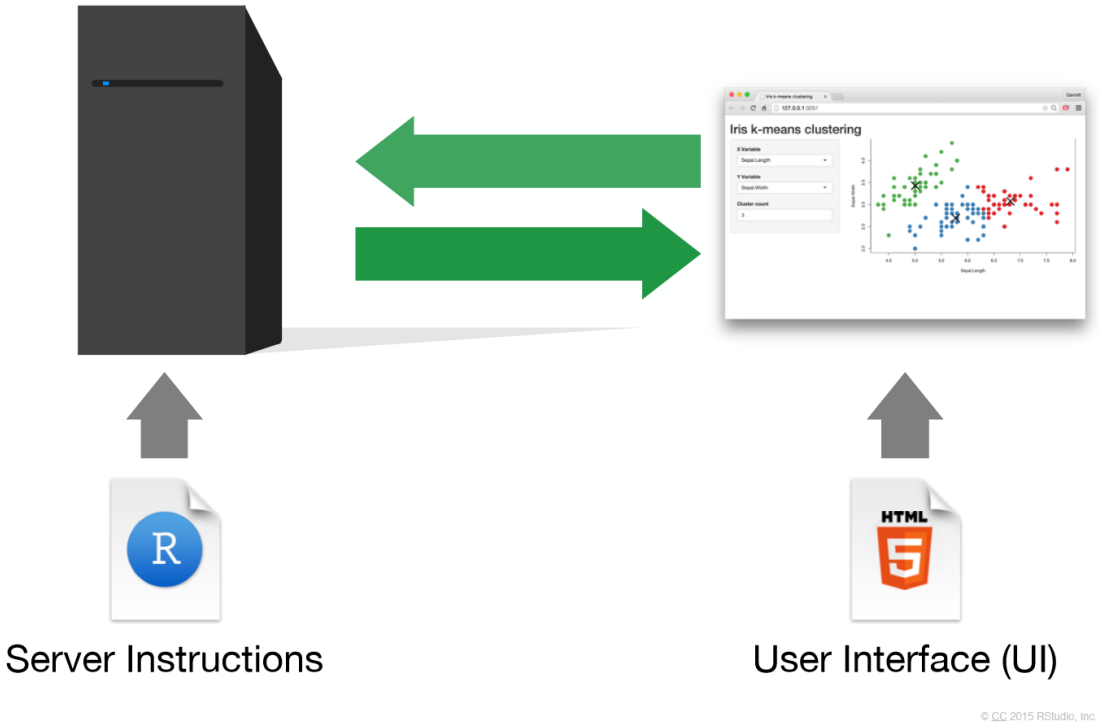
http://shiny.rstudio.com

http://www.shinyapps.io/

https://www.shinyproxy.io/

https://www.rstudio.com/products/shiny/shiny-server/.

A shiny web applications requires a computer/server with **R**

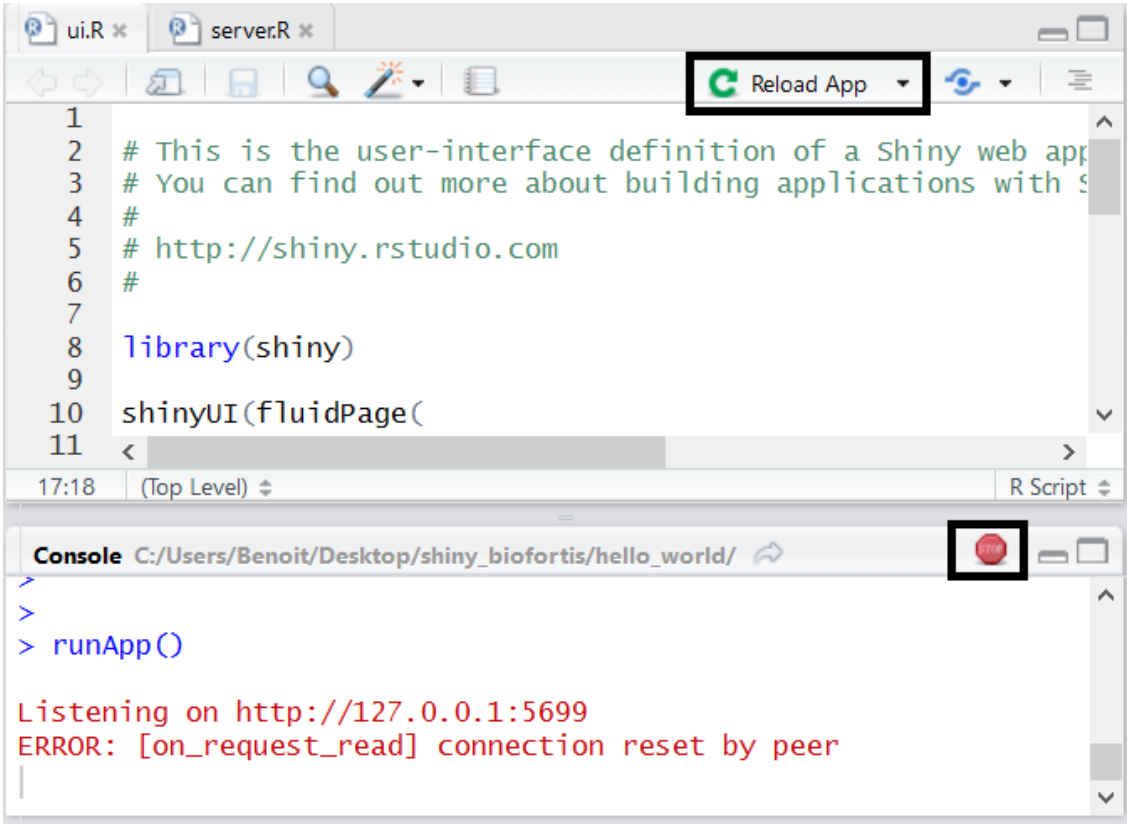


1.3 My first application

- Starting an application is easy with **RStudio**, just start a **new project**
  - File -> New Project -> New Directory -> Shiny Web Application
  - Or File -> New File -> Shiny Web App -> Multiple File
  - Based on two scripts: **ui.R** and **server.R**
- Useful commands:
  - run the application: button **Run app**

– update: button **Reload app**
– stop: button **Stop**

- **Run in Window**: new window, using **RStudio** environment
- **Run in Viewer Pane**: tab *Viewer* of **RStudio**
- **Run External**: in the default web browser

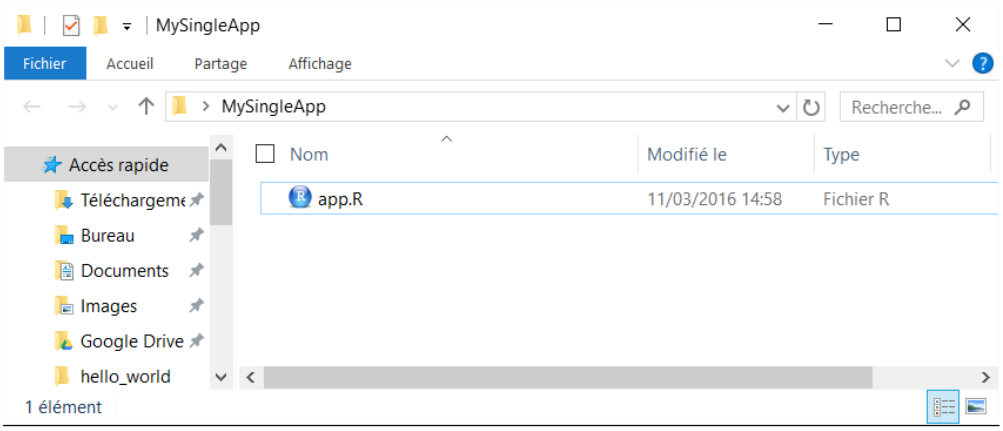


2 Starting with Rstudio

2.1 One folder with one file

Conventions:

- save as **app.R**
- end with shinyApp() command
- for **small applications**



2.2 One folder with one file

```
library(shiny)
ui <- fluidPage(
  sliderInput(inputId = "num", label = "Choose a number",
              value = 25, min = 1, max = 100),
  plotOutput("hist")
)
server <- function(input, output) {
  output$hist <- renderPlot({
    hist(rnorm(input$num))
  })
}
shinyApp(ui = ui, server = server)
```

2.3 One folder with two files

Conventions:

- user interface (layout and appearance) in **ui.R**
- **R** instructions needed to build the app in **server.R**
- best structure for **complex applications**

2.4 One folder with two files

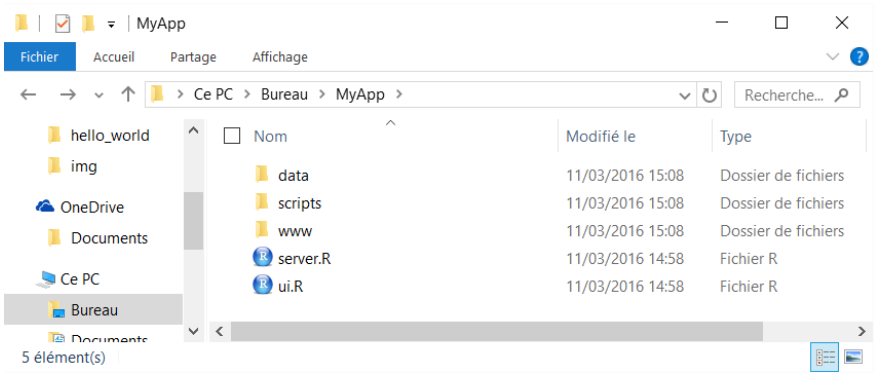
ui.R

```
library(shiny)
fluidPage(
  sliderInput(inputId = "num", label = "Choose a number",
              value = 25, min = 1, max = 100),
  plotOutput("hist")
)
```

server.R

```
library(shiny)
function(input, output) {
  output$hist <- renderPlot({hist(rnorm(input$num))})
}
```

2.5 Data/additional files

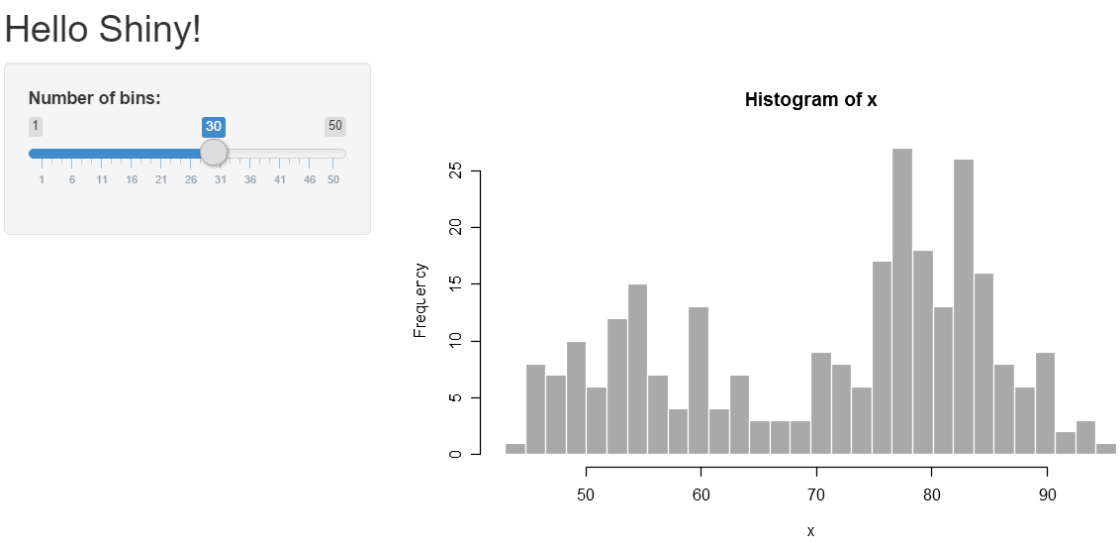


3 Interactivity and communication

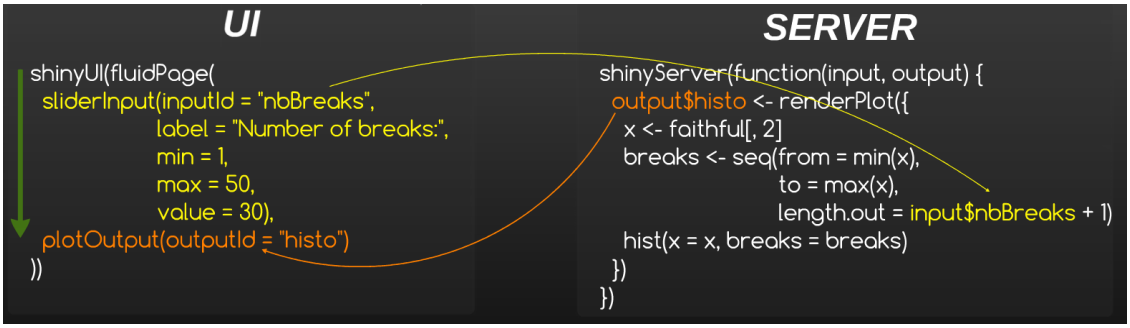
3.1 Introduction | Example

```
shinyApp(
  ui = fluidPage(
    titlePanel("Hello Shiny!"),
    sidebarLayout(
      sidebarPanel(
        sliderInput("bins",
                    "Number of bins:",
                    min = 1,
                    max = 50,
                    value = 30)
      ),
      mainPanel(
        plotOutput("distPlot")
      )
    )
  ),

  server = function(input, output) {

    # Expression that generates a histogram. The expression is
    # wrapped in a call to renderPlot to indicate that:
    #
    #  1) It is "reactive" and therefore should be automatically
    #     re-executed when inputs change
    #  2) Its output type is a plot

    output$distPlot <- renderPlot({
      x    <- faithful[, 2]  # Old Faithful Geyser data
      bins <- seq(min(x), max(x), length.out = input$bins + 1)
```

```
    # draw the histogram with the specified number of bins
    hist(x, breaks = bins, col = 'darkgray', border = 'white')
  })
})
```



3.2 Introduction | process



- **ui**: organize inputs and outputs
- **server**: compute the outputs (from the inputs)
- **Server and ui communicate through inputs and outputs**
- **By default an output is updated as soon as an input changes**

3.3 Notice

Definition of the user interface: UI

- definition of the inputs
- architecture of the page, with location of the outputs

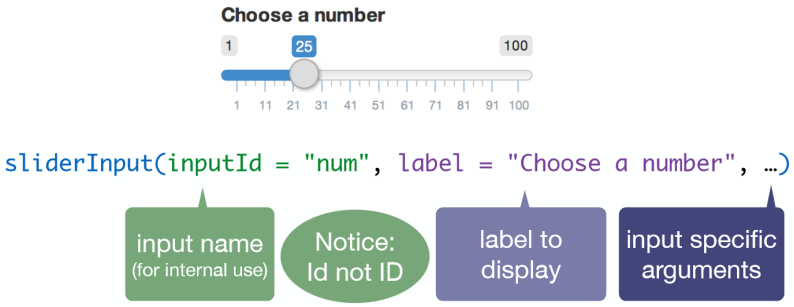
server/computing part: SERVER

- definition and computation of the outputs

3.4 UI part (input definition)

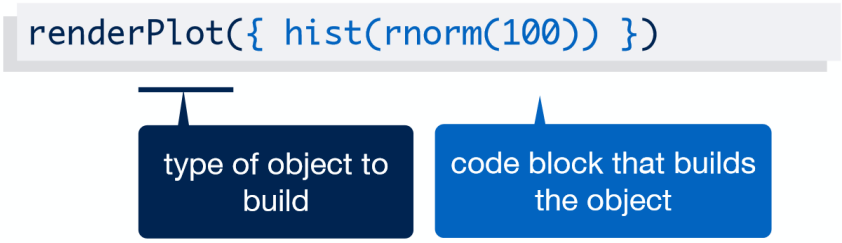
Two kinds of items in UI

- xxInput(inputId = . . . , . . .):
  - for an element which requires an action of the user
  - available in the server through its ID **input$inputID**



3.5 Server part (output construction)

- renderXX({expr}):
  - compute and return an output (which can depend on inputs) with classical **R** commands

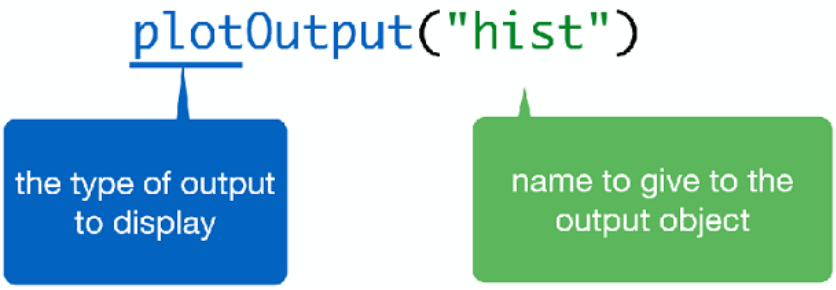


- Example:

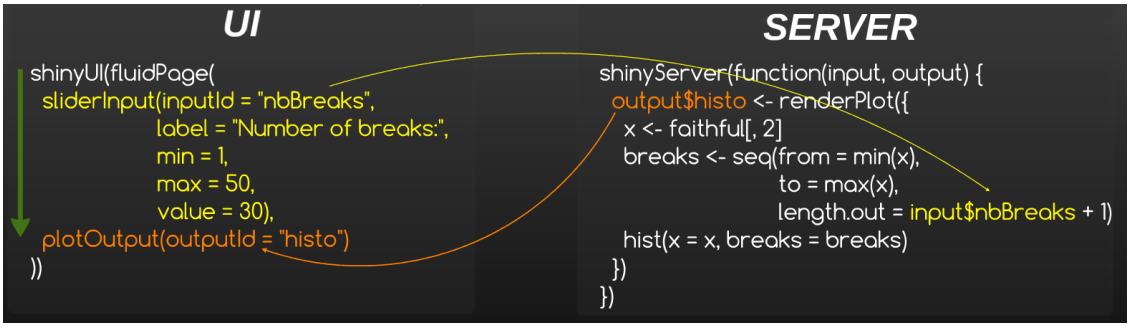
```
output$hist <- renderPlot({
  #commands to build the histogram
})
```

3.6 UI part (output visualization)

- xxOutput(ouputId = . . .):
  - refer to an output created in the server
  - often for graphs and/or tables



3.7 Back on the process



Is it clearer?

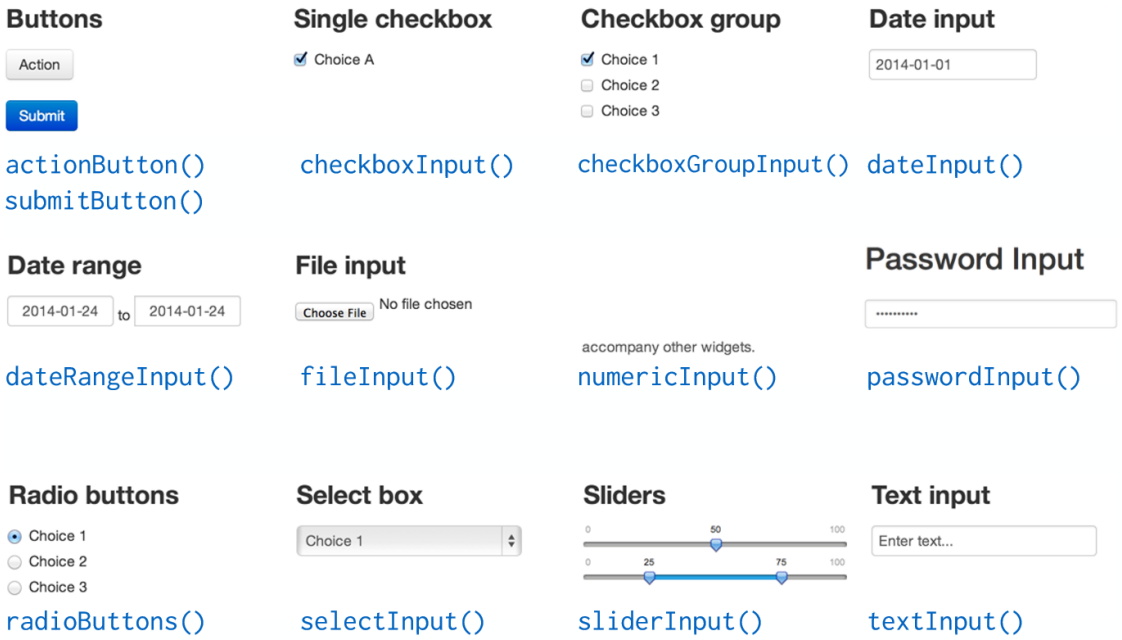
3.8 Sharing ui <-> server

Server and ui only communicates through inputs and outputs

- We can add an other file **global.R** if we want to share elements (datasets, functions...) between **UI** and **SERVER**
- All the elements in **global.R** are available for **ui.R** and **server.R**
- The script **global.R** is running just one time, at the beginning of the process.

4 Inputs

4.1 Global view



4.2 Numeric

- Function:

```
numericInput(inputId, label, value, min = NA, max = NA, step = NA)
```

- Example:

```
numericInput(inputId = "id_num", label = "Please select a number",
         value = 0, min = 0, max = 100, step = 10)
```

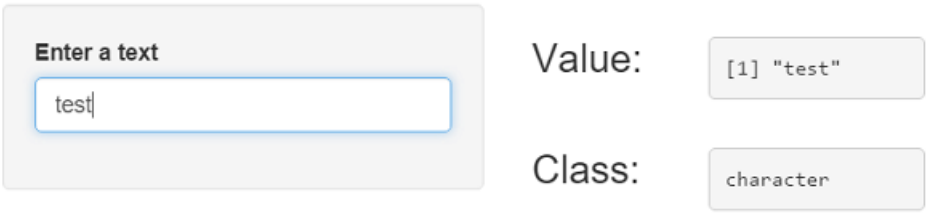
4.3 Characters

- Function:

```
textInput(inputId, label, value = "")
```

- Example:

```
textInput(inputId = "id_txt", label = "Enter a text", value = "")
```



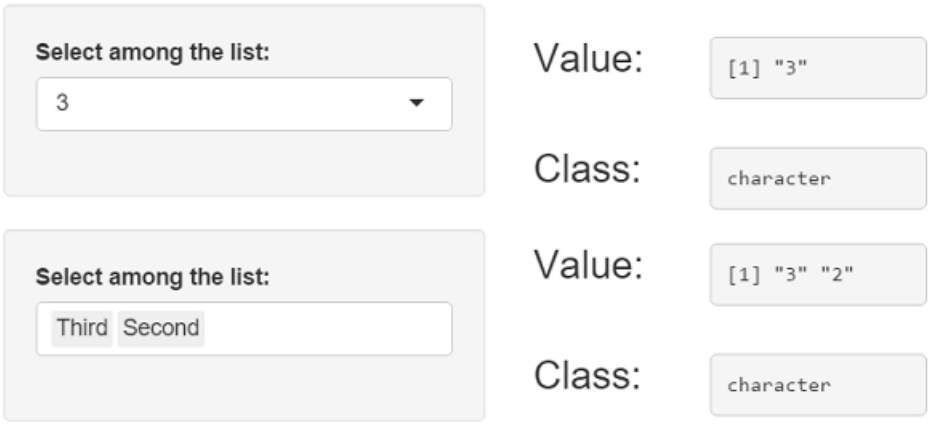
4.4 Unique choice in a list

- Function:

```
selectizeInput(inputId, label, choices, selected = NULL, multiple = FALSE,
        selectize = TRUE, width = NULL, size = NULL)
```

- Example:

```
selectizeInput(inputId = "id_sel1", label = "Select among the list: ", selected = 3,
           choices = c(1:3))
```



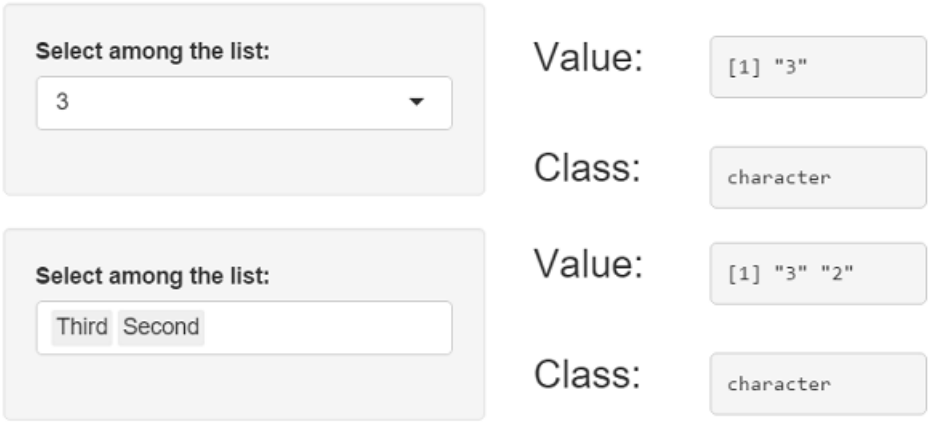
4.5 Multiple choices in a list

- Function:

```
selectInput(inputId, label, choices, selected = NULL, multiple = FALSE,
        selectize = TRUE, width = NULL, size = NULL)
```

- Example:

```
selectInput(inputId = "id_sel2", label = "Select among the list: ", selected = 3,
        choices = c("First" = 1, "Second" = 2, "Third" = 3), multiple = TRUE)
```



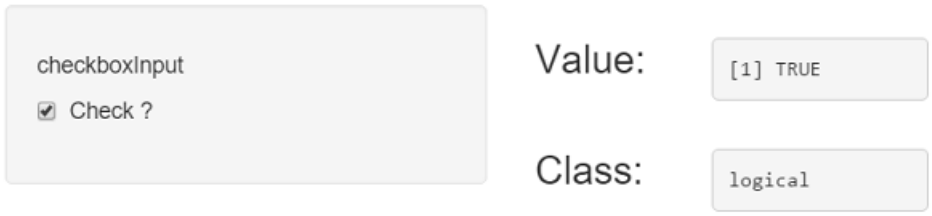
4.6 Simple Checkbox

- Function:

```
checkboxInput(inputId, label, value = FALSE)
```

- Example:

```
checkboxInput(inputId = "id_check_1", label = "Check?")
```



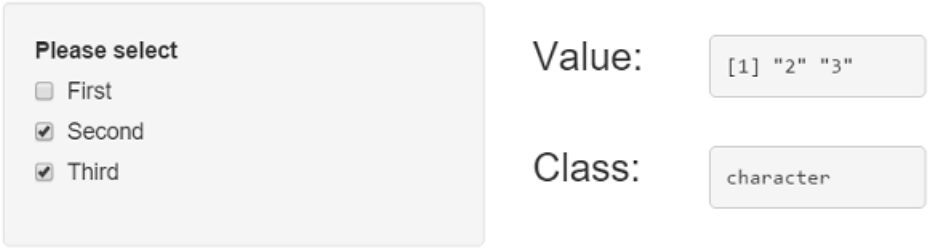
4.7 Multiple checkboxes

- Function:

```
checkboxGroupInput(inputId, label, choices, selected = NULL, inline = FALSE)
```

- Example:

```
checkboxGroupInput(inputId = "id_check_2", label = "Please select", selected = 3,
                   choices = c("First" = 1, "Second" = 2, "Third" = 3))
```



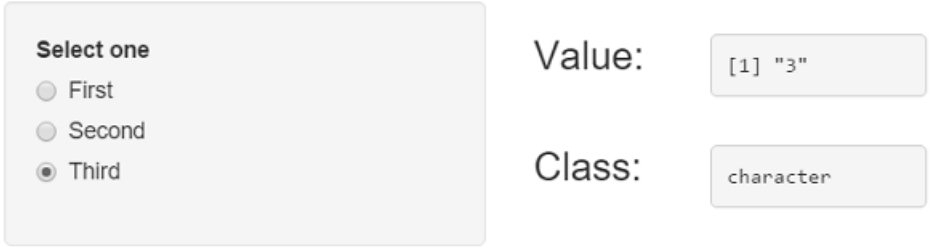
4.8 Radio buttons

- Function:

```
radioButtons(inputId, label, choices, selected = NULL, inline = FALSE)
```

- Example:

```
radioButtons(inputId = "id_radio", label = "Select one",
             choices = c("First" = 1, "Second" = 2, "Third" = 3),
             selected = 3)
```



4.9 Date | *Code*

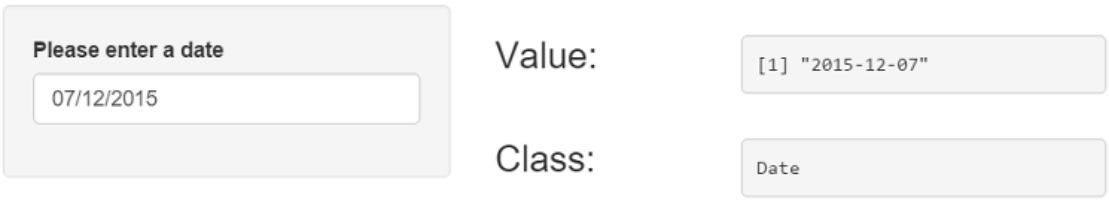
- Function:

```
dateInput(inputId, label, value = NULL, min = NULL, max = NULL, format = "yyyy-mm-dd",
          startview = "month", weekstart = 0, language = "en")
```

- Example:

```
dateInput(inputId = "id_date", label = "Please enter a date", value = "09/10/2020",
      format = "dd/mm/yyyy", startview = "month", weekstart = 0, language = "fr")
```

4.10 Date | *App*



4.11 Period | *Code*

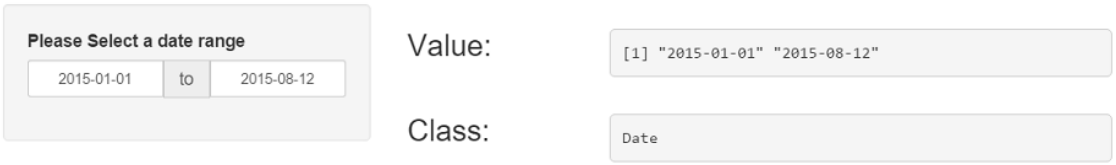
- Function:

```
dateRangeInput(inputId, label, start = NULL, end = NULL, min = NULL, max = NULL,
           format = "yyyy-mm-dd", startview = "month", weekstart = 0,
           language = "en", separator = " to ")
```

- Example:

```
dateRangeInput(inputId = "id_daterange", label = "Please Select a date range",
           start = "2020-10-04", end = "2020-10-18", format = "yyyy-mm-dd",
           language = "en", separator = " to ")
```

4.12 Period | *App*



4.13 Numeric slider numérique: one value

- Function:

```
sliderInput(inputId, label, min, max, value, step = NULL, round = FALSE,
        format = NULL, locale = NULL, ticks = TRUE, animate = FALSE,
        width = NULL, sep = ",", pre = NULL, post = NULL)
```

- Example:

```
sliderInput(inputId = "id_slider", label = "Select a number", min = 0, max = 10,
        value = 5, step = 1)
```

4.14 Numeric slider: range

- Function:

```
sliderInput(inputId, label, min, max, value, step = NULL, round = FALSE,
        format = NULL, locale = NULL, ticks = TRUE, animate = FALSE,
        width = NULL, sep = ",", pre = NULL, post = NULL)
```

- Example:

```
sliderInput(inputId = "id_slider2", label = "Select a number", min = 0, max = 10,
        value = c(2,7), step = 1)
```

4.15 Importing a file

- Function:

```
fileInput(inputId, label, multiple = FALSE, accept = NULL)
```

- Example:

```
fileInput(inputId = "id_file", label = "Select a file")
```

Value:

	name	size	type	datapath
1	tab2.csv	40	application/vnd.ms-excel	C:\Users\Benoit\AppD

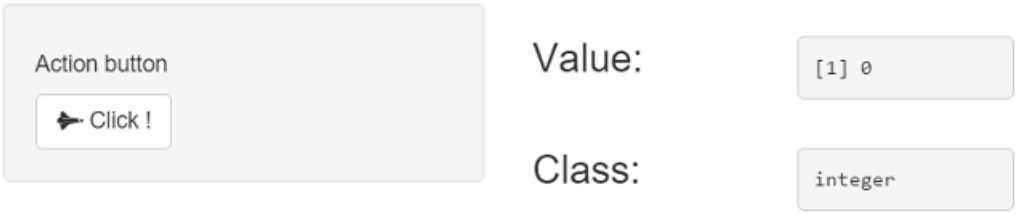
4.16 Action button

- Function:

```
actionButton(inputId, label, icon = NULL, ...)
```

- Example:

```
actionButton(inputId = "id_action", label = "Click !",
         icon = icon("hand-spock-o"))
```



4.17 Taking things further: building an input

Require skills in HTML/CSS/JavaScript

Tutorial: http://shiny.rstudio.com/articles/building-inputs.html

Two examples:

- http://shiny.rstudio.com/gallery/custom-input-control.html
- http://shiny.rstudio.com/gallery/custom-input-bindings.html

5 Outputs

5.1 Global view

server fonction	ui fonction	type de sortie
renderDataTable()	dataTableOutput()	une table intéractive
renderImage()	imageOutput()	une image sauvegardée
renderPlot()	plotOutput	un graphique R
renderPrint()	verbatimTextOutput()	affichage type console R
renderTable()	tableOutput()	une table statique
renderText()	textOutput()	une chaîne de caractère
renderUI()	uiOutput()	un élément de type UI

5.2 Rules to define outputs

- assign the output in the list **output**, use a good name to identify it in the **UI**
- use a function **renderXX({expr})**

```
#ui.R
selectInput("lettre", "Lettres:", LETTERS[1:3])
verbatimTextOutput(outputId = "selection")
#server.R
output$selection <- renderPrint({input$lettre})
```

5.3 Print

- **ui.r**:

```
verbatimTextOutput(outputId = "texte")
```

- **server.r**:

```
output$texte <- renderPrint({
  c("Hello shiny !")
})
```

```
[1] "Hello shiny !"
```

5.4 Text

- **ui.r**:

```
textOutput(outputId = "texte")
```

- **server.r**:

```
output$texte <- renderText({
  c("Hello shiny !")
})
```

Hello shiny !

5.5 Plot | *Code*

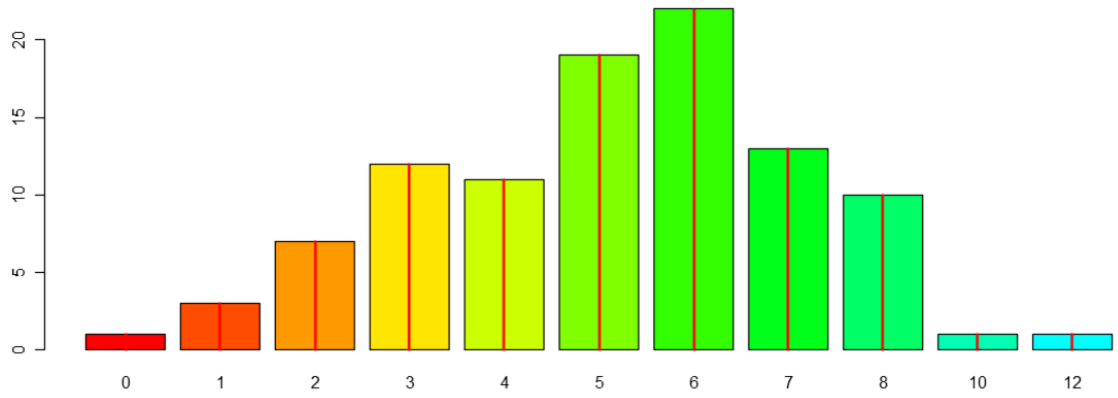
- **ui.r**:

```
plotOutput("myplot")
```

- **server.r**:

```
output$myplot <- renderPlot({
  require(grDevices) # for colours
  tN <- table(Ni <- stats::rpois(100, lambda = 5))

  r <- barplot(tN, col = rainbow(20))
  lines(r, tN, type = "h", col = "red", lwd = 2)
})
```

5.6 Plot | *App*



5.7 Table | *Code*

- **ui.r**:

```
tableOutput(outputId = "table")
```

- **server.r**:

```
data("iris")
output$table <- renderTable({
  iris[1:5, ]
})
```

5.8 Table | *App*

	Sepal.Length	Sepal.Width	Petal.Length	Petal.Width	Species
1	5.10	3.50	1.40	0.20	setosa
2	4.90	3.00	1.40	0.20	setosa
3	4.70	3.20	1.30	0.20	setosa
4	4.60	3.10	1.50	0.20	setosa
5	5.00	3.60	1.40	0.20	setosa

5.9 DataTable | *Code*

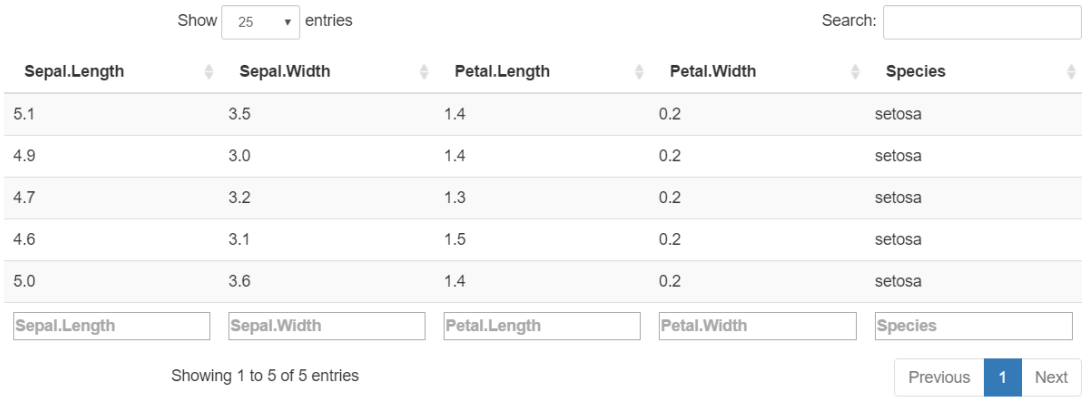
- **ui.r**:

```
dataTableOutput(outputId = "dataTable")
```

- **server.r**:

```
data("iris")
output$dataTable <- renderDataTable({
  iris
})
```

5.10 DataTable | *App*



5.11 Defining UI elements in the SEVER | Process

Sometimes it could be interested to define inputs in the server

We can do that with `uiOutput` and `renderUI`

5.12 Defining UI elements in the SEVER | A simple example

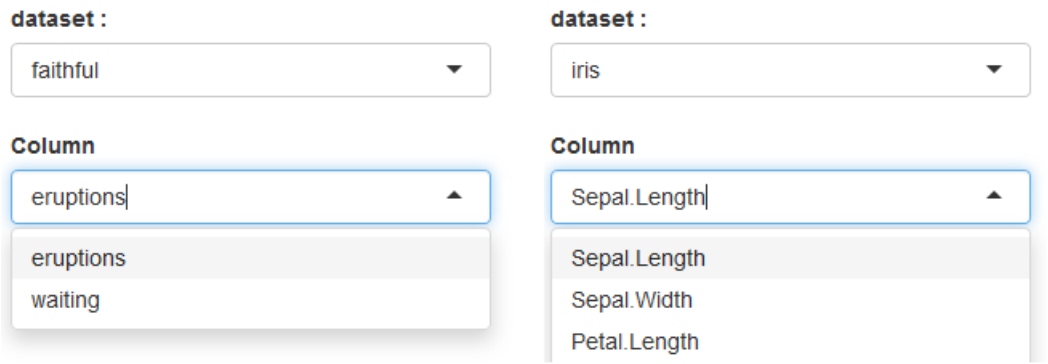
- **ui.r**:

```
uiOutput(outputId = "columns")
```

- **server.r**:

```
output$columns <- renderUI({
  selectInput(inputId = "sel_col", label = "Column", choices = colnames(data))
})
```

```
shinyApp(
  ui = fluidPage(
    selectInput(inputId = "my_data", label = "dataset : ",
                choices = c("iris", "faithful")),
    uiOutput(outputId = "columns")
  ),
  server = function(input, output) {
    data <- reactive(get(input$my_data, "package:datasets"))
    output$columns <- renderUI({
      selectInput(inputId = "sel_col", label = "Column", choices = colnames(data()))
    })
  })
```



5.13 Taking things further: building an output

Require some skills in HTML/CSS/JavaScript

Tutorial: http://shiny.rstudio.com/articles/building-outputs.html

6 Organizing the application

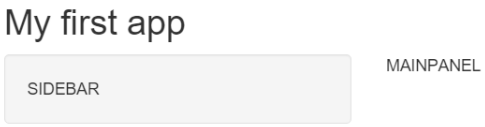
6.1 sidebarLayout | Definition

Basic template `sidebarLayout` divides the page in two columns and should contains:

- `sidebarPanel`, left part, generally for the inputs
- `mainPanel`, right part, generally for the outputs

```
shinyUI(
  fluidPage(
    titlePanel("Old Faithful Geyser Data"), # title
    sidebarLayout(
      sidebarPanel("Elements of sidebar (separated with commas)"),
      mainPanel("Elements of panel (separated with commas)")
    )
  )
)
```

6.2 sidebarLayout | Example

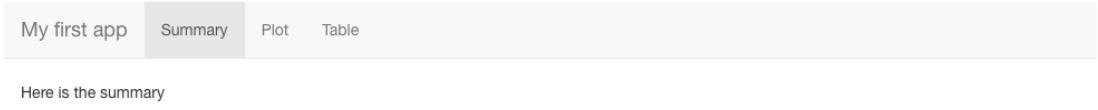


6.3 navbarPage | Definition

Use a navigation bar page with `navbarPage` and `tabPanel`:

```
shinyUI(
  navbarPage(
    title = "My first app",
    tabPanel(title = "Summary",
             "Here is the summary"),
    tabPanel(title = "Plot",
             "some charts"),
    tabPanel(title = "Table",
             "some tables")
  )
)
```

6.4 navbarPage | App

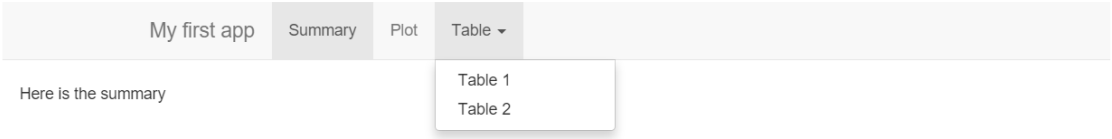


6.5 navbarPage | with navbarMenu

We can add a second level for the navigation with `navbarMenu`:

```
shinyUI(
  navbarPage(
    title = "My first app",
    tabPanel(title = "Summary",
             "Here is the summary"),
    tabPanel(title = "Plot",
             "some charts"),
    navbarMenu("Table",
      tabPanel("a table"),
      tabPanel("another table")
    )
  )
)
```

6.6 navbarPage | Shiny app



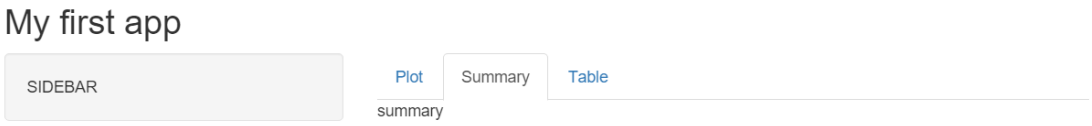
6.7 tabsetPanel | Definition

More generally, we can create navigation bar pages everywhere with `tabsetPanel` & `tabPanel`:

```
sidebarLayout(
  sidebarPanel("SIDEBAR"),
  mainPanel(
    tabsetPanel(
      tabPanel("Plot", plotOutput("plot")),
      tabPanel("Summary", verbatimTextOutput("summary")),
      tabPanel("Table", tableOutput("table"))
    )
  )
)
```

- **navbarPage**: create tabs in the application
- **tabsetPanel**: create tabs in a structure of the application

6.8 tabsetPanel | Example



6.9 navlistPanel | Definition

An alternative to `tabsetPanel`, to obtain a vertical position instead of horizontal: `navlistPanel`

```
shinyUI(fluidPage(
      navlistPanel(
        tabPanel("Plot", plotOutput("plot")),
        tabPanel("Summary", verbatimTextOutput("summary")),
        tabPanel("Table", tableOutput("table"))
    )
))
```

6.10 navlistPanel | Example

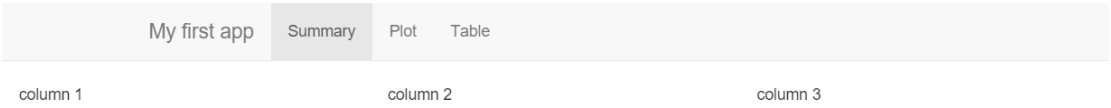
6.11 Grid Layout | Definition

Define your own organization with `fluidRow()` and `column()`

- any lines can be divided into 12 columns
- page size fits automatically to the number of rows/columns.

```
tabPanel(title = "Summary",
     # A fluid row can contain from 0 to 12 columns
     fluidRow(
       # A column is defined necessarily
       # with its argument "width"
       column(width = 4, "column 1"),
       column(width = 4, "column 2"),
       column(width = 4, "column 3"),
     ))
```

6.12 Grid Layout | Shiny app



6.13 wellPanel | Definition

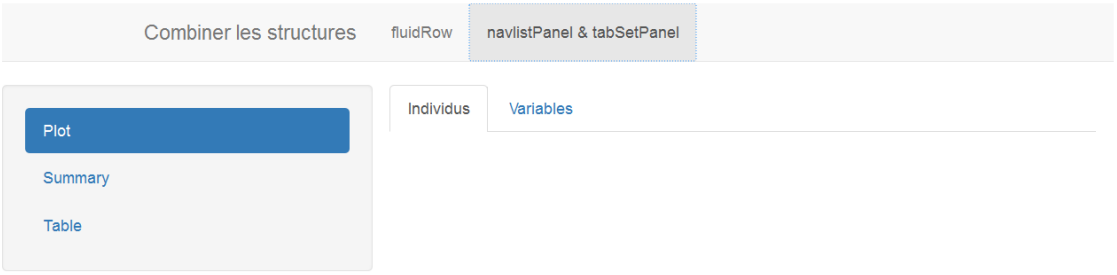
You can obtain a grey background with `wellPanel`:

```
fluidRow(
  column(6,
    h2("Without wellPanel"), # title
    sliderInput("num", "Choose a number", value = 25, min = 1, max = 100),
    textInput("title", value = "Histogram", label = "Write a title")
  ),
  column(6,
    h2("With wellPanel"), # title
    wellPanel(
      sliderInput("num", "Choose a number", value = 25, min = 1, max = 100),
      textInput("title", value = "Histogram", label = "Write a title")
    )
  )
)
```

6.14 wellPanel | Example

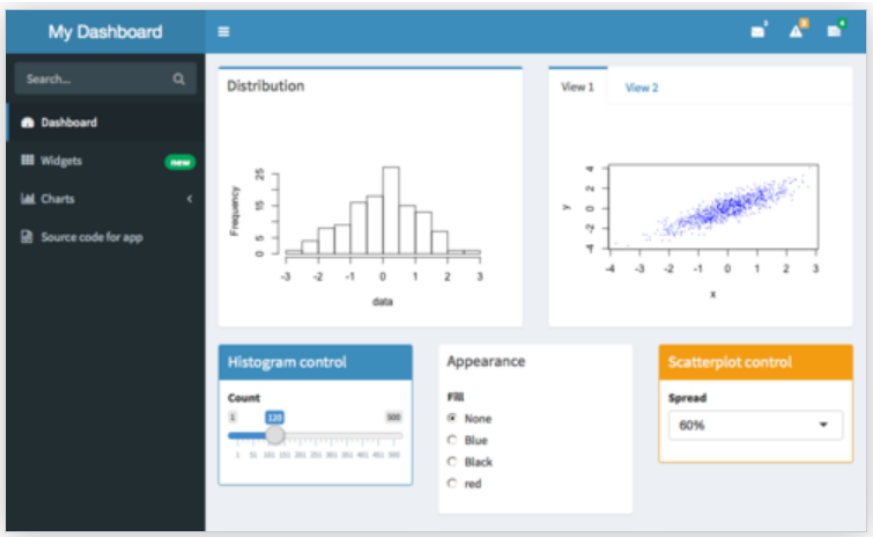
6.15 Combine structures | Shiny app

All structures can be used at the same time!



6.16 shinydashboard

The package shinydashboard has other functions to define `dashboards`:



https://rstudio.github.io/shinydashboard/

7 Interactive charts

7.1 Introduction

Since the creation of htmlwidgets package, more and more javascript possibilities are available with **R**:

- dygraphs (time series)
- DT (interactive tables)
- Leafet (maps)
- d3heatmap
- rAmCharts
- visNetwork
- ...

You can look at this gallery

7.2 Integration in shiny

All these packages can be used in **shiny**. Indeed, they posses the two required functions:

- **renderXX**
- **xxOutput**

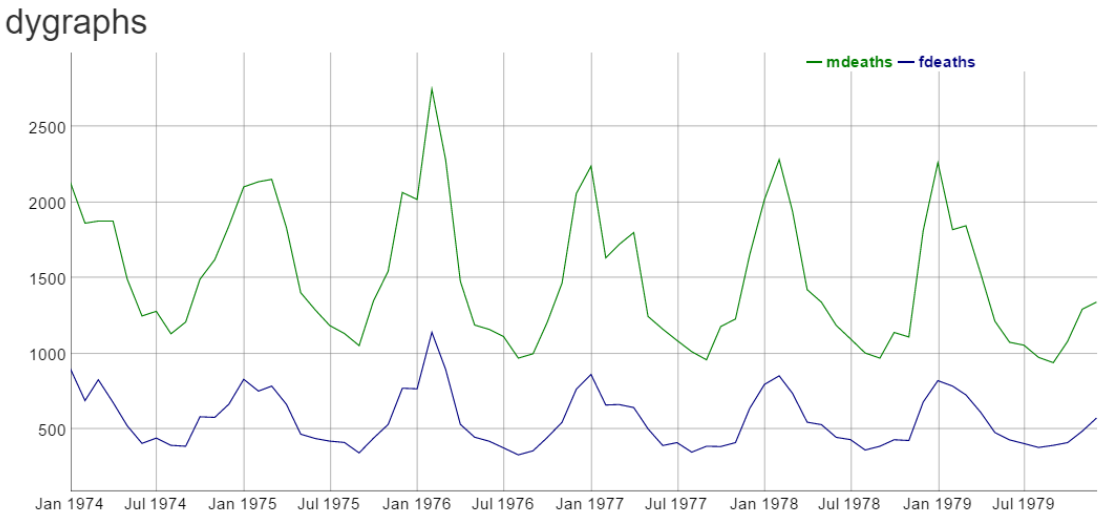
An example with dygraphs package:

```
# Server
output$dygraph <- renderDygraph({
    dygraph(predicted(), main = "Predicted Deaths/Month")
})
# Ui
dygraphOutput("dygraph")
```

7.3 Examples for server and ui functions

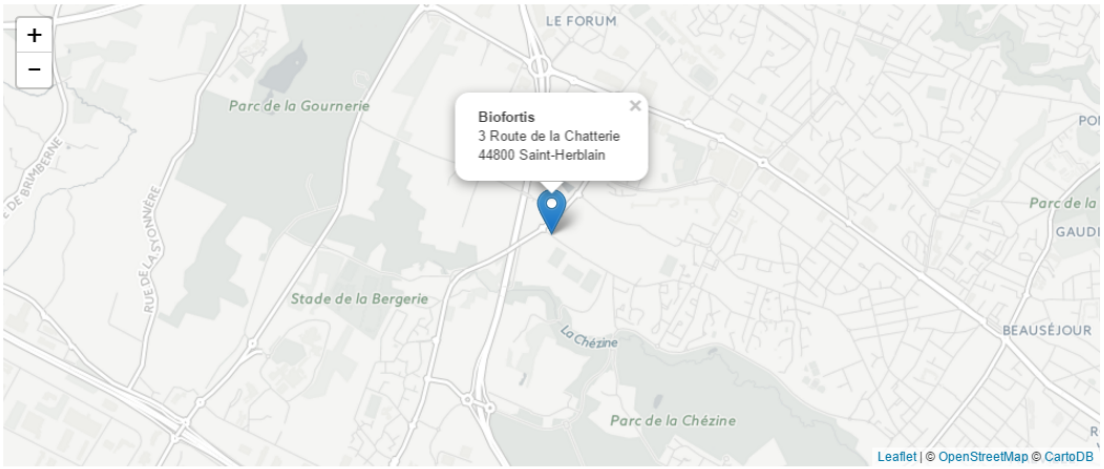
Package	server function	ui function
dygraph	renderDygraph	dygraphOutput
rAmcharts	renderAmCharts	amChartsOutput
leaflet	renderLeaflet	leafletOutput
plotly	renderPlotly	plotlyOutput
visNetwork	renderVisNetwork	visNetworkOutput

7.4 Interactive charts: example



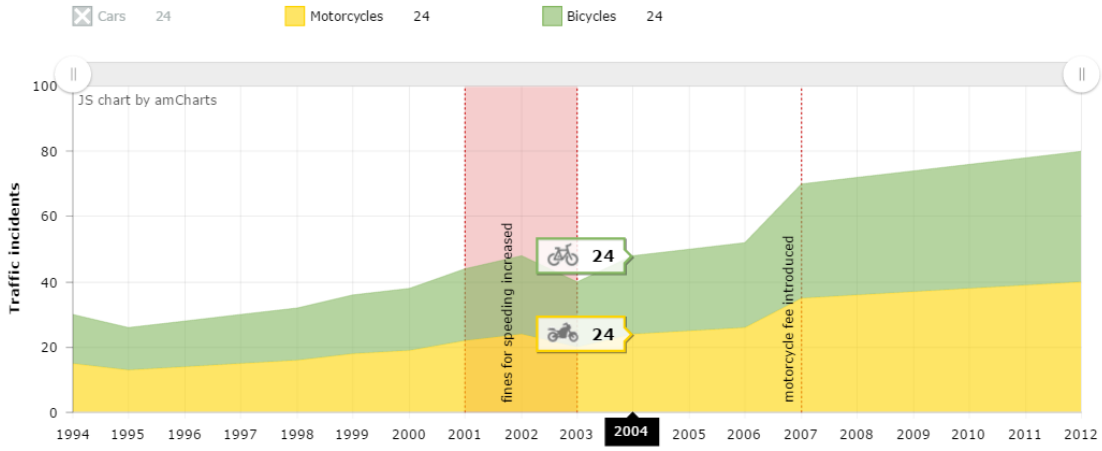
7.5 Interactive charts: example

leaflet

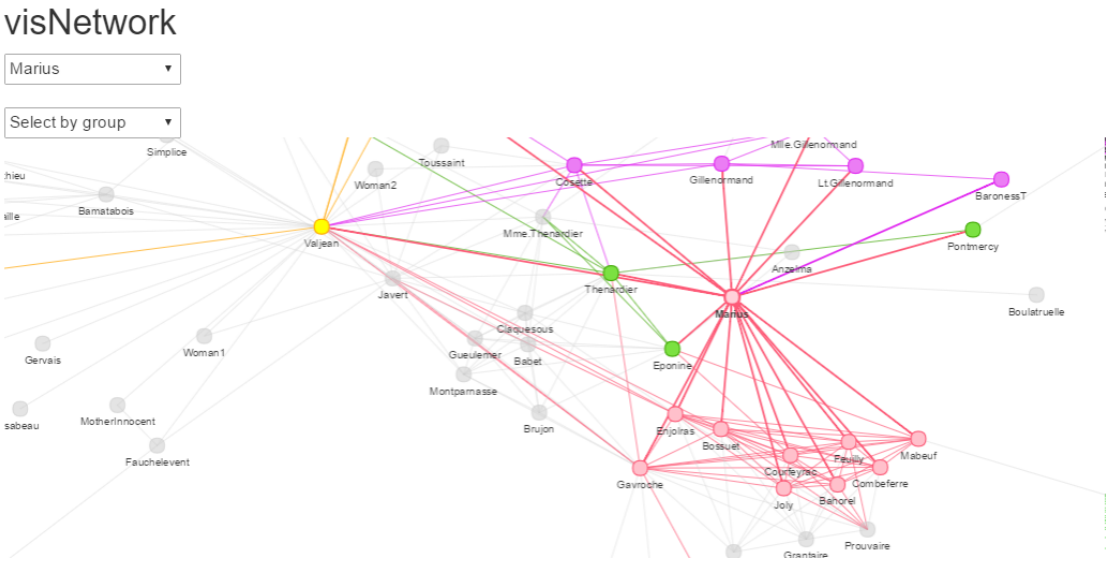


7.6 Interactive charts: example

rAmCharts



7.7 Interactive charts: example



8 Isolation

8.1 Definition

- By default, outputs and reactive expressions are updated as soon as the user changes one input
- It would be interesting to control this **update process**
- For instance, with a check button (**actionButton**) to start the computation of the outputs
- An input can be isolated with `isolate(input$id)`
- For an expression we use `isolate({expr})` (don't forget `{}`)

8.2 Example | ui.R

Three inputs: **color** and **bins** for the histogram, and one **actionButton**:

```
shinyUI(fluidPage(
  titlePanel("Isolation"),
  sidebarLayout(
    sidebarPanel(
      radioButtons(inputId = "col", label = "Choose a color", inline = TRUE,
                   choices = c("red", "blue", "darkgrey")),
      sliderInput("bins", "Number of bins:", min = 1, max = 50, value = 30),
      actionButton("go_graph", "Update!")
    ),
    mainPanel(plotOutput("distPlot"))
  )
))
```

8.3 Example | server.R

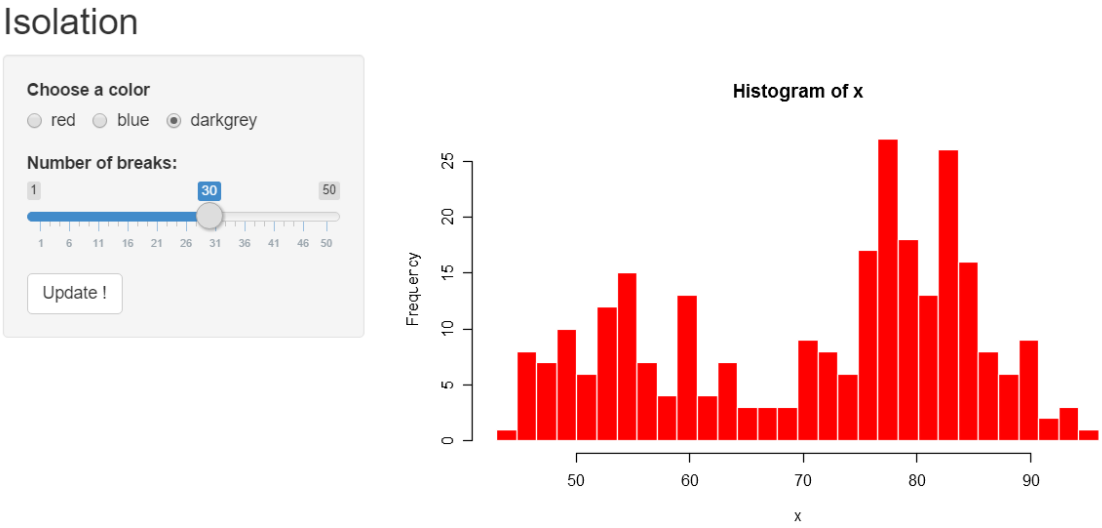
Isolation of everything excepted the **actionButton**:

```
shinyServer(function(input, output) {
  output$distPlot <- renderPlot({
    input$go_graph #action to start the update process
```

```
    isolate({
      inputColor <- input$color
      x <- faithful[, 2]
      bins <- seq(min(x), max(x), length.out = input$bins + 1)
      hist(x, breaks = bins, col = inputColor, border = 'white')
    })
  })
})
```

The histogram will be updated when the user will click on the button.

8.4 Example | App



9 Reactive expressions

9.1 Definition

- Very usefull when we want to use the same result/objects in many outputs, by doing the calculation just one time.
- Just have to use the function `reactive` in **server.R**
- For instance, we want to visualize two graphs of a PCA:
  - projection of individuals
  - projection of variables.

9.2 Without reactive expressions

- **server.R**: the calculation is performed twice...
- By default, **only** R expressions in **renderXX** functions are updated.

```
require(FactoMineR) ; data("decathlon")

output$graph_pca_ind <- renderPlot({
  res_pca <- PCA(decathlon[ ,input$variables], graph = FALSE)
  plot.PCA(res_pca, choix = "ind", axes = c(1,2))
```

```
})

output$graph_pca_var <- renderPlot({
  res_pca <- PCA(decathlon[,input$variables], graph = FALSE)
  plot.PCA(res_pca, choix = "var", axes = c(1,2))
})
```

9.3 With a reactive expression

- **server.R** : The calculation is performed only once!

```
require(FactoMineR) ; data("decathlon")

res_pca <- reactive({
  PCA(decathlon[,input$variables], graph = FALSE)
})

output$graph_pca_ind <- renderPlot({
  plot.PCA(res_pca(), choix = "ind", axes = c(1,2))
})

output$graph_pca_var <- renderPlot({
  plot.PCA(res_pca(), choix = "var", axes = c(1,2))
})
```

9.4 Notes

- A reactive expression will save time and memory.
- **Use reactive expressions only when they depend on inputs**
- Reactive expressions updates as soon as the user changes an input
- We obtain its value with "()"

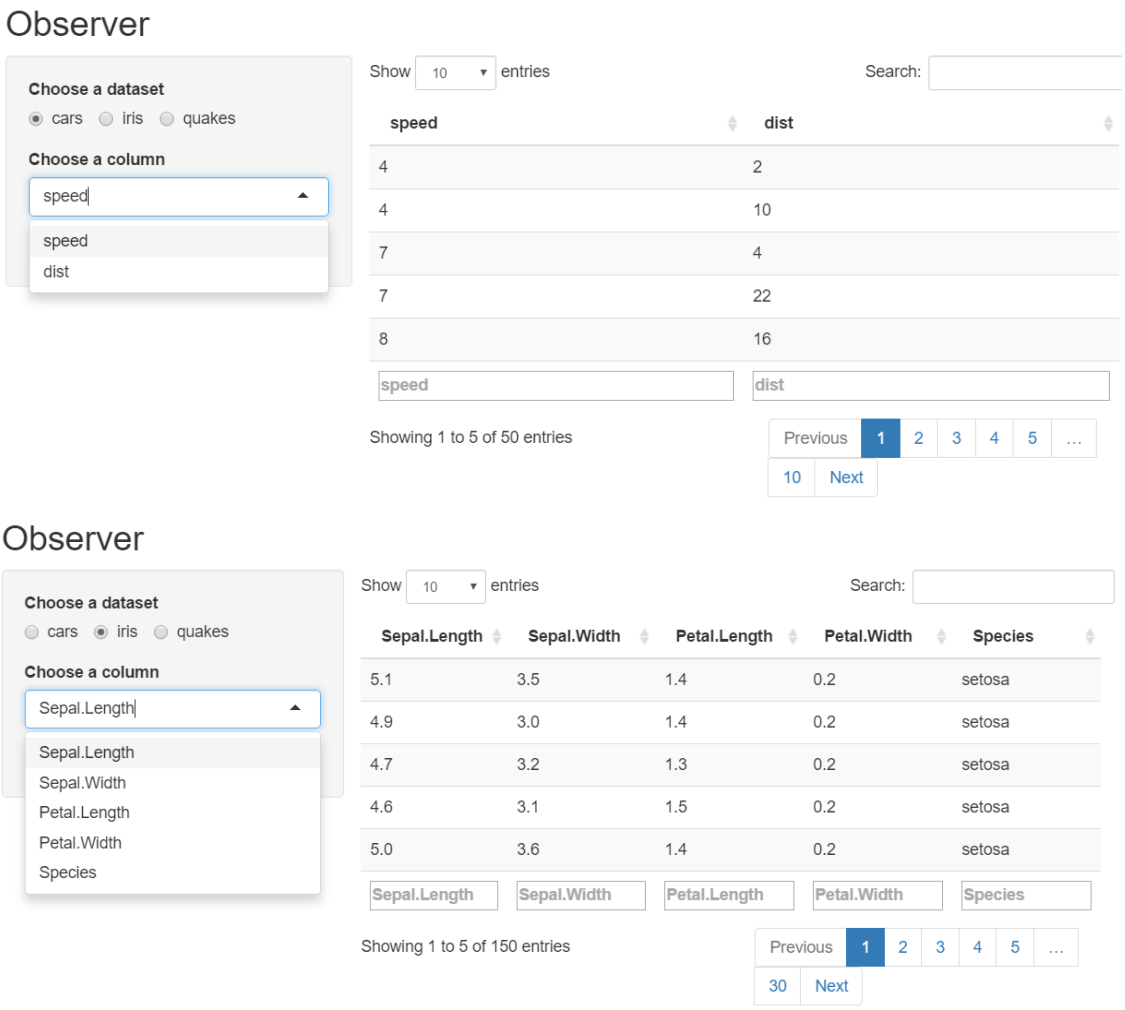
10 Observe & functions to update

10.1 Observe & fonctions to update

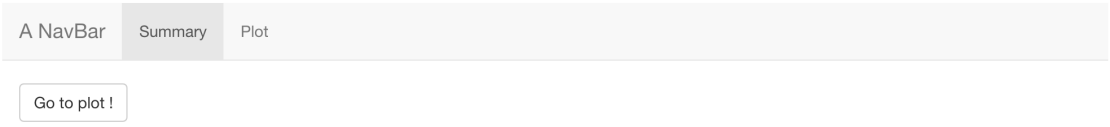
- There exists many functions to update inputs and some structures
- They start with `update...`
- They are generally used in `observe({expr})`
- **Be careful**: we have to add *"session"* in the definition of **server**

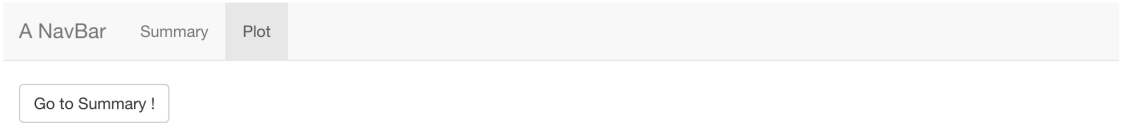
```
shinyServer(function(input, output, session) {...})
```

10.2 Example for an input | App



10.3 Example for tabs | App





For inputs:

- **updateCheckboxGroupInput**
- **updateCheckboxInput**
- **updateDateInput Change**
- **updateDateRangeInput**
- **updateNumericInput**
- **updateRadioButtons**
- **updateSelectInput**
- **updateSelectizeInput**
- **updateSliderInput**
- **updateTextInput**

To change a selected tab

- **updateNavbarPage**, **updateNavlistPanel**, **updateTabsetPanel**

10.4 Example for an input | ui.R

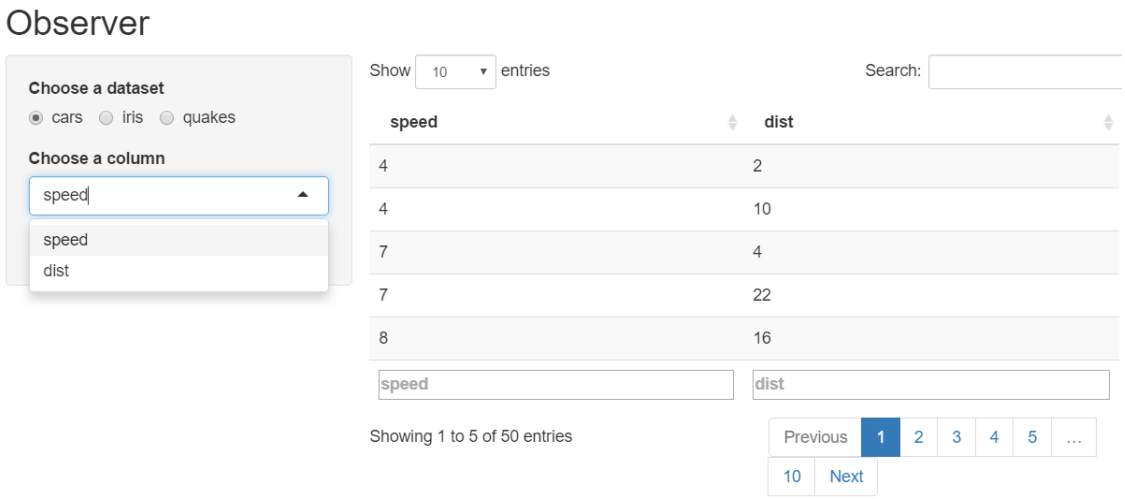
```
shinyUI(fluidPage(
  titlePanel("Observe"),
  sidebarLayout(
    sidebarPanel(
      radioButtons(inputId = "id_dataset", label = "Choose a dataset", inline = TRUE,
                   choices = c("cars", "iris", "quakes"), selected = "cars"),
      selectInput("id_col", "Choose a column", choices = colnames(cars)),
      textOutput(outputId = "txt_obs")
    ),
    mainPanel(fluidRow(
      dataTableOutput(outputId = "dataset_obs")
    ))
  )
))
```

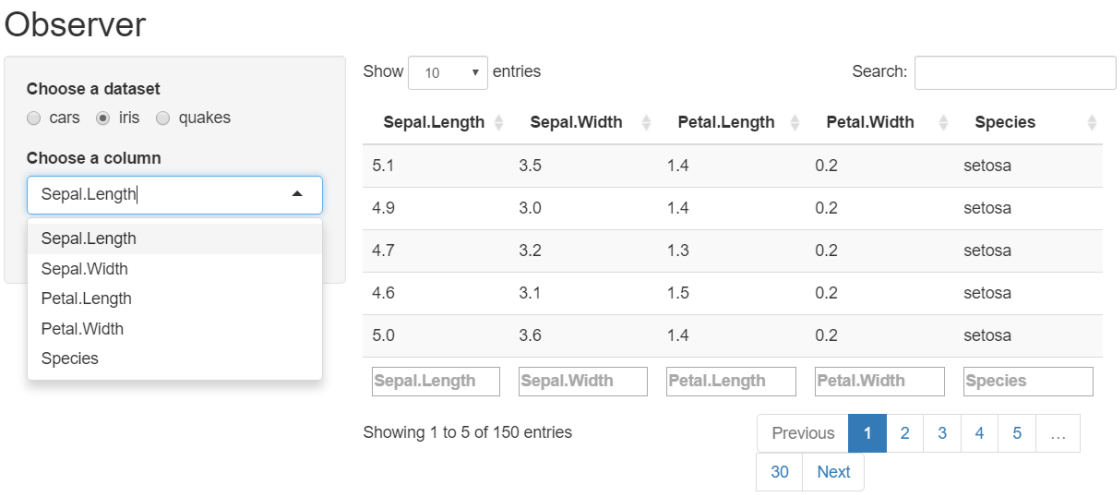
10.5 Example for an input | server.R

```
shinyServer(function(input, output, session) {
  dataset <- reactive(get(input$id_dataset, "package:datasets"))

  observe({
    updateSelectInput(session, inputId = "id_col", label = "Choose a column",
                      choices = colnames(dataset()))
```

```
  })

  output$txt_obs <- renderText(paste0("Selected column : ", input$id_col))

  output$dataset_obs <- renderDataTable(
    dataset(),
    options = list(pageLength = 5)
  )
})
```

10.6 Example for an input | App





10.7 Example for tabs | ui.R

We have to add an ID in the structure

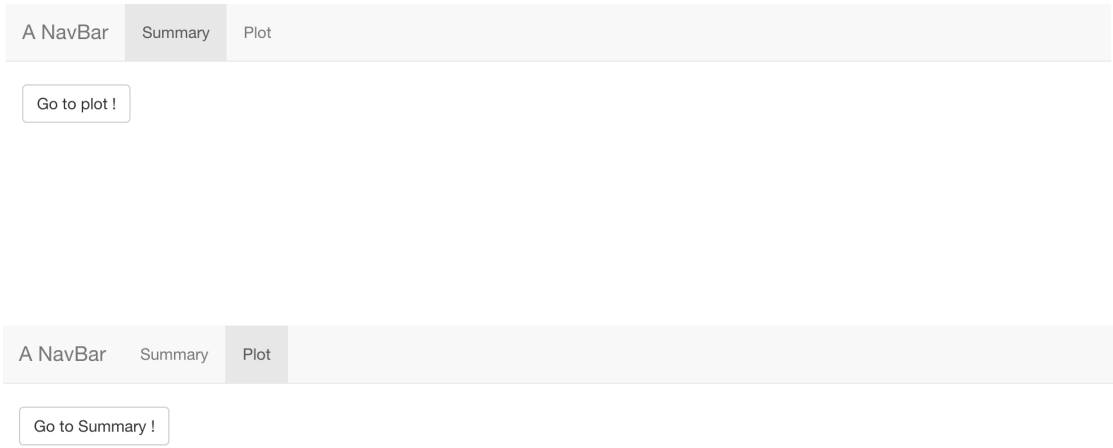
```
shinyUI(
  navbarPage(
    id = "idnavbar", # need an id for observe & update
    title = "A NavBar",
    tabPanel(title = "Summary",
```

```
            actionButton("goPlot", "Go to plot !")),
    tabPanel(title = "Plot",
             actionButton("goSummary", "Go to Summary !"))

  )
)
```

10.8 Example for tabs | server.R

```
shinyServer(function(input, output, session) {
  observe({
    input$goPlot #action to start the update process
    updateTabsetPanel(session, "idnavbar", selected = "Plot")
  })
  observe({
    input$goSummary #action to start the update process
    updateTabsetPanel(session, "idnavbar", selected = "Summary")
  })
})
```

10.9 Example for tabs | App



10.10 ObserveEvent

- An alternative to `observe`: `observeEvent`
- We have to define both the expression of the event and the expression to execute when the event occurs

```
# with observe
observe({
  input$goPlot
  updateTabsetPanel(session, "idnavbar", selected = "Plot")
```

```
})

# same with observeEvent
observeEvent(input$goSummary, {
  updateTabsetPanel(session, "idnavbar", selected = "Summary")
})
```

11 Conditional panels

11.1 Definition

- We can use conditions to print some inputs/outputs

```
conditionalPanel(condition = [...], )
```

- The condition can depend on inputs or outputs
- Be careful: it should be written in **javascript**...

```
conditionalPanel(condition = "input.checkbox == true", [...])
```

11.2 Example for an input

```
shinyApp(
  ui = fluidPage(
    fluidRow(
      column(width = 4, align = "center",
        checkboxInput("checkbox", "View other inputs", value = FALSE)
      ),
      column(width = 8, align = "center",
        conditionalPanel(
          condition = "input.checkbox == true",
          sliderInput("slider", "Select value", min = 1, max = 10, value = 5),
          textInput("txt", "Enter text", value = "")
        )
      )
    )
  ),
  server = function(input, output) {}
)
```

11.3 Example for an input

12 Taking things further: HTML / CSS

12.1 Including HTML

Many **html tags** are availabe with `tags` functions:

```
##   [1] "a"                  "abbr"               "address"
##   [4] "animate"            "animateMotion"      "animateTransform"
##   [7] "area"               "article"            "aside"
##  [10] "audio"              "b"                  "base"
##  [13] "bdi"                "bdo"                "blockquote"
##  [16] "body"               "br"                 "button"
##  [19] "canvas"             "caption"            "circle"
##  [22] "cite"               "clipPath"           "code"
##  [25] "col"                "colgroup"           "color-profile"
##  [28] "command"            "data"               "datalist"
##  [31] "dd"                 "defs"               "del"
##  [34] "desc"               "details"            "dfn"
##  [37] "dialog"             "discard"            "div"
##  [40] "dl"                 "dt"                 "ellipse"
##  [43] "em"                 "embed"              "eventsource"
##  [46] "feBlend"            "feColorMatrix"      "feComponentTransfer"
##  [49] "feComposite"        "feConvolveMatrix"   "feDiffuseLighting"
##  [52] "feDisplacementMap"  "feDistantLight"     "feDropShadow"
##  [55] "feFlood"            "feFuncA"            "feFuncB"
##  [58] "feFuncG"            "feFuncR"            "feGaussianBlur"
##  [61] "feImage"            "feMerge"            "feMergeNode"
##  [64] "feMorphology"       "feOffset"           "fePointLight"
##  [67] "feSpecularLighting" "feSpotLight"        "feTile"
##  [70] "feTurbulence"       "fieldset"           "figcaption"
##  [73] "figure"             "filter"             "footer"
##  [76] "foreignObject"      "form"               "g"
##  [79] "h1"                 "h2"                 "h3"
##  [82] "h4"                 "h5"                 "h6"
##  [85] "hatch"              "hatchpath"          "head"
##  [88] "header"             "hgroup"             "hr"
##  [91] "html"               "i"                  "iframe"
```

```
##  [94] "image"              "img"              "input"
##  [97] "ins"                "kbd"              "keygen"
## [100] "label"              "legend"           "li"
## [103] "line"               "linearGradient"   "link"
## [106] "main"               "map"              "mark"
## [109] "marker"             "mask"             "menu"
## [112] "meta"               "metadata"         "meter"
## [115] "mpath"              "nav"              "noscript"
## [118] "object"             "ol"               "optgroup"
## [121] "option"             "output"           "p"
## [124] "param"              "path"             "pattern"
## [127] "picture"            "polygon"          "polyline"
## [130] "pre"                "progress"         "q"
## [133] "radialGradient"     "rb"               "rect"
## [136] "rp"                 "rt"               "rtc"
## [139] "ruby"               "s"                "samp"
## [142] "script"             "section"          "select"
## [145] "set"                "slot"             "small"
## [148] "solidcolor"         "source"           "span"
## [151] "stop"               "strong"           "style"
## [154] "sub"                "summary"          "sup"
## [157] "svg"                "switch"           "symbol"
## [160] "table"              "tbody"            "td"
## [163] "template"           "text"             "textarea"
## [166] "textPath"           "tfoot"            "th"
## [169] "thead"              "time"             "title"
## [172] "tr"                 "track"            "tspan"
## [175] "u"                  "ul"               "use"
## [178] "var"                "video"            "view"
## [181] "wbr"
```

We can also use **html** code with **HTML** function:

```
fluidPage(
  HTML("<h1>My Shiny App</h1>")
)
```

12.2 Some interested tags

- `div(..., align = "center")`: center elements
- `br()`: line break

- `hr()`: horizontal line
- `img(src="img/logo.jpg", title="Popup", width = "80%")`: insert an image in **www/img**
- `a(href="https://r2018-rennes.sciencesconf.org/", target="_blank", "Rencontres R")`: link to a website
- `a(href = './doc/guide.pdf', target="_blank", class = "btn", icon("download"), 'Télécharger le guide utilisateur')`: link to download a document in **www/doc**

12.3 CSS: introduction

Shiny use Bootstrap for the **CSS** part.

As for classical web development, we can change the **CSS** in three ways:

- link to a **.css file** in the directory `www`
- adding **CSS** in the **HTML** header
- using **CSS** codes in an element.

Priority order : 1. **CSS** codes in an element 2. **CSS** in the **HTML** header 3. **.css file**

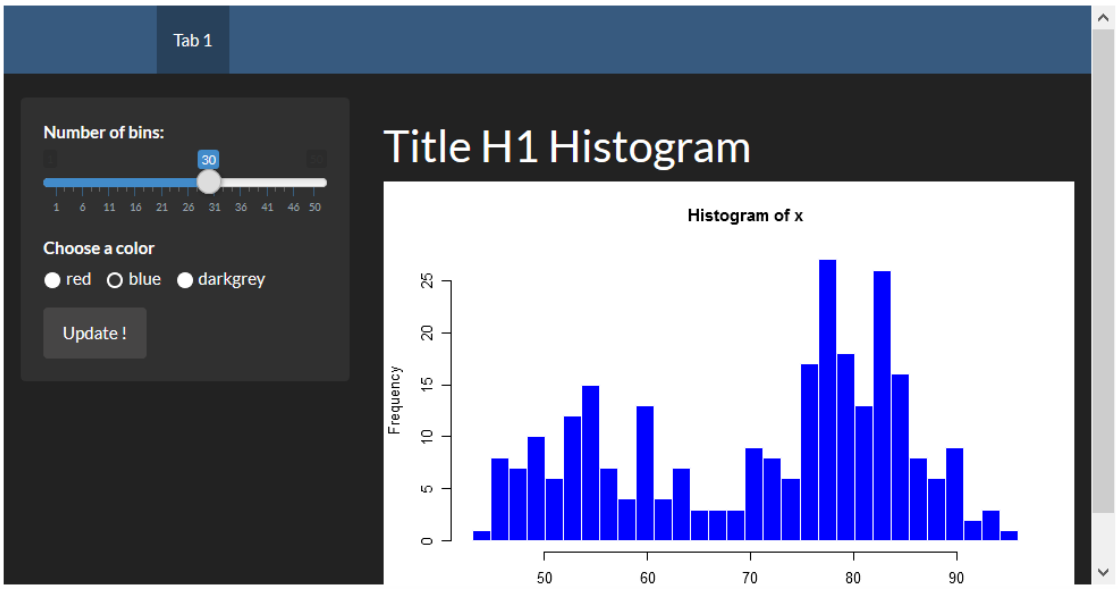
We can also use the shinythemes package.

12.4 HTML / CSS | css external file

You can find some themes in bootswatch.

- Two ways to specify the theme: + option `theme` in some functions (`fluidPage`, `navbarPage`, ...) + with a **html tags** : `tags$head` et `tags$link`

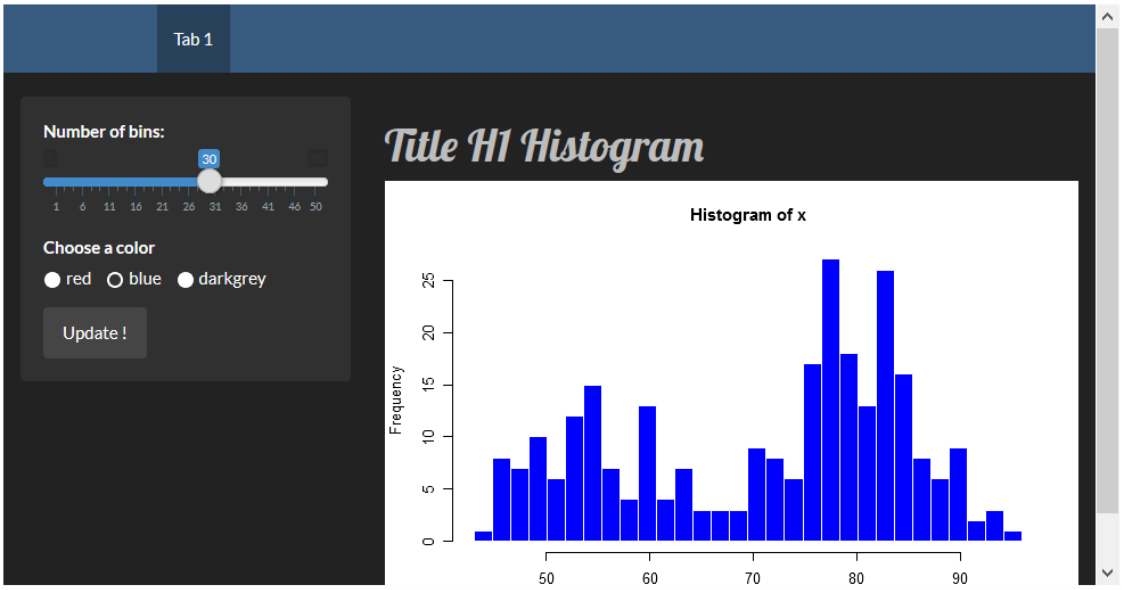
```
library(shiny)
ui <- fluidPage(theme = "mytheme.css",
  # or with a tags
  tags$head(
tags$link(rel = "stylesheet", type = "text/css", href = "mytheme.css")
  ),
  # ...
)
```



12.5 HTML / CSS | css in the header

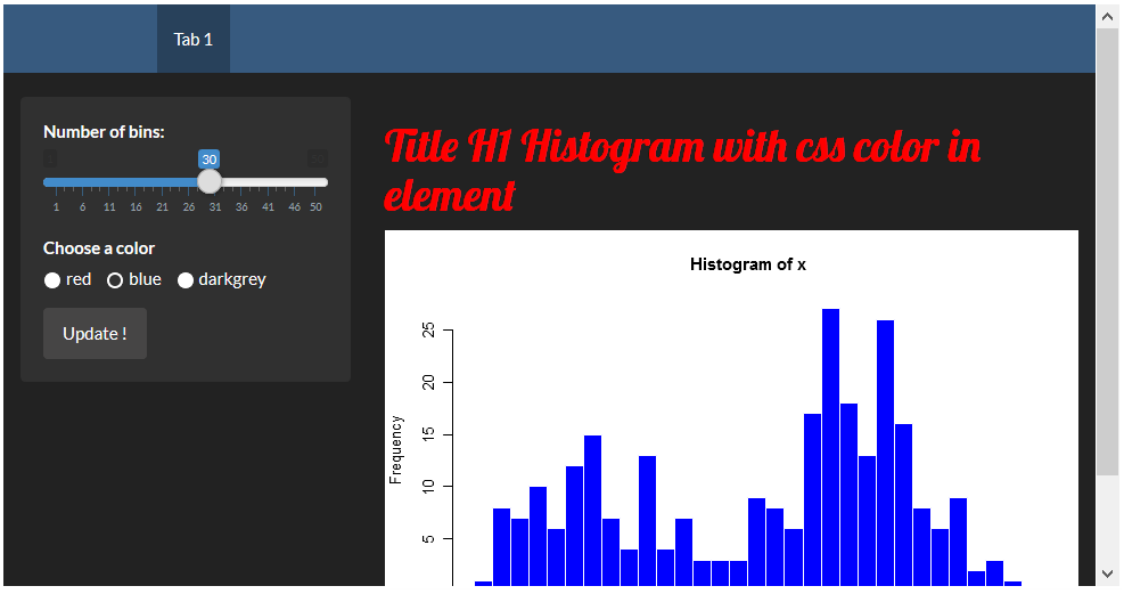
- With **html tags**: `tags$head` and `tags$style`

```
library(shiny)
  tags$head(
tags$style(HTML("h1 { color: #48ca3b;}")
)
  ),
  # ...
)
```



12.6 HTML / CSS | CSS in an element

```
library(shiny)
  h1("Mon titre", style = "color: #48ca3b;")
  # reste de l'application
)
```



13 Taking things further: some important "rules"

13.1 Good approach

- Choose underscore (_) instead of point (.) in the names of the objects or variables. Indeedt, the point . can lead to some confusions with other languages, such as **JavaScript**
- Use packrat package to avoid problems with **version packages**
- Use **R script** for the calculation part and make test with (testthat).

13.2 Good approach

- Divide the **ui.R** and **server.R** parts in several scripts, on for each tabs for instance:

```
# ui.R
shinyUI(
  navbarPage("Divide UI & SERVER",
source("src/ui/01_ui_plot.R", local = TRUE)$value,
source("src/ui/02_ui_data.R", local = TRUE)$value
  )
)
# server.R
shinyServer(function(input, output, session) {
  source("src/server/01_server_plot.R", local = TRUE)
  source("src/server/02_server_data.R", local = TRUE)
})
```

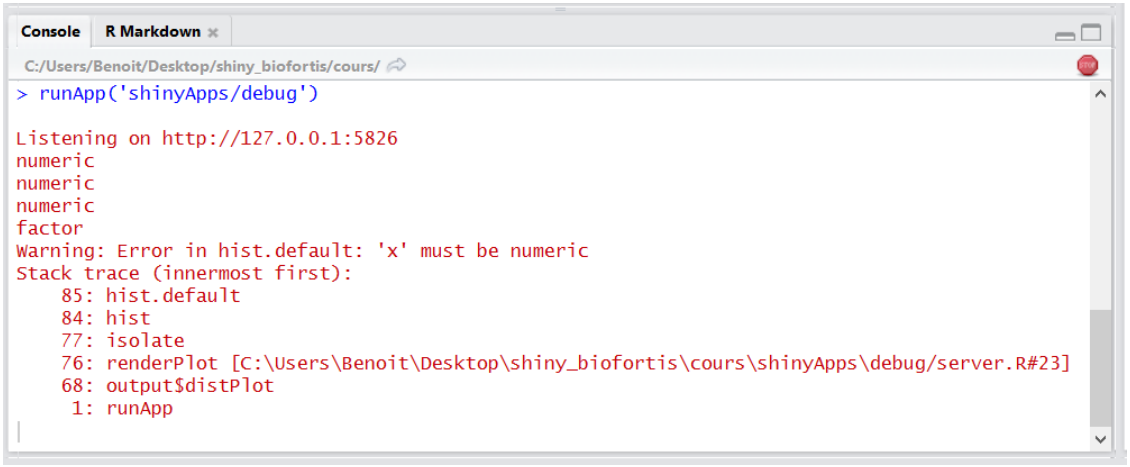
14 Taking things further: debugging

14.1 Printing in the console

- You can use some `print` in the application
- It allws to visualize informations during the process
- In **shiny**, use `cat(file=stderr(), ...)` to be sure that the display operates for all kind of outputs

```r
 output$distPlot <- renderPlot({
  x <- iris[, input$variable]
  cat(file=stderr(), class(x)) # affichage de la classe de x
  hist(x)
})
```

14.2 Printing in the console



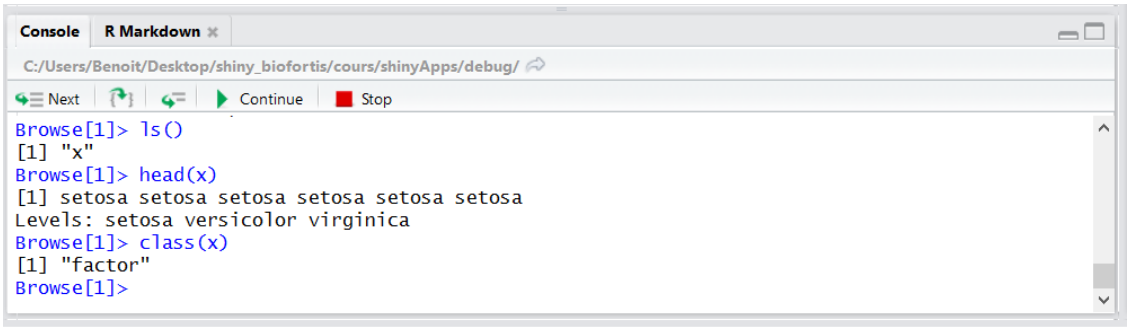
14.3 Manual launch of a browser

- We can launch a browser with `browser()` everywhere
- It allows to observe the different objects

```r
 output$distPlot <- renderPlot({
  x <- iris[, input$variable]
  browser() # lancement du browser
  hist(x)
})
```

- Don't forget to remove it!

14.4 Manual launch of a browser



14.5 Automatic launch of a browser

- The option `options(shiny.error = browser)` allows to launch `browser()` as soon as an error appears

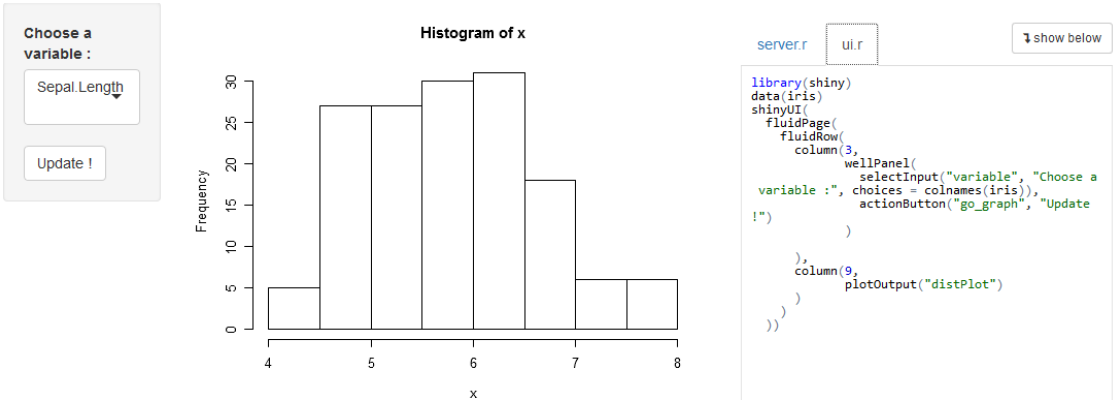
```
options(shiny.error = browser)
```

14.6 Mode “showcase”

- With the `display.mode="showcase"` in `runApp()`, we can observe directly the executed code:

```
runApp("path/to/myapp", display.mode="showcase")
```

14.7 Mode “showcase”



14.8 Reactive log

- With `shiny.reactlog`, we can visualize dependences betwwen **reactive objects** and **shiny**
  - use `ctrl+F3` in the web browser
  - with `showReactLog()` in the shiny code

```
options(shiny.reactlog=TRUE)

output$distPlot <- renderPlot({
  x <- iris[, input$variable]
  showReactLog() # launch shiny.reactlog
  hist(x)
})
```

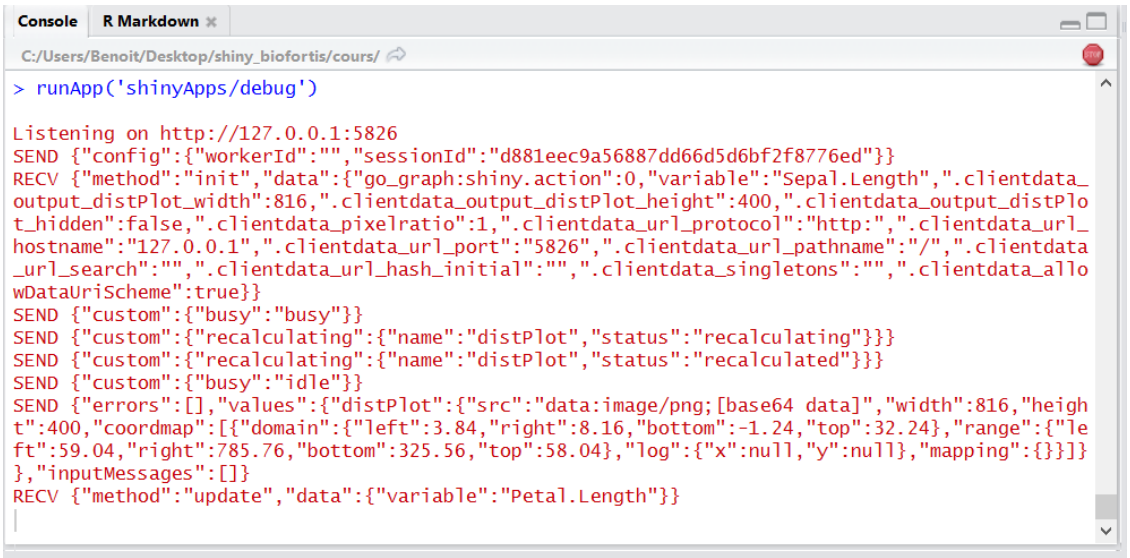
14.9 Reactive log

14.10 Communication in the server

- We can visualize these communications with the option `shiny.trace`

```
options(shiny.trace = TRUE)
```

14.11 Communication in the server

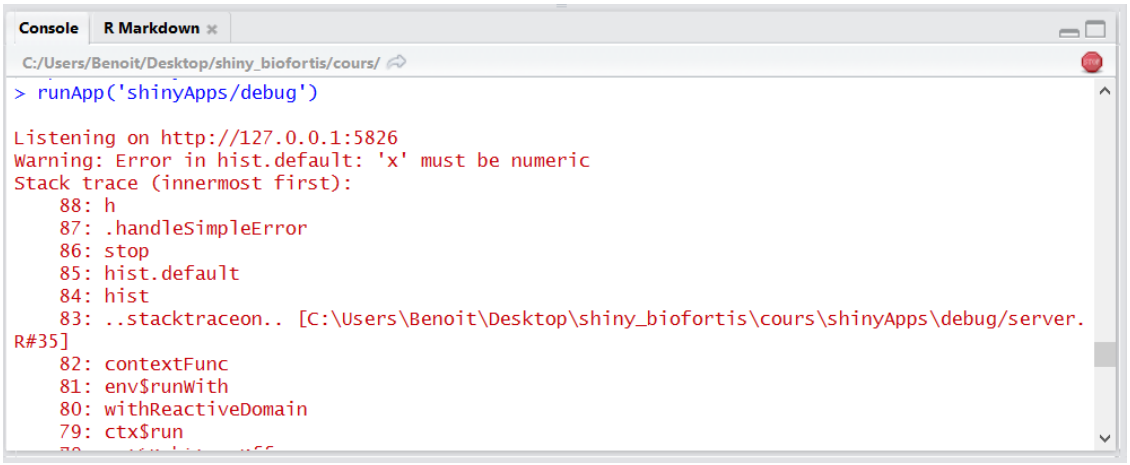


14.12 Error tracking

- Sincce `shiny_0.13.1`, we can obtain a stack trace when an error occurs
- We can obtain more inofrmations with `options(shiny.fullstacktrace = TRUE)`

```
options(shiny.fullstacktrace = TRUE)
```

14.13 Error tracking



15 References

15.1 Tutorials / Examples

- http://shiny.rstudio.com/
- http://shiny.rstudio.com/articles/
- http://shiny.rstudio.com/tutorial/
- http://shiny.rstudio.com/gallery/
- https://www.rstudio.com/products/shiny/shiny-user-showcase/
- http://www.showmeshiny.com/