QTM 151

Week 13 – Shiny web applications

Umberto Mignozzetti
Apr 23

Recap

We learned:

- `qplot`: quick way to make ggplot graphs.
- `ggplotly` and `plot_ly`: create nice plotly graphs.
- `dplyr` methods: data wrangling
- `dplyr *_join` methods: joining data
- `tidyr` methods: reshape datasets
- `forcats` methods: working with categorical variables
- `lubridate` methods: processing dates and times
- `maps` and `ggmap` for creating maps.

Great job!!

Do you have any questions about any of these contents?

Today we are going to talk about Shiny Web Apps in R.

This week

We will have a **quiz** posted today after 4:00 PM. Due by **Monday**

We will **not** have a **problem set** this week. You should focus on the final project!

Our GitHub page is: https://github.com/umbertomig/qtm151

Final Project Important Dates

For the final project, we have the following important dates:

1. Presentations are due by Apr 30, at 12:00PM. You should submit the slides, and be prepared to them present during class.

2. Your final reports are due by May 3.

Do you have any questions?

Shiny Webapps

Getting Started: loading packages

```
# Loading tidyverse
library(tidyverse)
```

```
## ── Attaching packages ─────────────────────────────────────── tidyv

## ✓ ggplot2 3.3.3     ✓ purrr   0.3.4
## ✓ tibble  3.1.0     ✓ dplyr   1.0.5
## ✓ tidyr   1.1.3     ✓ stringr 1.4.0
## ✓ readr   1.4.0     ✓ forcats 0.5.1

## ── Conflicts ────────────────────────────────────────── tidyverse_c
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

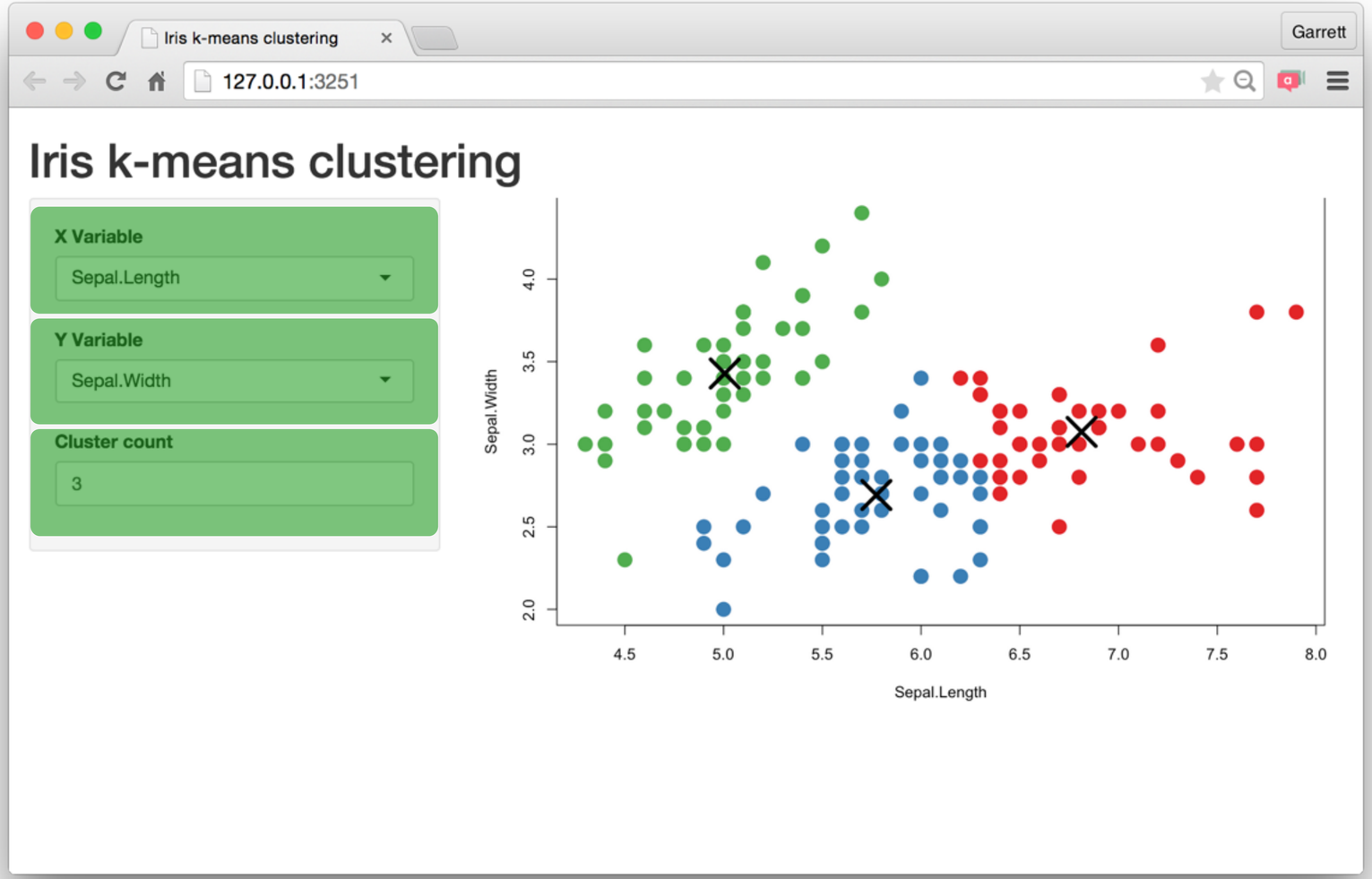
```
library(shiny)
```

Getting Started: loading data

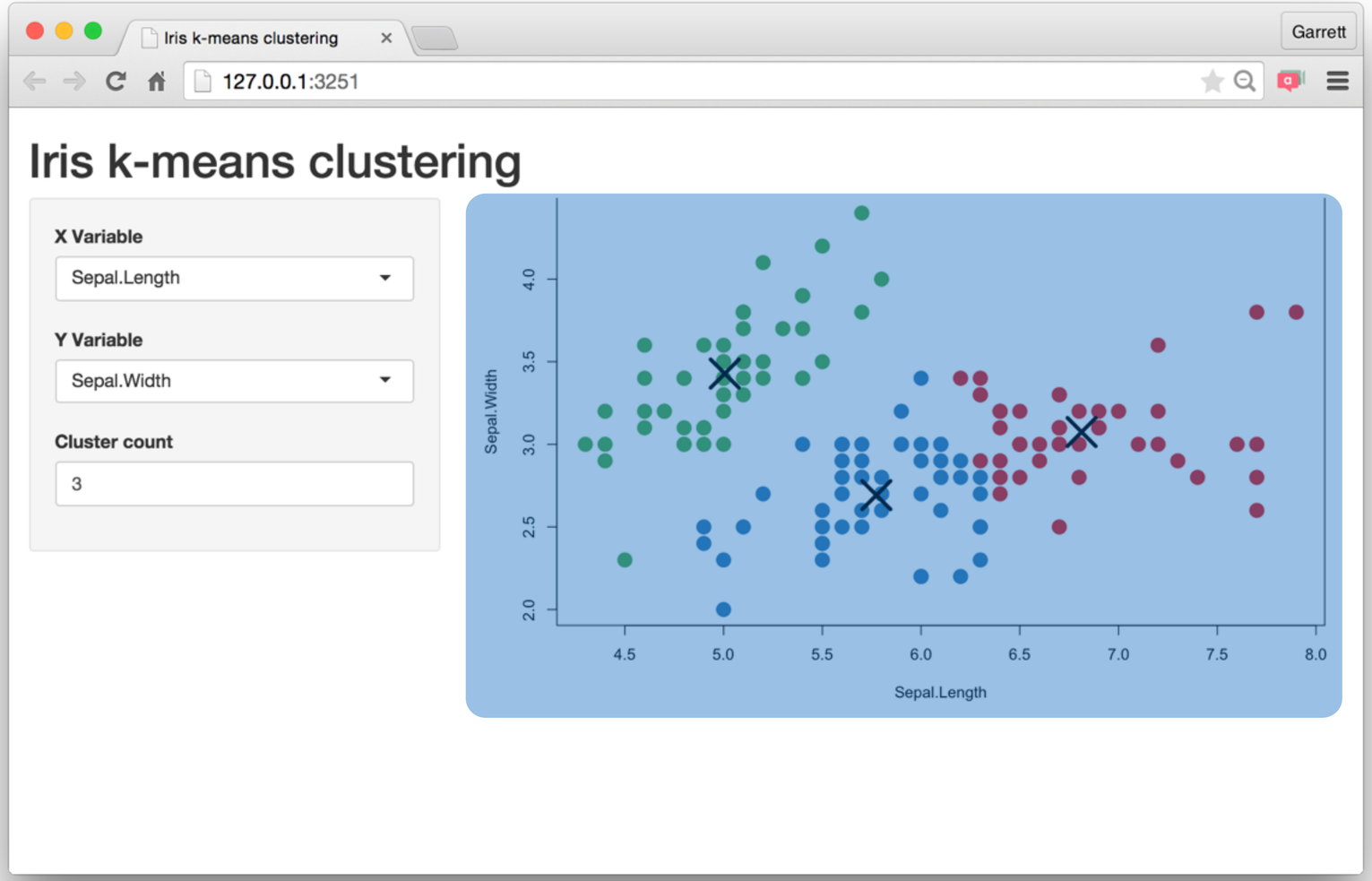
We will use the shiny presentation by Garrett Grolemund, one of the R Studio main Data Scientists

Build your app around Inputs and Outputs

Build your app around **inputs** and **outputs**



Build your app around **inputs** and **outputs**



Add elements to your app as arguments to `fluidPage()`

```
ui <- fluidPage(
  # *Input() functions,
  # *Output() functions
)
```

Inputs

Create an input with an ***Input()** function.

```
sliderInput(inputId = "num",
  label = "Choose a number",
  value = 25, min = 1, max = 100)
```

```
<div class="form-group shiny-input-container">
  <label class="control-label" for="num">Choose a number</label>
  <input class="js-range-slider" id="num" data-min="1" data-max="100"
   data-from="25" data-step="1" data-grid="true" data-grid-num="9.9"
   data-grid-snap="false" data-prettify-separator="," data-keyboard="true"
   data-keyboard-step="1.01010101010101"/>
</div>
```

Create an input with an input function.

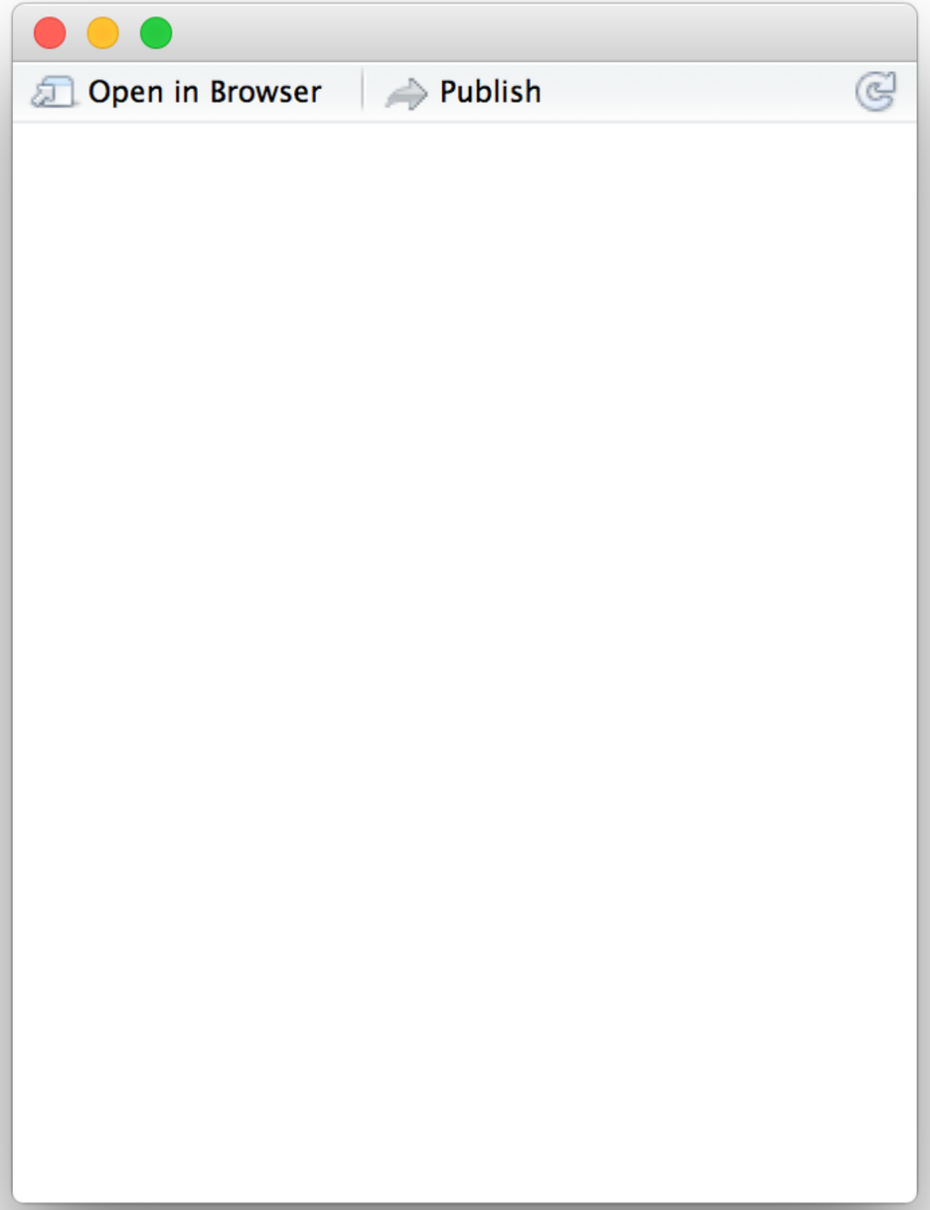
```
library(shiny)
ui <- fluidPage(




)

server <- function(input, output) {}

shinyApp(server = server, ui = ui)
```

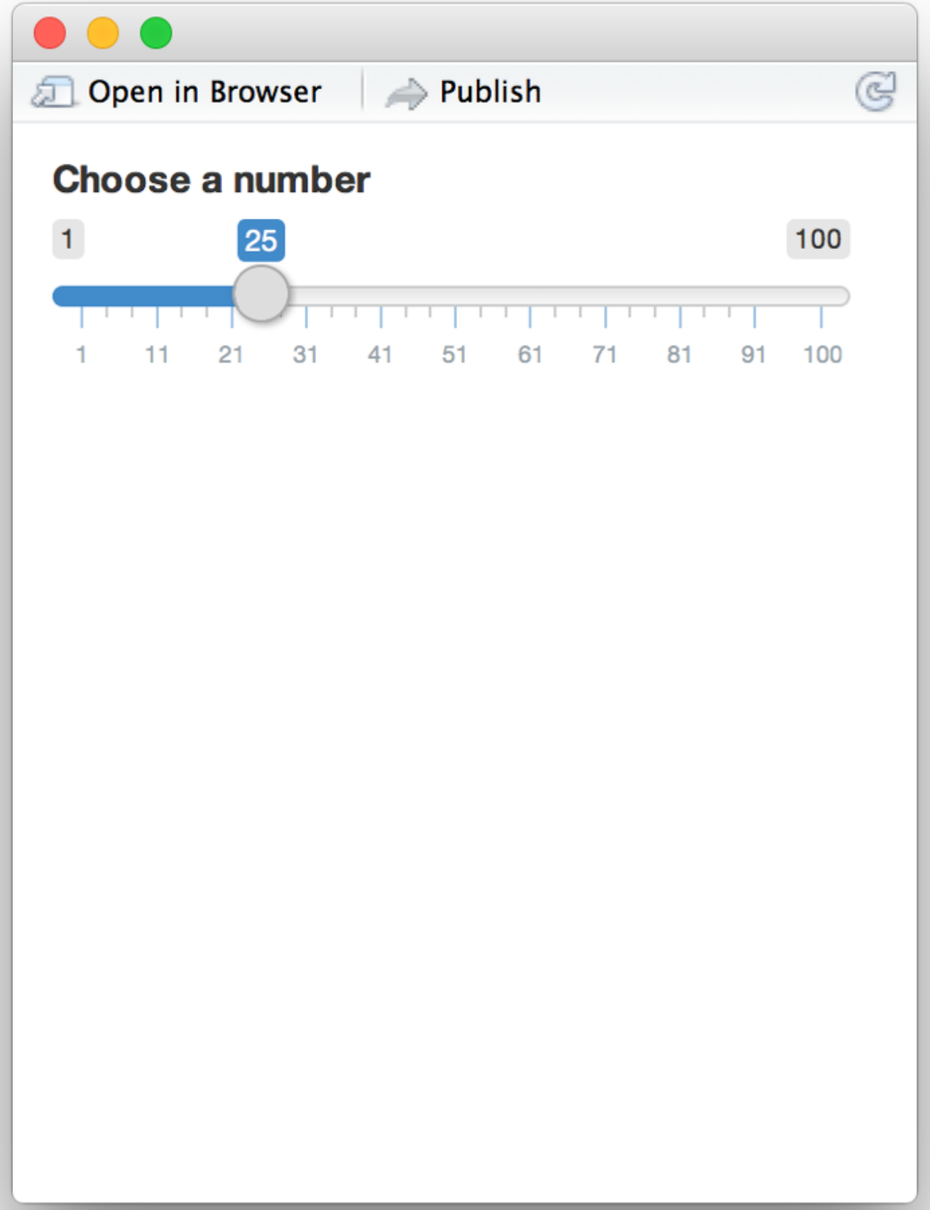


Create an input with an input function.

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

server <- function(input, output) {}

shinyApp(server = server, ui = ui)
```



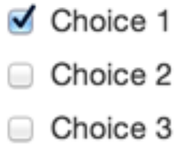
Buttons

`actionButton()`
`submitButton()`

Single checkbox

`checkboxInput()`

Checkbox group



`checkboxGroupInput()`

Date input

`dateInput()`

Date range

`dateRangeInput()`

File input

`fileInput()`

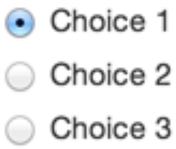
Numeric input

`numericInput()`

Password Input

`passwordInput()`

Radio buttons



`radioButtons()`

Select box

`selectInput()`

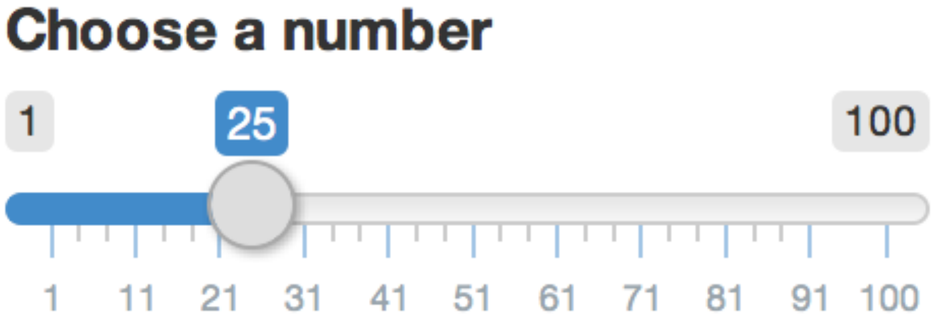
Sliders

`sliderInput()`

Text input

`textInput()`

Syntax




```
sliderInput(inputId = "num", label = "Choose a number", …)
```

input name
(for internal use)

Notice:
Id not ID

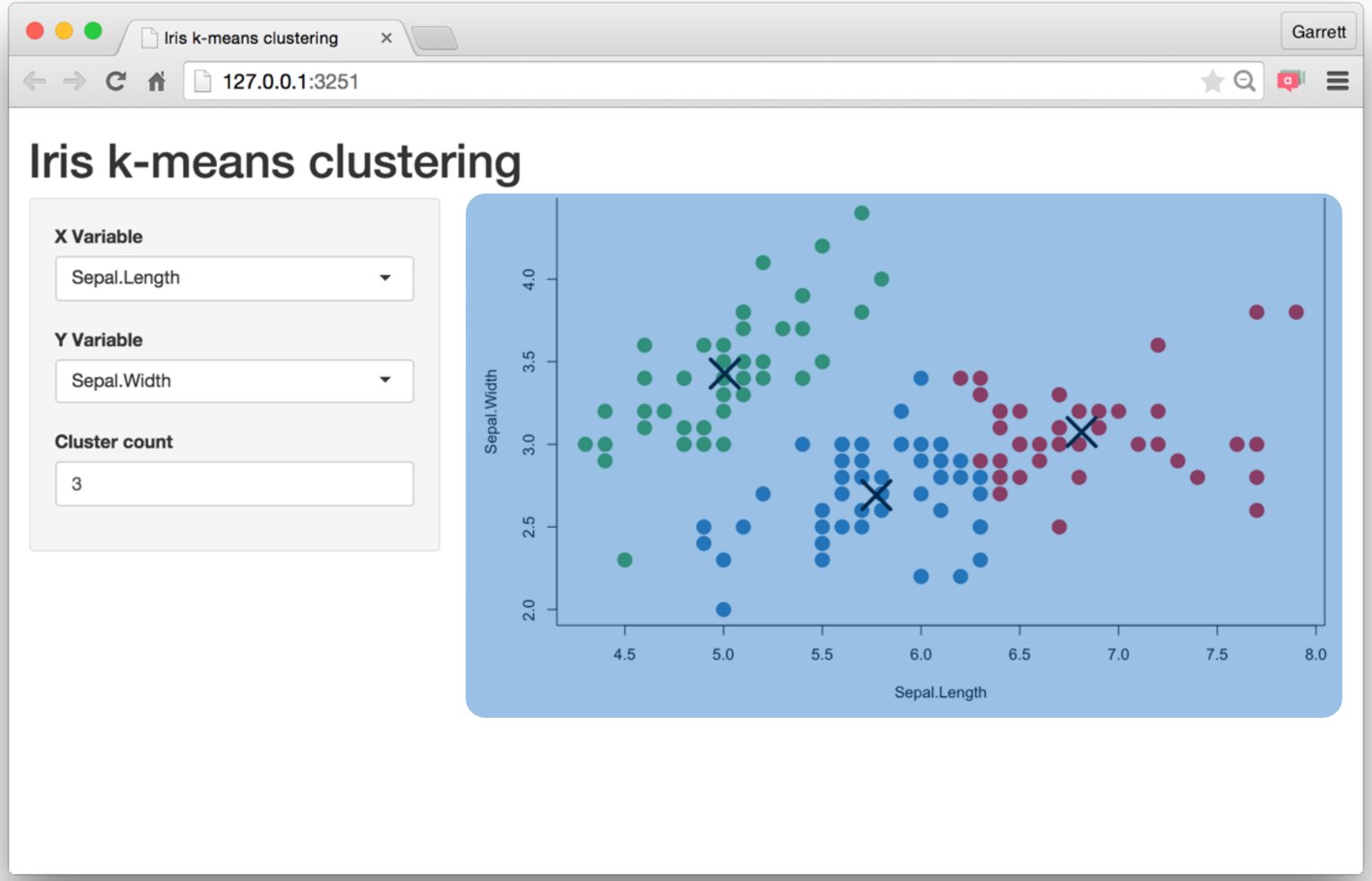
label to display

input specific arguments

```
?sliderInput
```

Outputs

Build your app around **inputs** and **outputs**



Function	Inserts
`dataTableOutput()`	an interactive table
`htmlOutput()`	raw HTML
`imageOutput()`	image
`plotOutput()`	plot
`tableOutput()`	table
`textOutput()`	text
`uiOutput()`	a Shiny UI element
`verbatimTextOutput()`	text

*Output()

To display output, add it to `fluidPage()` with an `*Output()` function

```
plotOutput("hist")
```

the type of output to display

name to give to the output object

```
library(shiny)

ui <- fluidPage(
  sliderInput(inputId = "num",
    label = "Choose a number",
    value = 25, min = 1, max = 100),
  plotOutput("hist")
)

server <- function(input, output) {}

shinyApp(ui = ui, server = server)
```

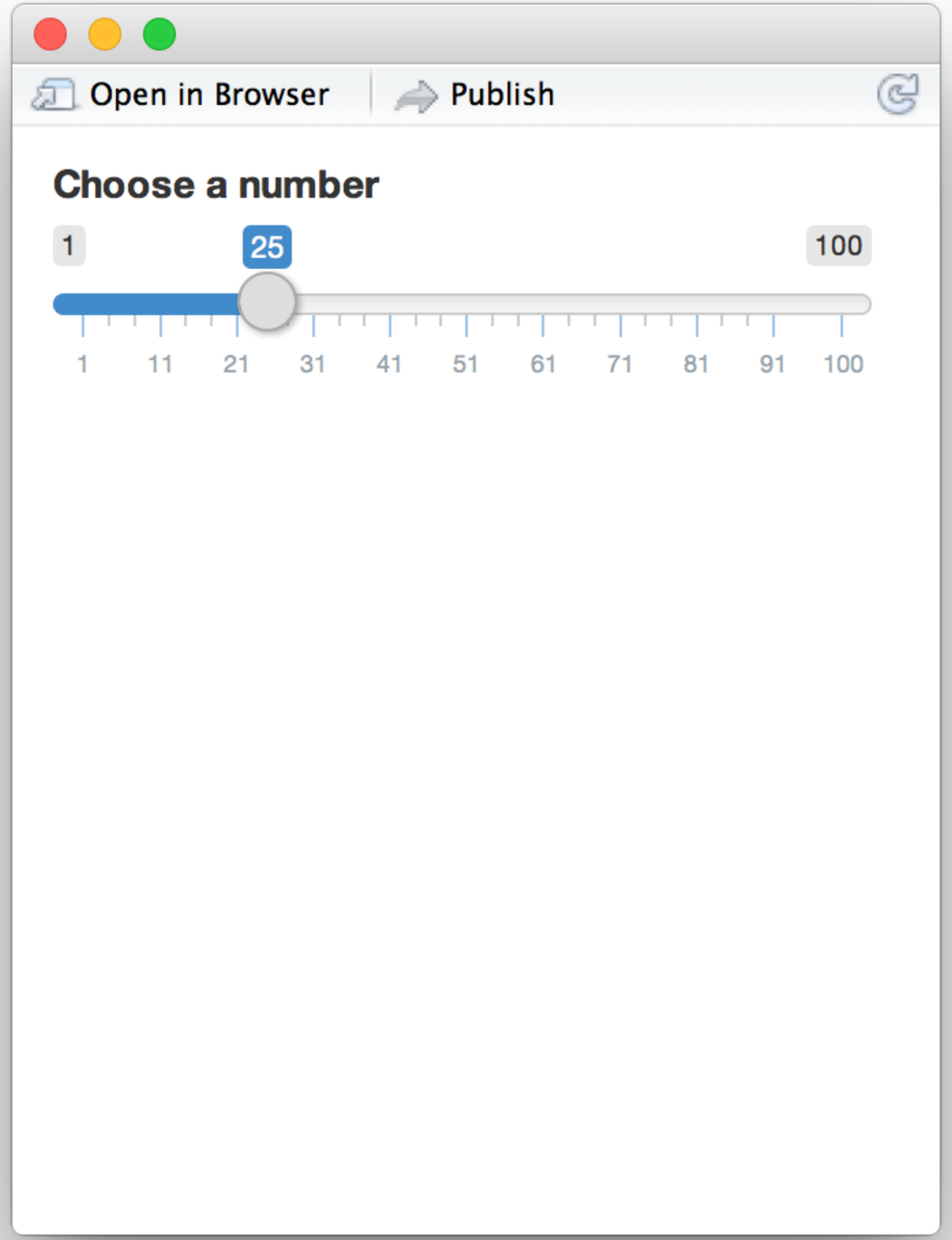
Comma between arguments

```
library(shiny)

ui <- fluidPage(
  sliderInput(inputId = "num",
    label = "Choose a number",
    value = 25, min = 1, max = 100),
  plotOutput("hist")
)

server <- function(input, output) {}

shinyApp(ui = ui, server = server)
```

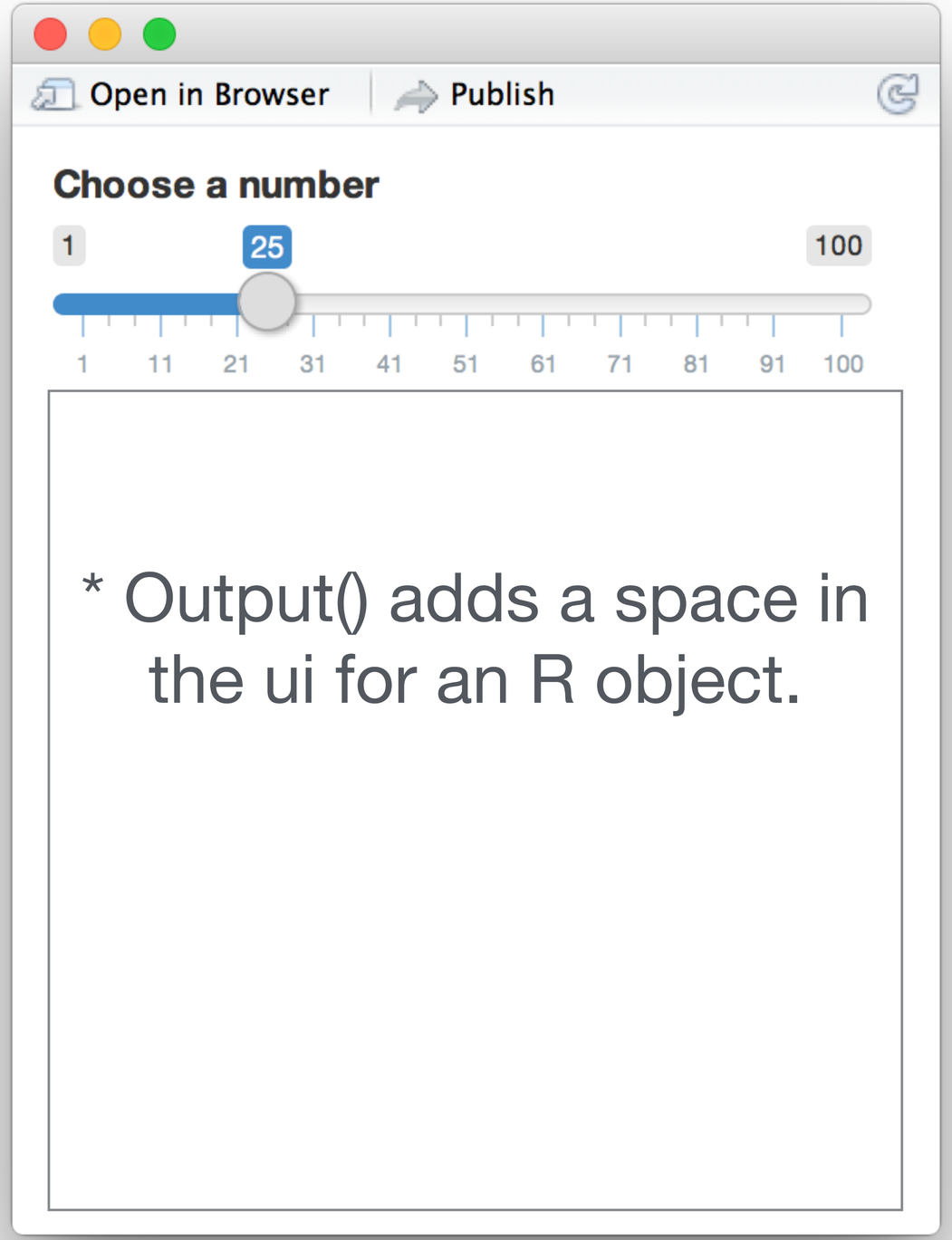


```
library(shiny)

ui <- fluidPage(
  sliderInput(inputId = "num",
    label = "Choose a number",
    value = 25, min = 1, max = 100),
  plotOutput("hist")
)

server <- function(input, output) {}

shinyApp(ui = ui, server = server)
```

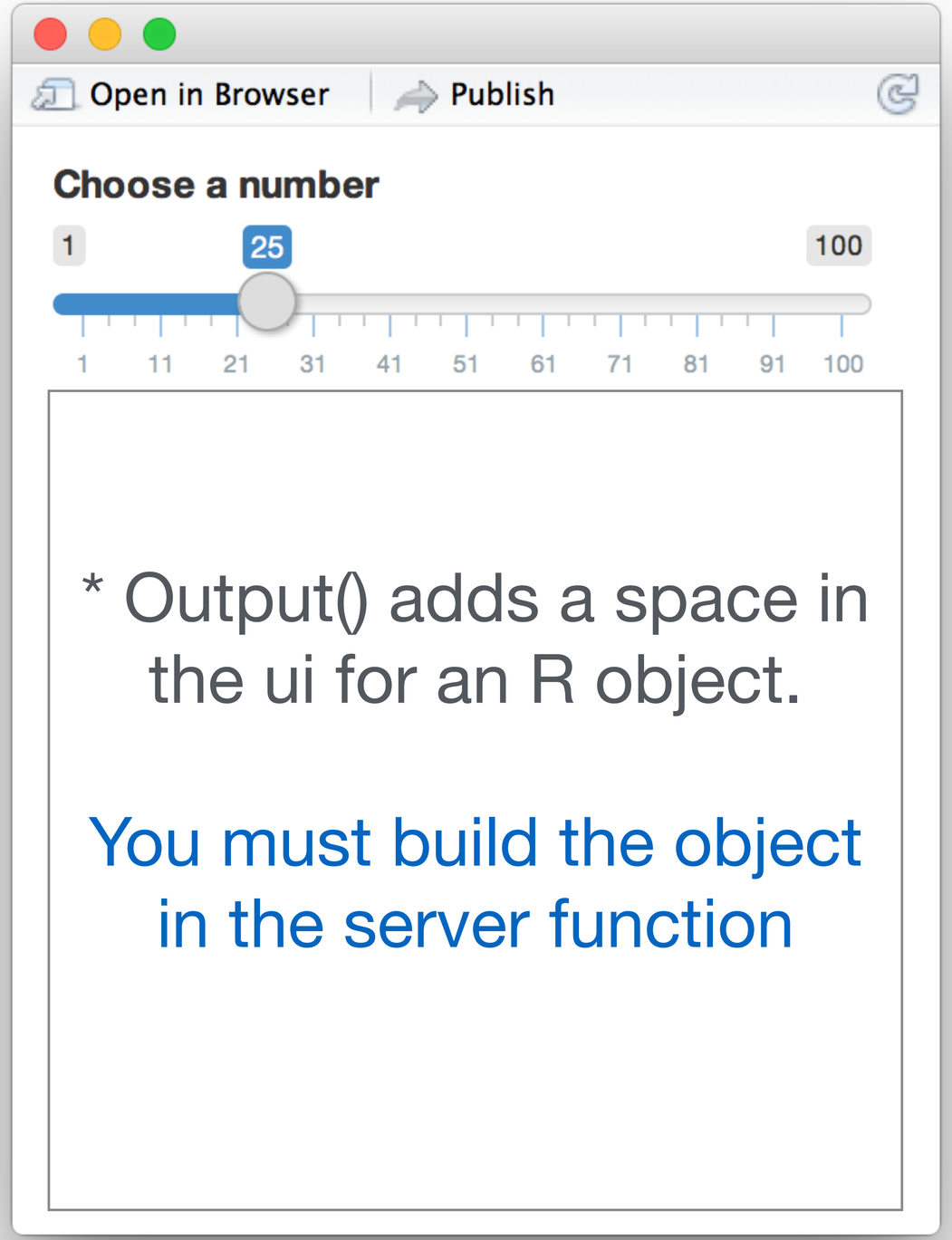


```
library(shiny)

ui <- fluidPage(
  sliderInput(inputId = "num",
    label = "Choose a number",
    value = 25, min = 1, max = 100),
  plotOutput("hist")
)

server <- function(input, output) {}

shinyApp(ui = ui, server = server)
```

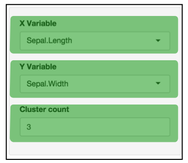


Recap

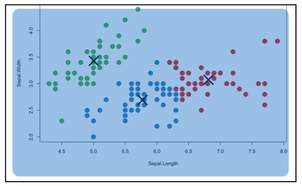
```
library(shiny)
ui <- fluidPage()
server <- function(input, output) {}
shinyApp(ui = ui, server = server)
```

Begin each app with the template

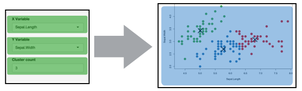
Add elements as arguments to **fluidPage()**



Create reactive inputs with an ***Input()** function



Display reactive results with an ***Output()** function



Assemble outputs from inputs in the server function

Tell the

server

how to assemble
inputs into outputs

Use 3 rules to write the server function

```
server <- function(input, output) {




}
```

1 Save objects to display to output$

```
server <- function(input, output) {
  output$hist <- # code



}
```

1 Save objects to display to output$

```
output$hist
```

```
plotOutput("hist")
```

2

Build objects to display with **render*()**

```
server <- function(input, output) {
  output$hist <- renderPlot({


  })
}
```

Use the **render*()** function that creates the type of output you wish to make.

function	creates
`renderDataTable()`	An interactive table (from a data frame, matrix, or other table-like structure)
`renderImage()`	An image (saved as a link to a source file)
`renderPlot()`	A plot
`renderPrint()`	A code block of printed output
`renderTable()`	A table (from a data frame, matrix, or other table-like structure)
`renderText()`	A character string
`renderUI()`	a Shiny UI element

render*()

Builds reactive output to display in UI

```
renderPlot({ hist(rnorm(100)) })
```

type of object to build

code block that builds the object

2

Build objects to display with **render*()**

```
server <- function(input, output) {
  output$hist <- renderPlot({
    hist(rnorm(100))
  })
}
```

2

Build objects to display with **render*()**

```
server <- function(input, output) {
  output$hist <- renderPlot({
    title <- "100 random normal values"
    hist(rnorm(100), main = title)
  })
}
```

3

Access **input** values with input$

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

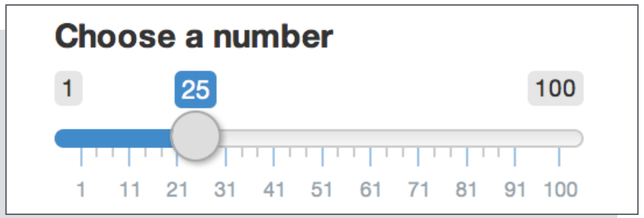
3 Access **input** values with input$

```
sliderInput(inputId = "num",…)
```

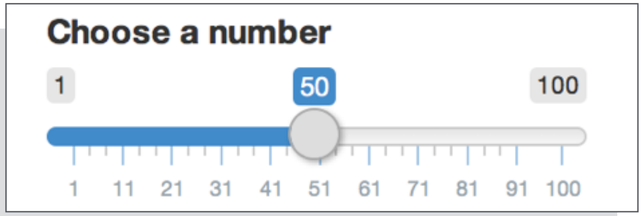
```
input$num
```

Input values

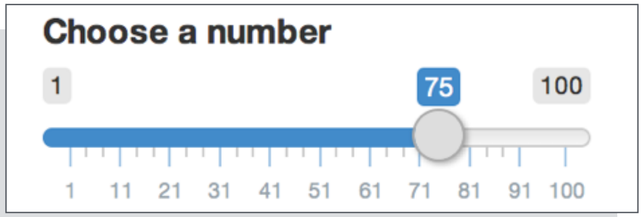
The input value changes whenever a user changes the input.




```
input$num = 25
```



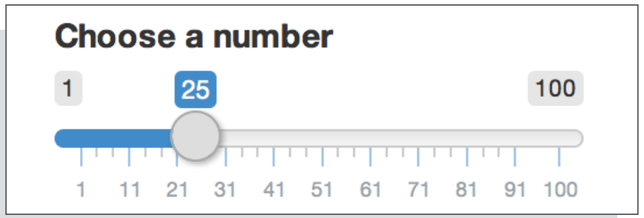

```
input$num = 50
```



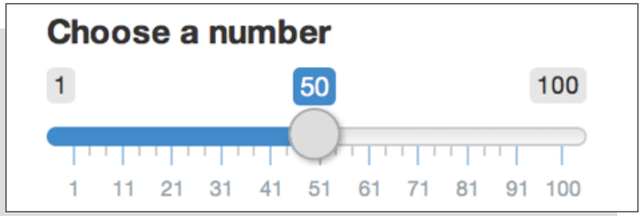

```
input$num = 75
```

Input values

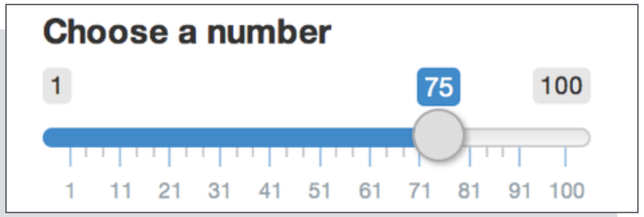
The input value changes whenever a user changes the input.




```
input$num = 25
```




```
input$num = 50
```



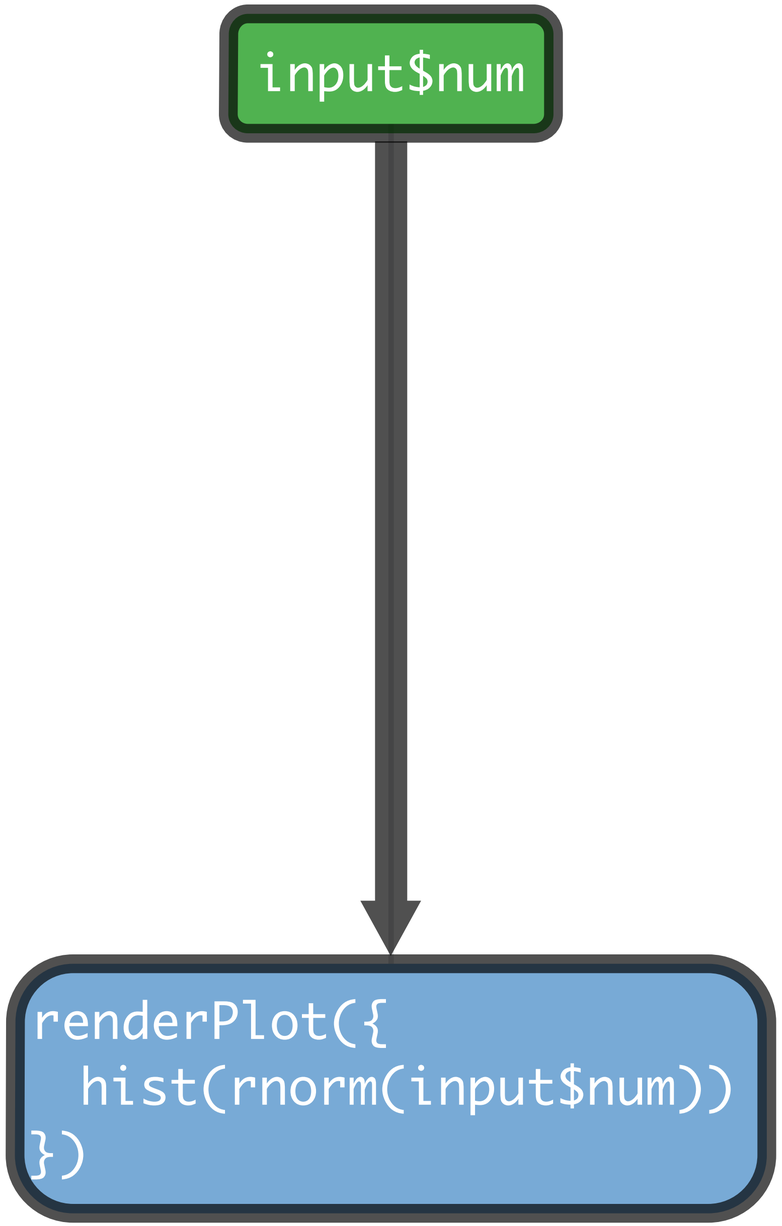

```
input$num =
```

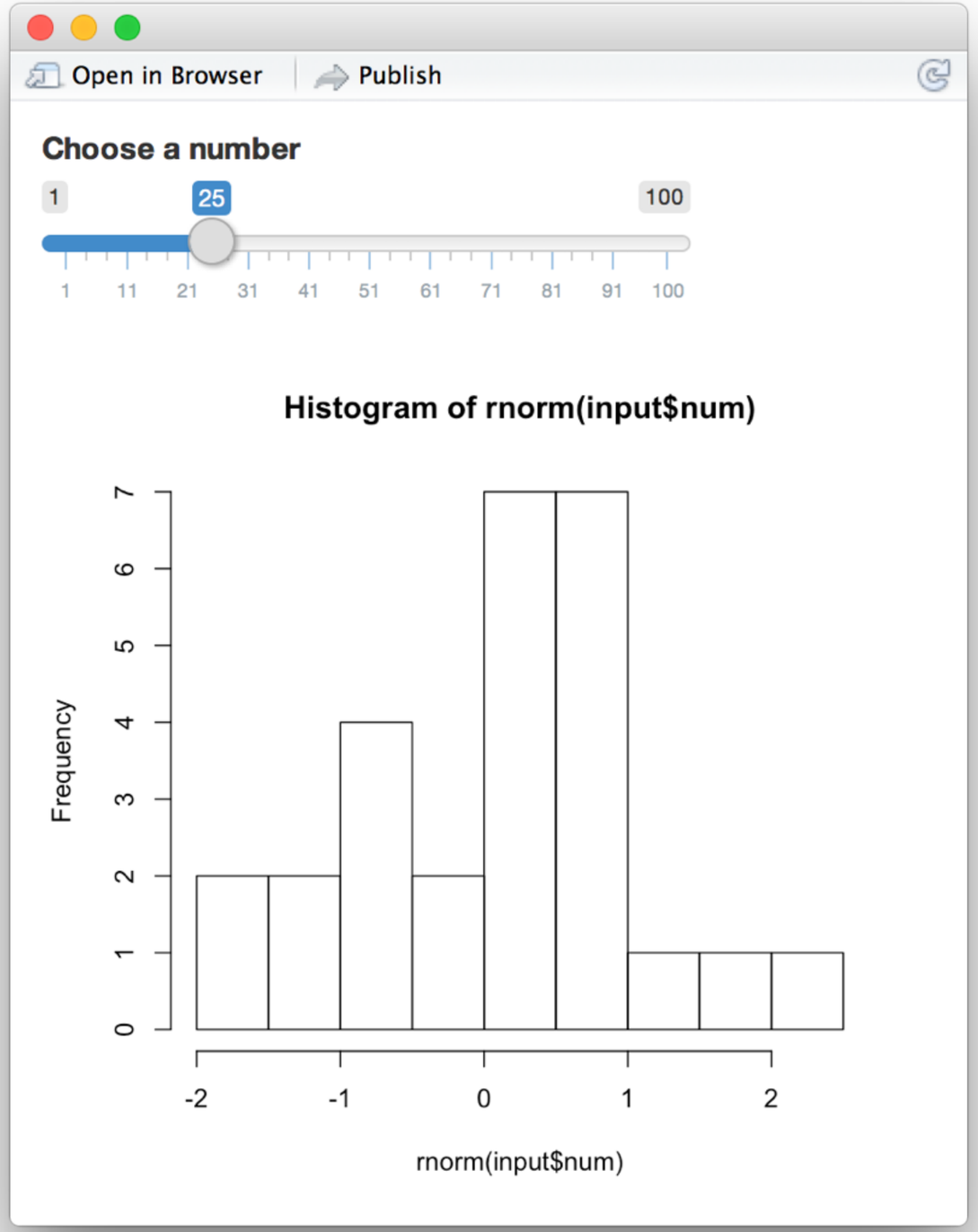
Output will automatically update if you follow the 3 rules

Reactivity 101

Reactivity automatically occurs whenever you use an input value to render an output object

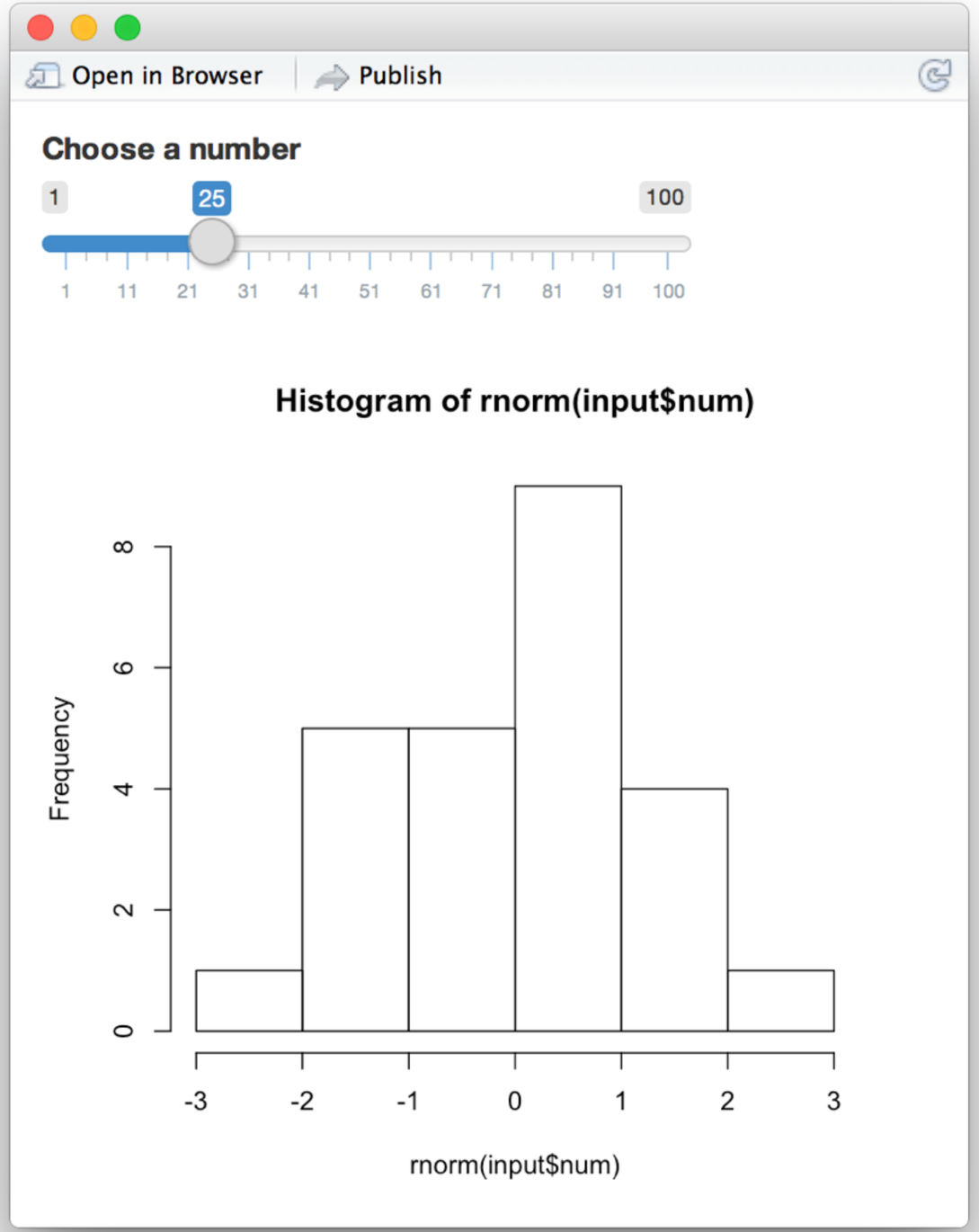
```
function(input, output) {
  output$hist <- renderPlot({
    hist(rnorm(input$num))
  })
})
```





input$num

```
renderPlot({
  hist(rnorm(input$num))
})
```



Recap: Server

Use the server function to assemble inputs into outputs. Follow 3 rules:

`output$hist <-`

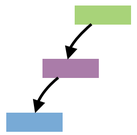
1. Save the output that you build to **output$**

```
renderPlot({
  hist(rnorm(input$num))
})
```

2. Build the output with a **render*()** function

`input$num`

3. Access input values with **input$**

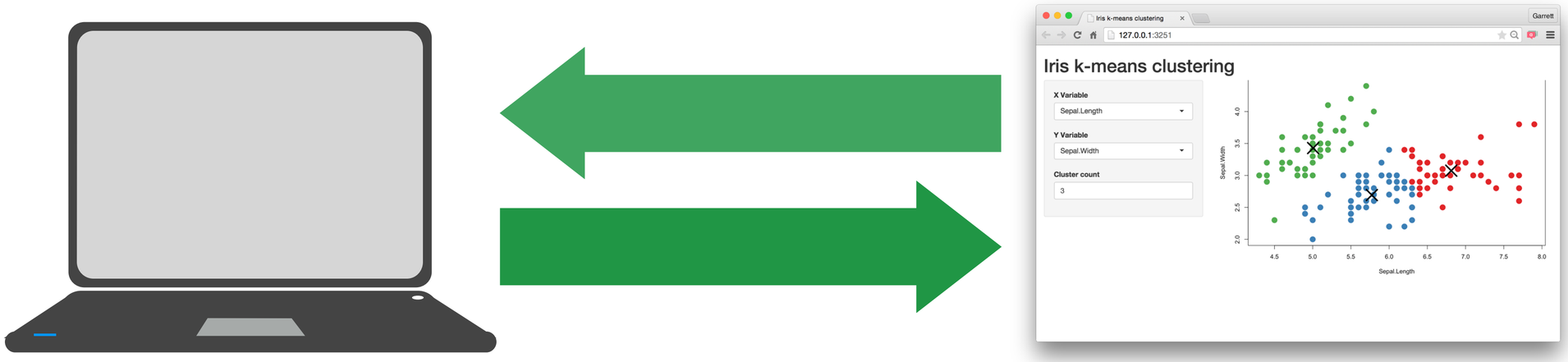


Create reactivity by using **Inputs** to build **rendered Outputs**

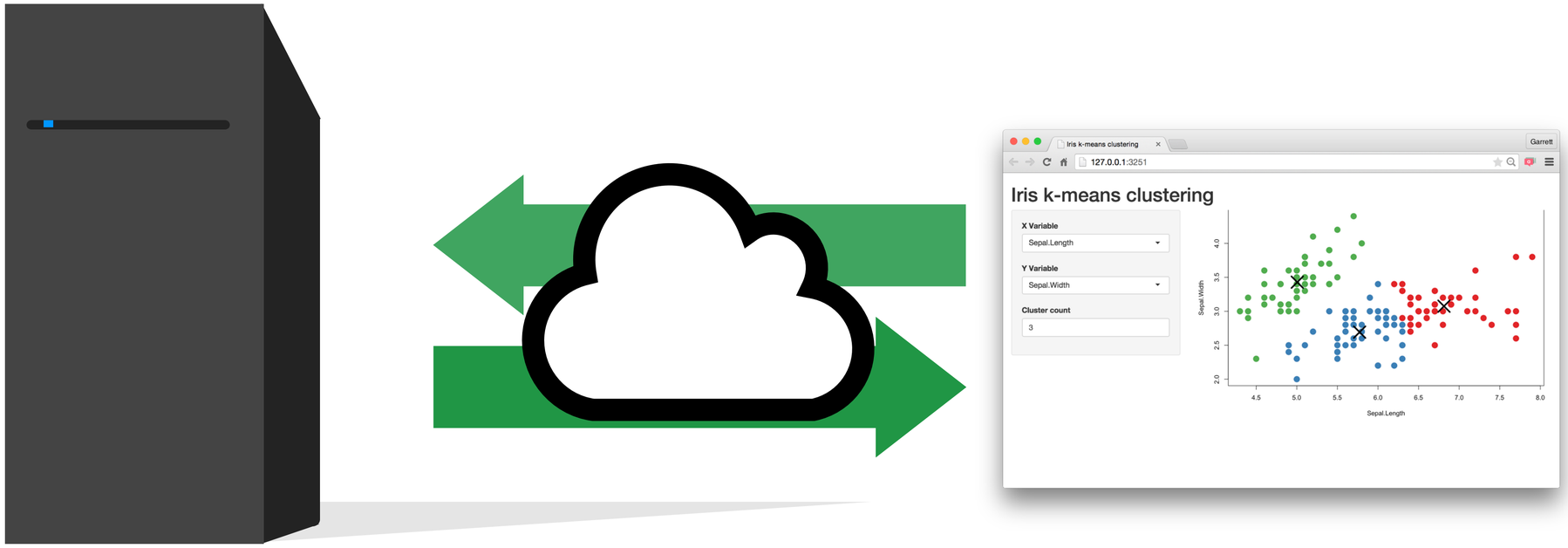
Share

your app

Every Shiny app is maintained by a computer running R



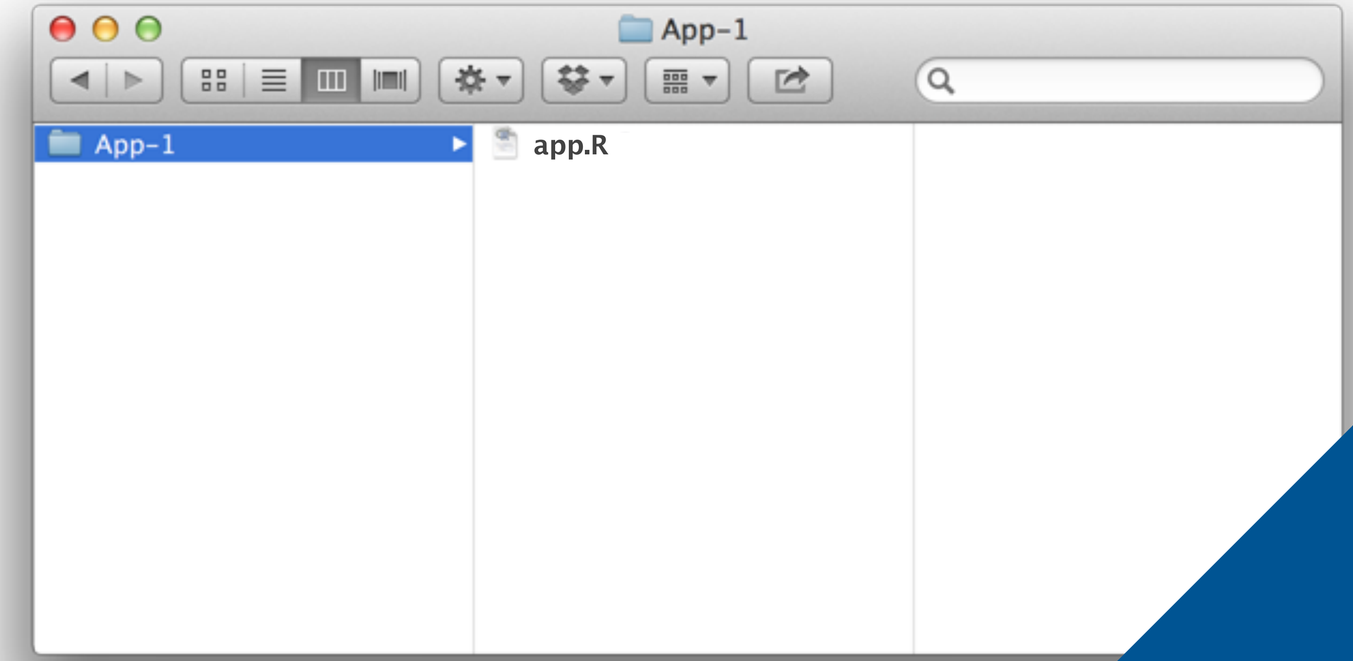
Every Shiny app is maintained by a computer running R



How to save your app

One directory with every file the app needs:

- app.R *(your script which ends with a call to shinyApp())*
- datasets, images, css, helper scripts, etc.



You must use this exact name (**app.R**)

Two file apps

```
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)
```

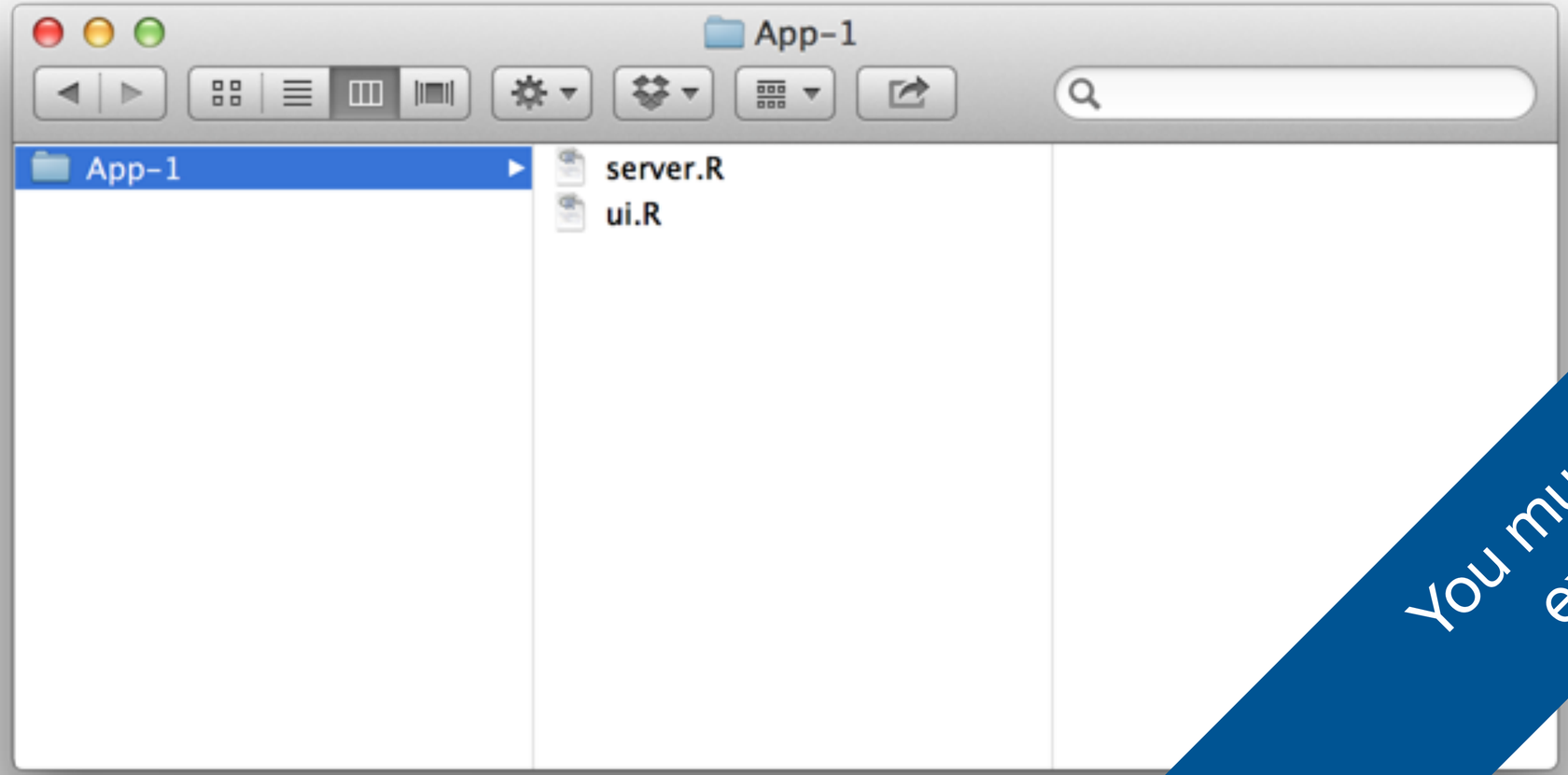
```
# ui.R
library(shiny)
fluidPage(
  sliderInput(inputId = "num",
    label = "Choose a number",
    value = 25, min = 1, max = 100),
  plotOutput("hist")
)
```

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

Two file apps

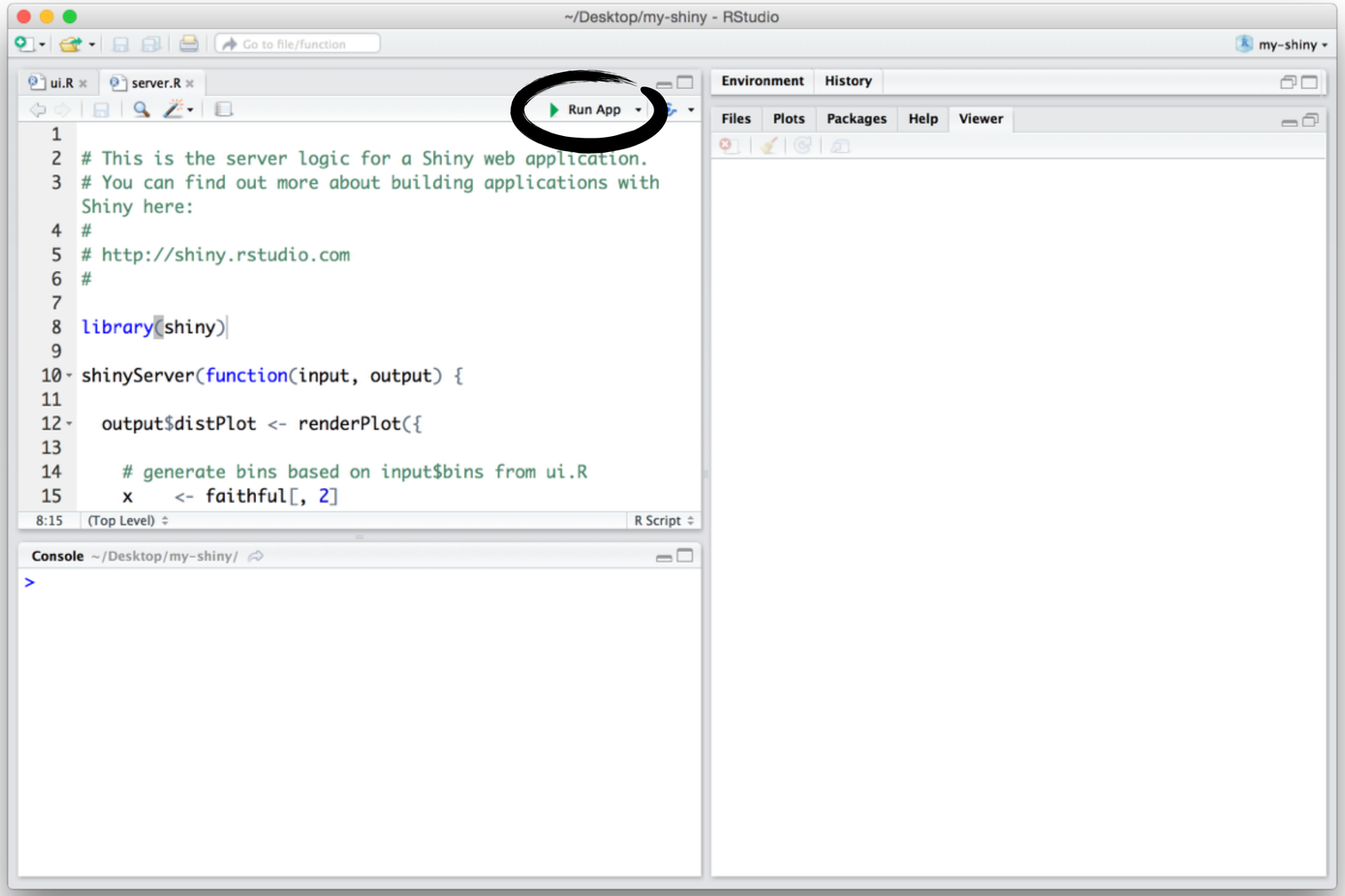
One directory with two files:

- server.R
- ui.R

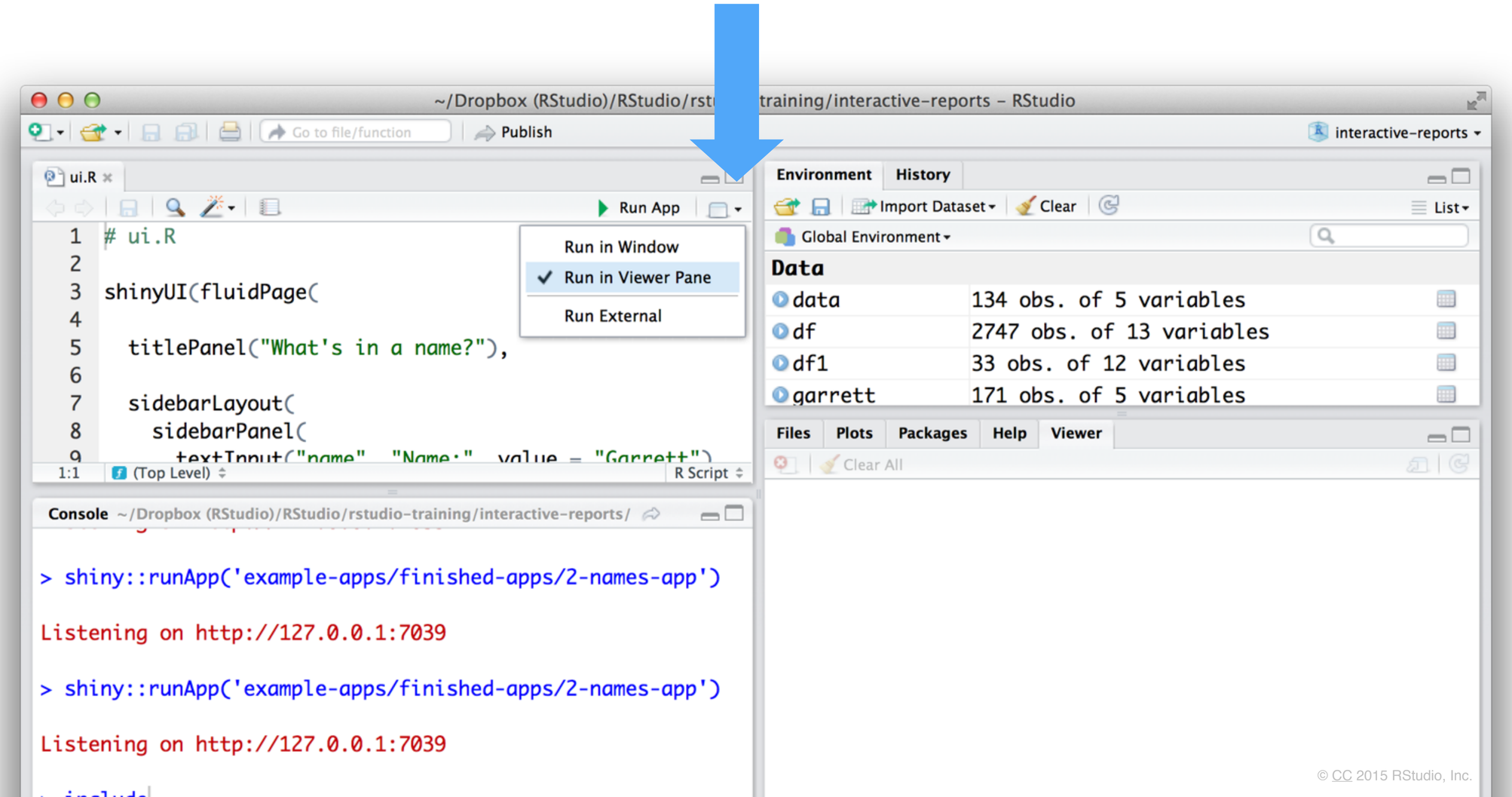


You must use these exact names

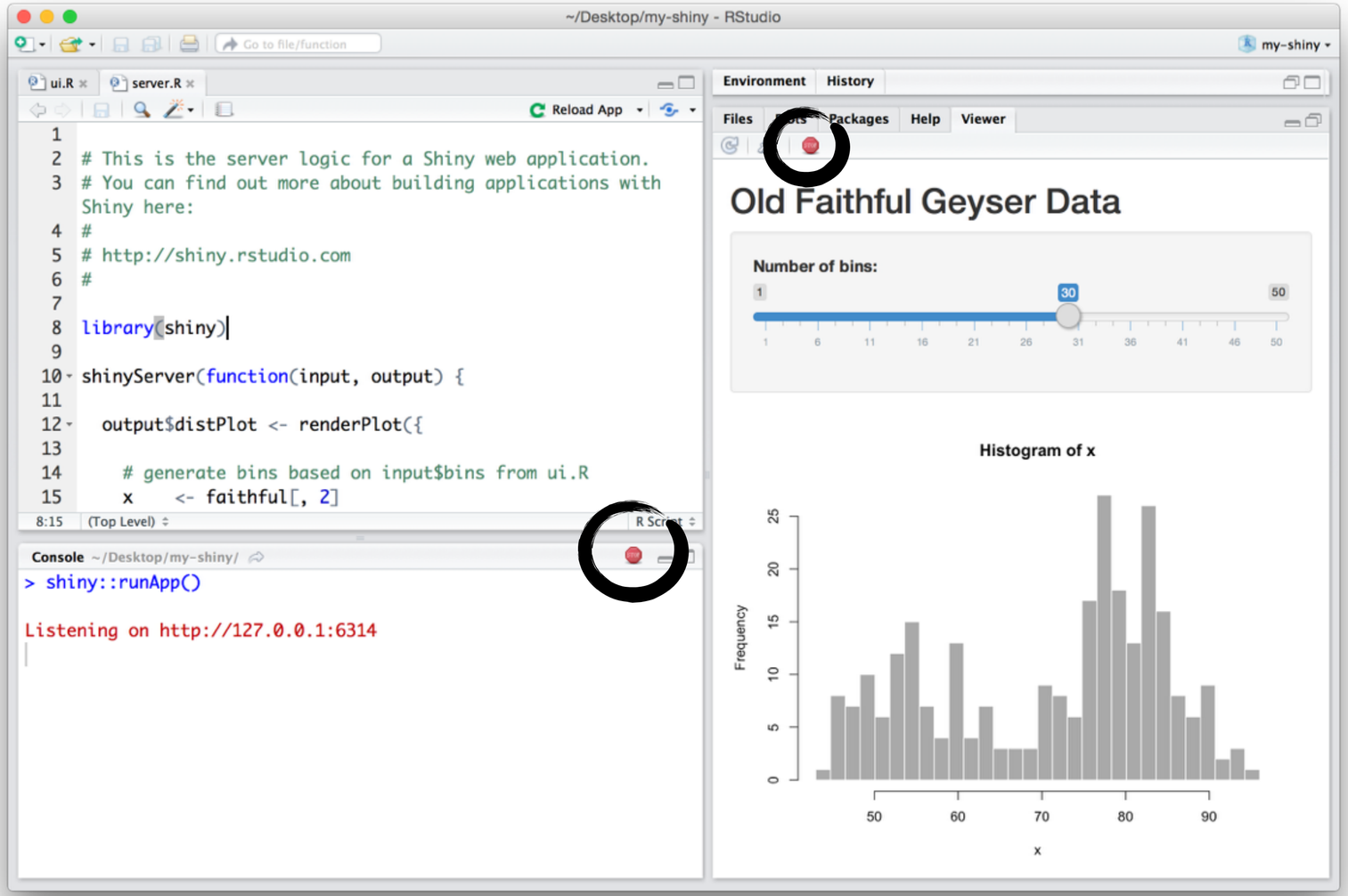
Launch an app



Display options

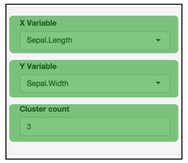


Close an app

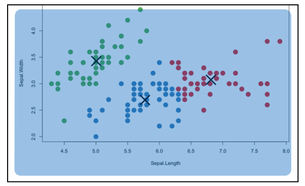


Learn more

You now how to



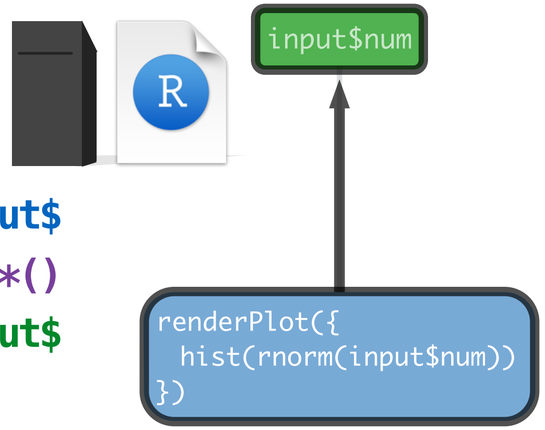

```
library(shiny)
ui <- fluidPage()
server <- function(input, output) {}
shinyApp(ui = ui, server = server)
```



*Input()

*Output()

Build an app



Create interactions

Share your apps

How to start with Shiny

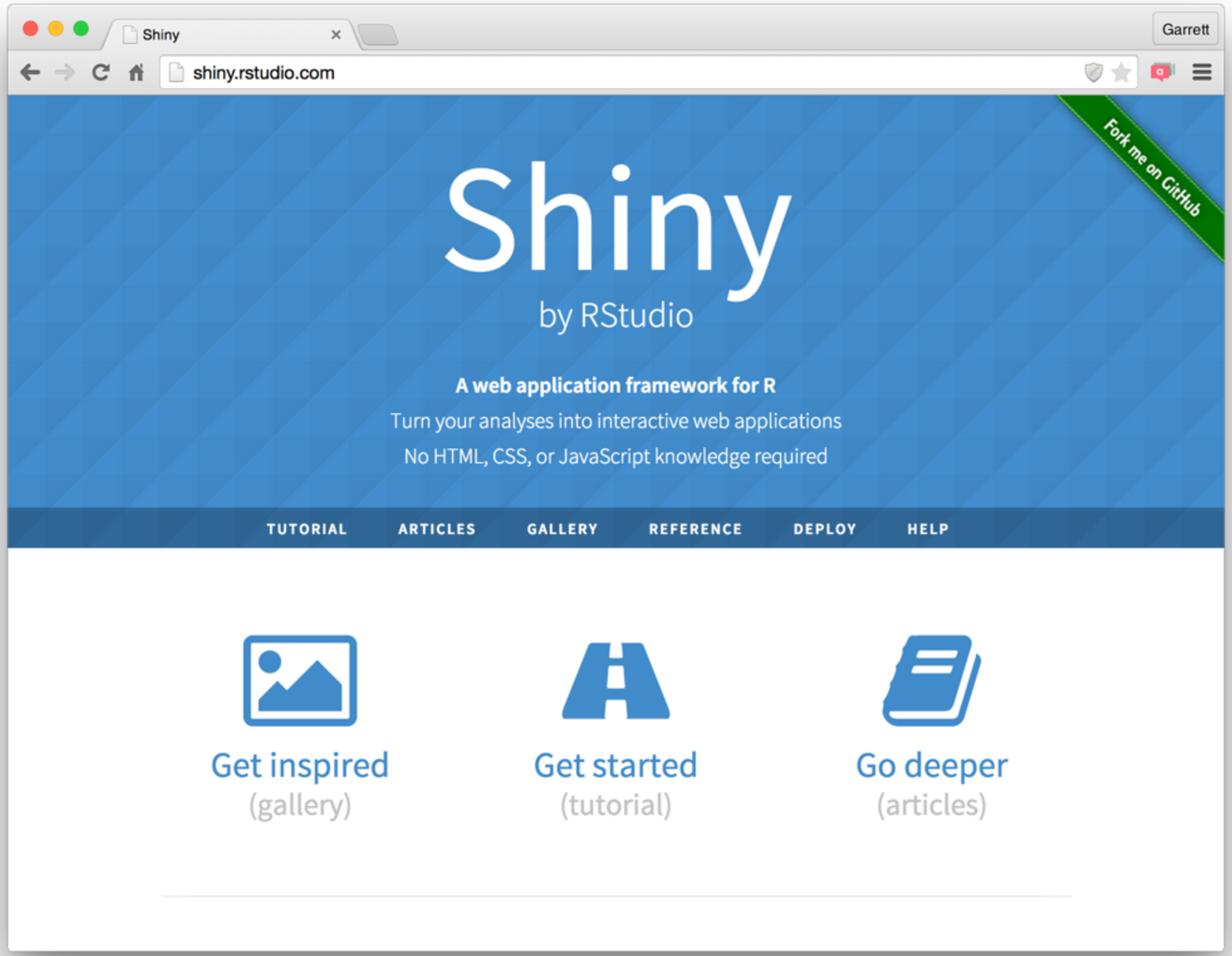
1. How to build a Shiny app (Today)

2. How to customize reactions (May 27)

3. How to customize appearance (June 3)

The Shiny Development Center

shiny.rstudio.com



Questions?

Have a great weekend!