Getting started with Shiny

Mine Çetinkaya-Rundel

@minebocek
mine-cetinkaya-rundel
mine@stat.duke.edu

`jsm18-sched/app.R`

DEMO

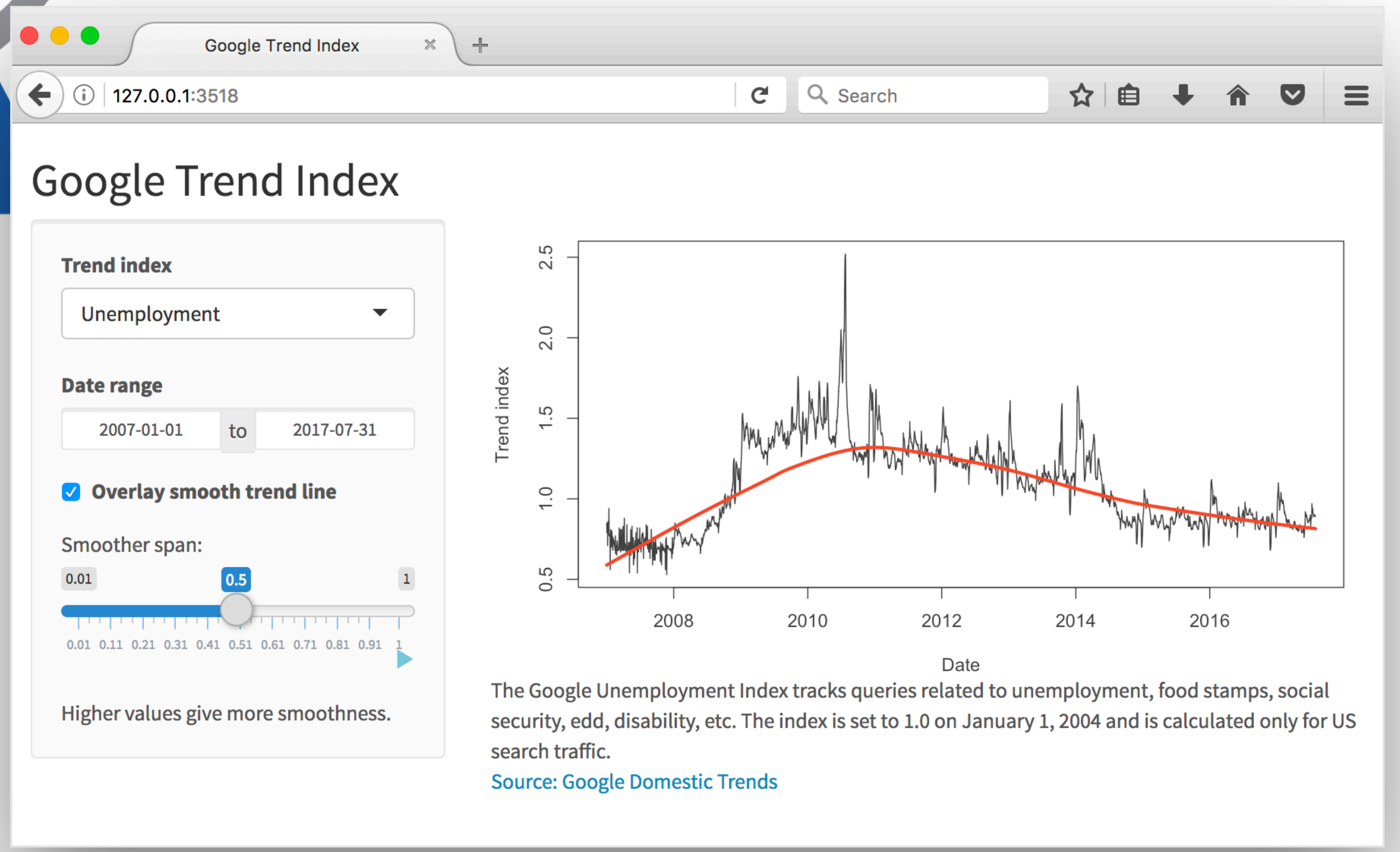
Your turn

- Open a new Shiny app with File ➔ New File ➔ Shiny Web App…
- Launch the app by opening `app.R` and clicking Run App
- Close the app by clicking the stop icon
- Select view mode in the drop down menu next to Run App

3m 00s

High level view

Every Shiny app has a webpage that the user visits, and behind this webpage there is a computer that serves this webpage by running R.



Google Trend Index

Trend index: Unemployment

Date range: 2007-01-01 to 2017-07-31

- [✓] Overlay smooth trend line

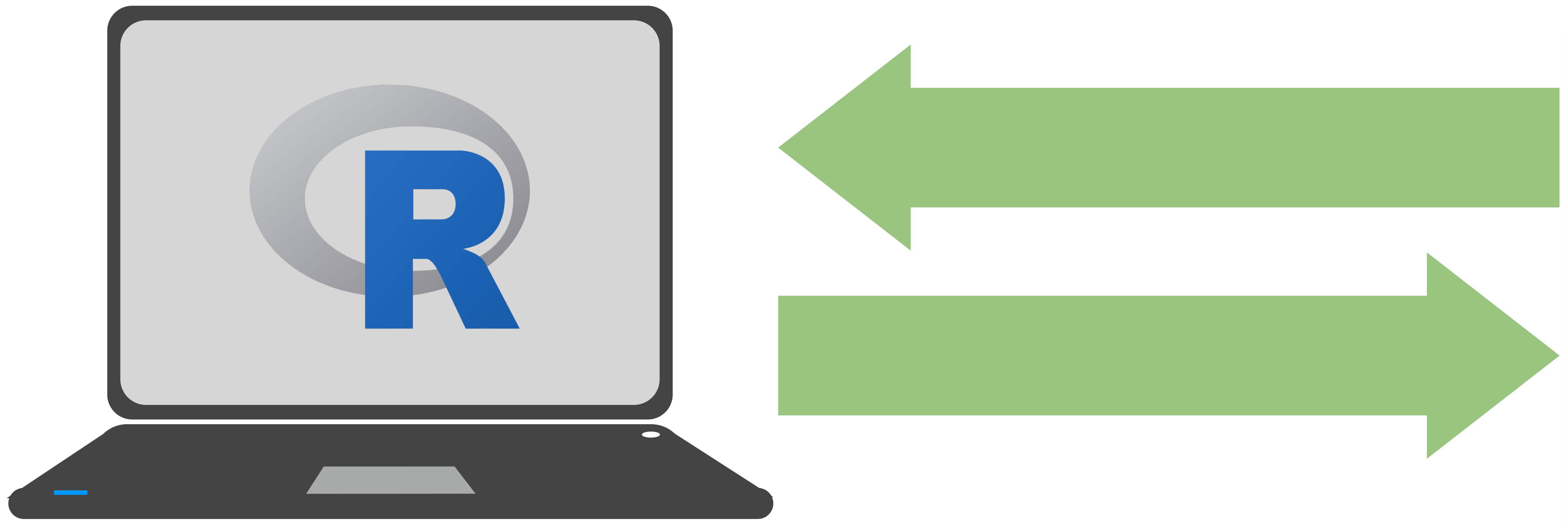
Smoother span: 0.5 (0.01 – 1)

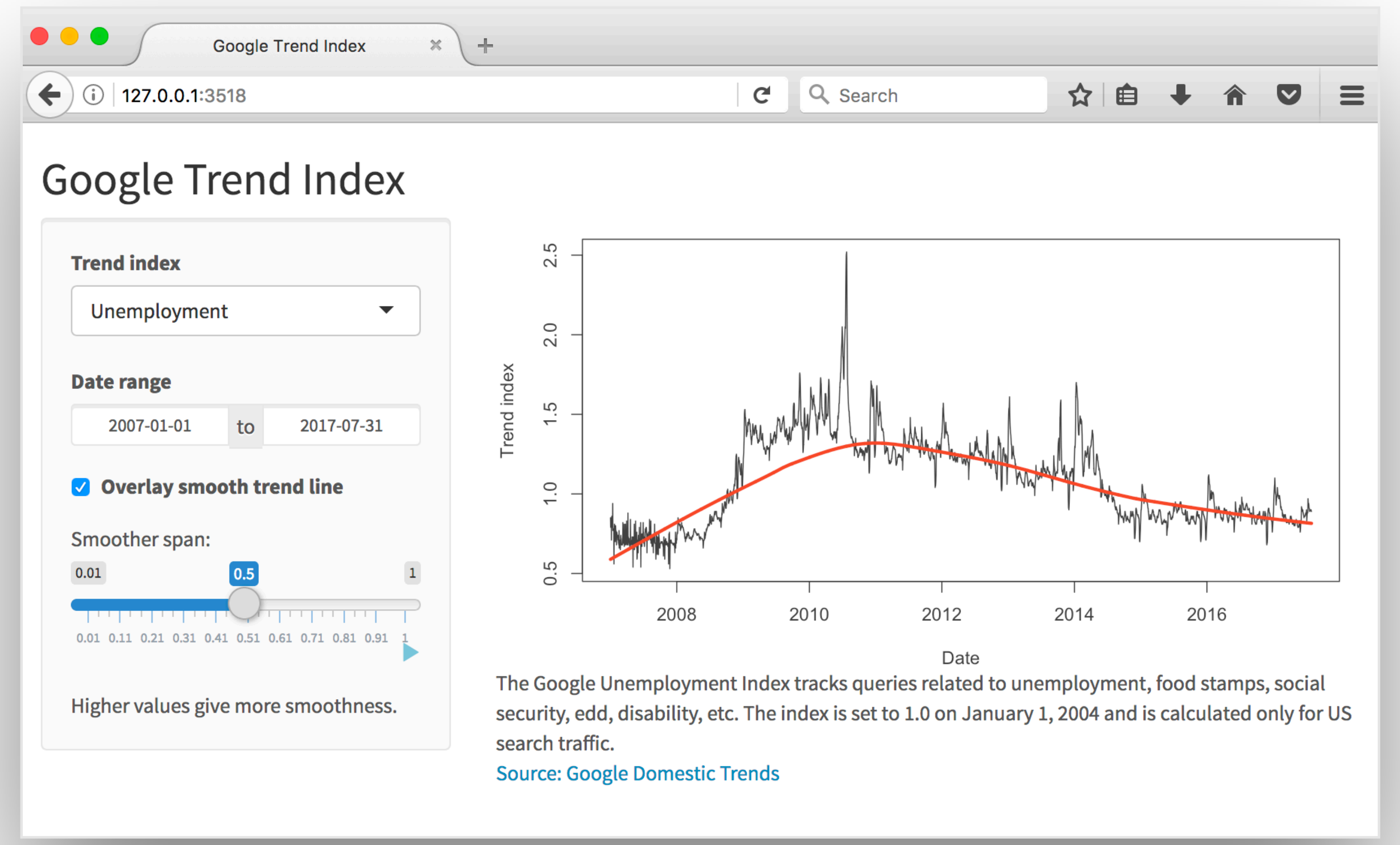
Higher values give more smoothness.

The Google Unemployment Index tracks queries related to unemployment, food stamps, social security, edd, disability, etc. The index is set to 1.0 on January 1, 2004 and is calculated only for US search traffic.

Source: Google Domestic Trends

When running your app locally, the computer serving your app is your computer.





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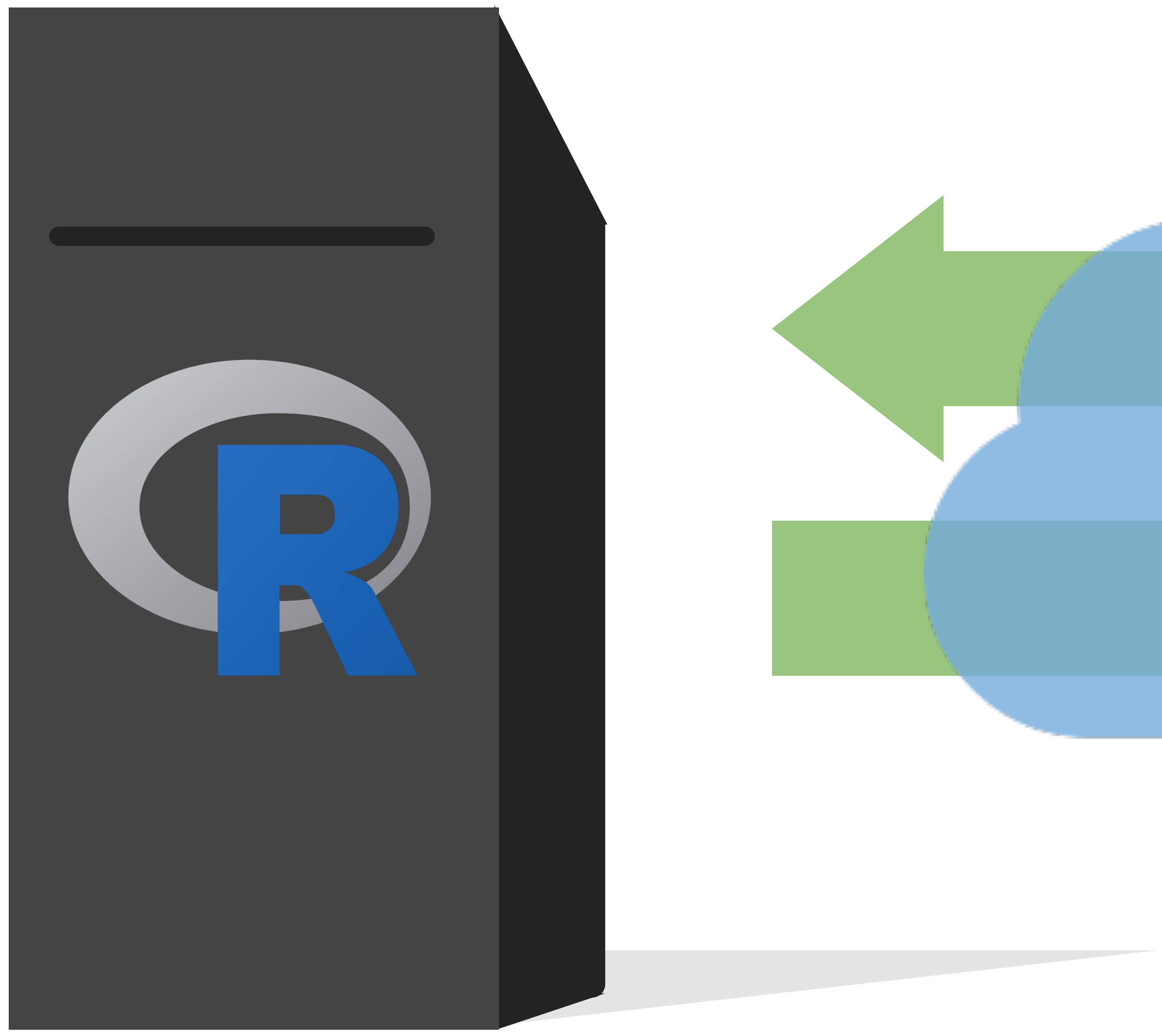
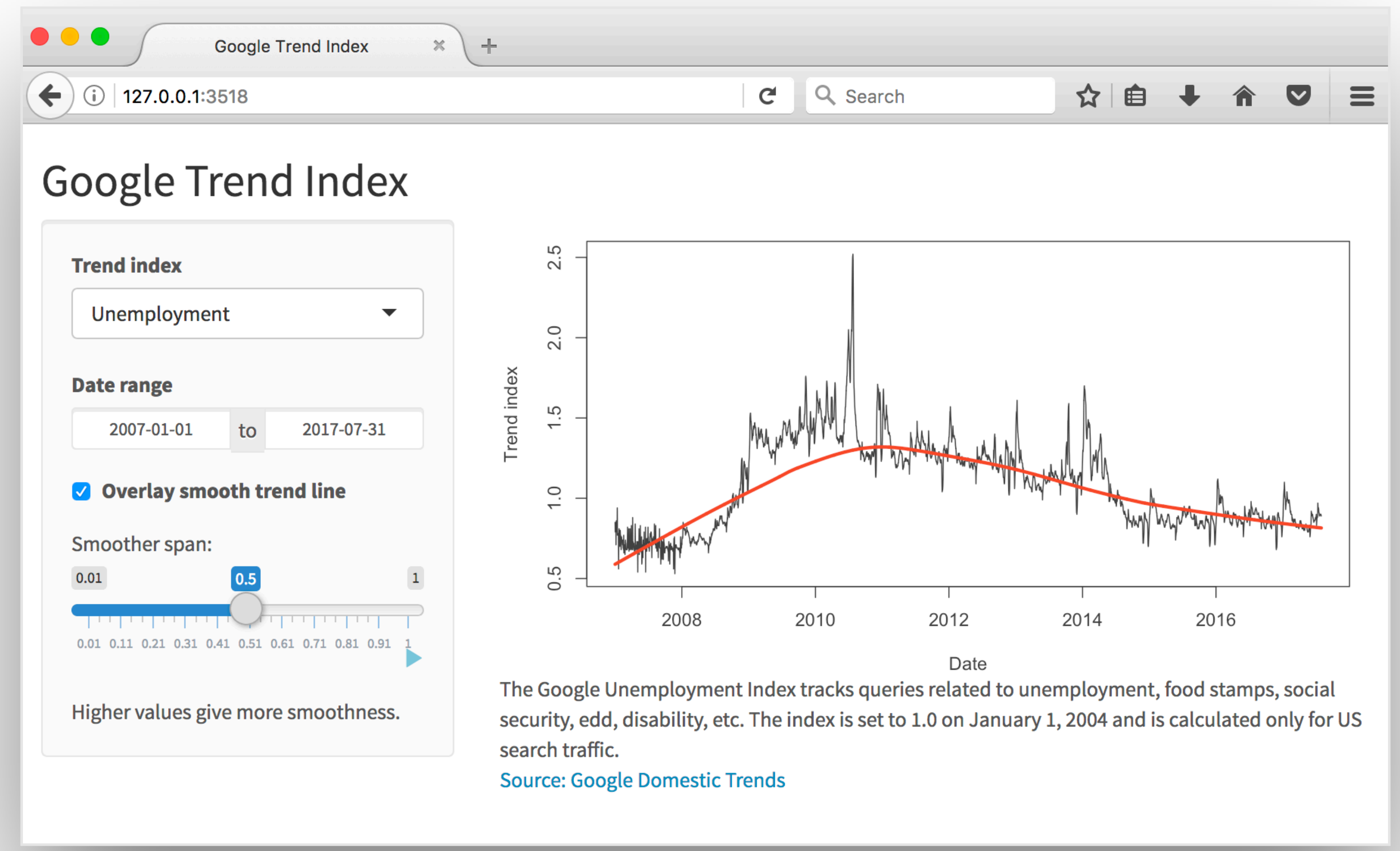
The Google Unemployment Index tracks queries related to unemployment, food stamps, social security, edd, disability, etc. The index is set to 1.0 on January 1, 2004 and is calculated only for US search traffic.

Source: Google Domestic Trends

When your app is deployed, the computer serving your app is a web server.





Google Trend Index

Trend index: Unemployment

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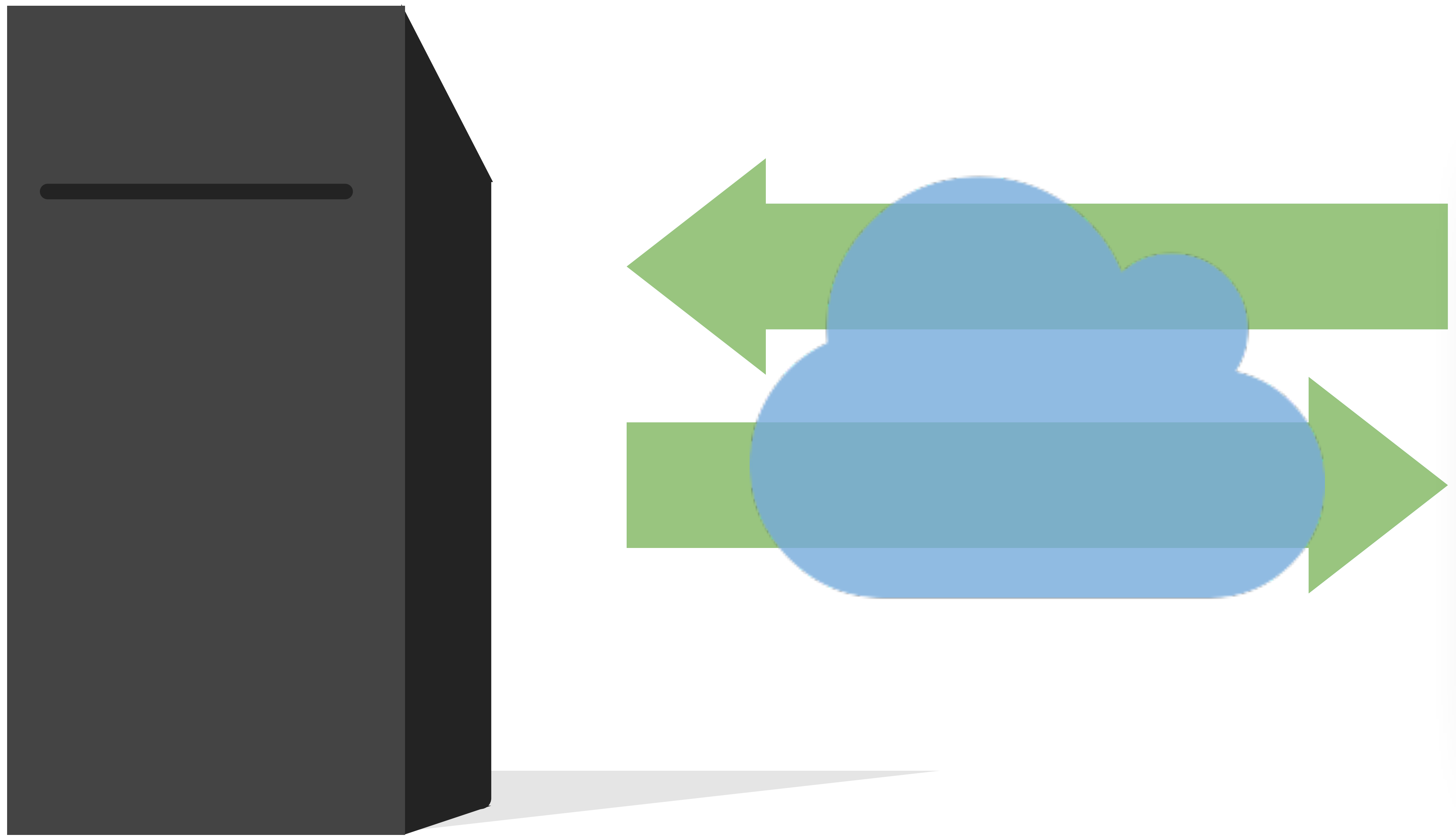

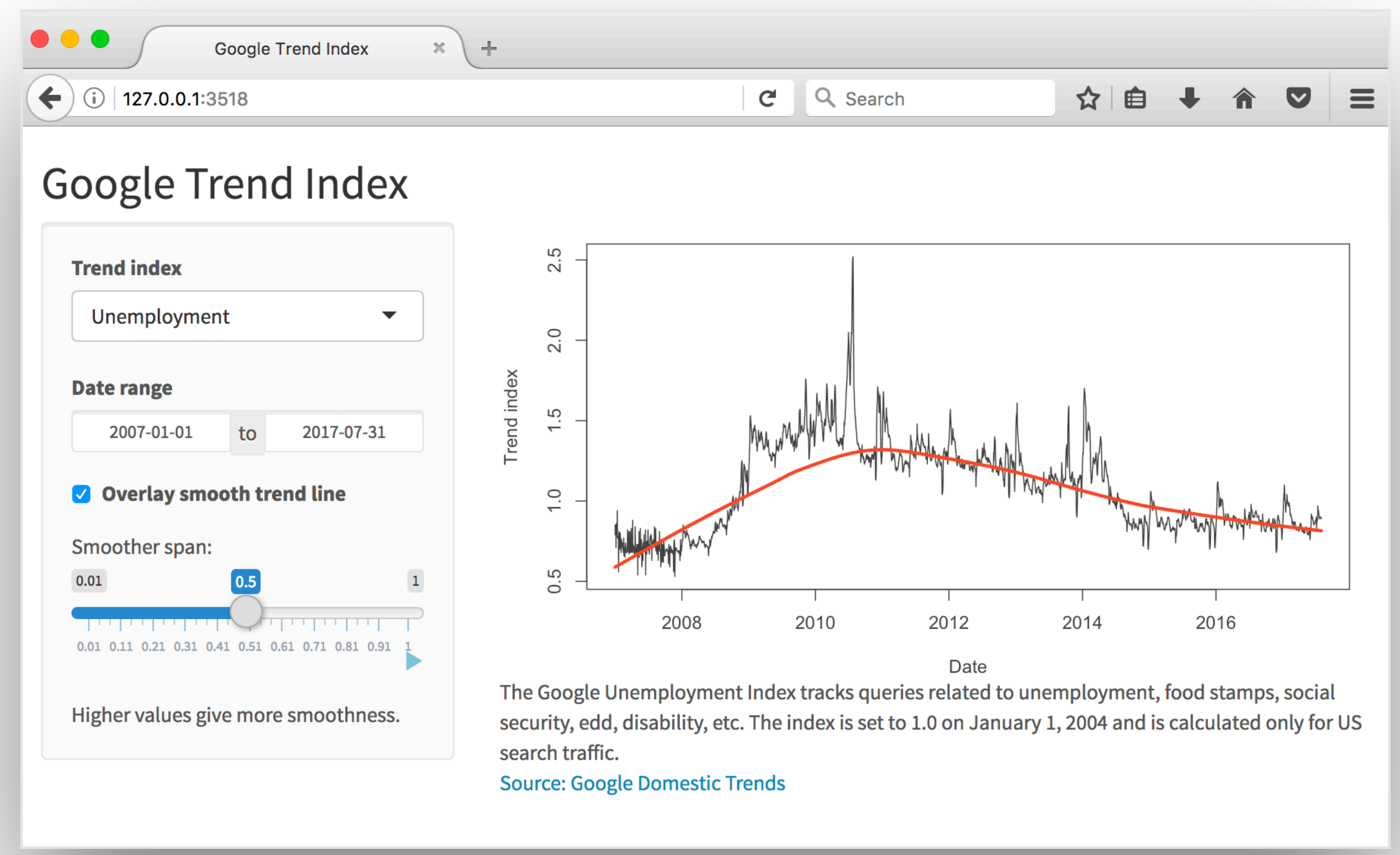

Google Trend Index

Trend index: Unemployment

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Higher values give more smoothness.

The Google Unemployment Index tracks queries related to unemployment, food stamps, social security, edd, disability, etc. The index is set to 1.0 on January 1, 2004 and is calculated only for US search traffic.

Source: Google Domestic Trends

Server instructions

User interface

Anatomy of a Shiny app

What's in an app?

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


server <- function(input, output) {}


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

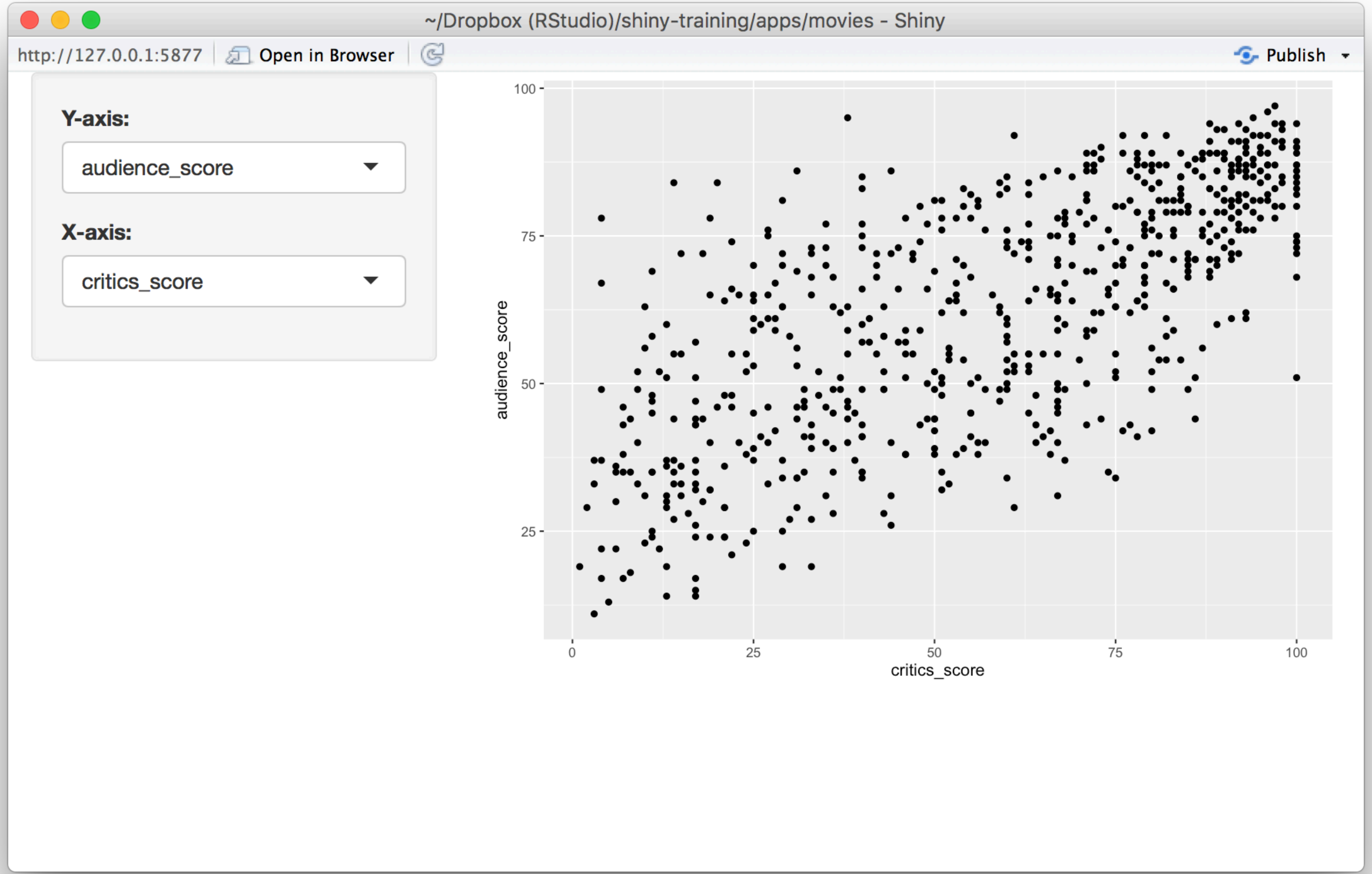
User interface
controls the layout and appearance of app

Server function
contains instructions needed to build app

Let's build a simple movie browser app!

`movies-apps/data/movies.Rdata`

Data from IMDB and Rotten Tomatoes on random sample of 651 movies released in the US between 1970 and 2014


~/Dropbox (RStudio)/shiny-training/apps/movies - Shiny

http://127.0.0.1:5877 Open in Browser Publish

Y-axis: audience_score

X-axis: critics_score

App template

```
library(shiny)
library(tidyverse)
load(“data/movies.Rdata")
ui <- fluidPage()

server <- function(input, output) {}

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

Dataset used for this app

User interface

```
# Define UI
ui <- fluidPage(

  # Sidebar layout with a input and output definitions
  sidebarLayout(
    # Inputs: Select variables to plot
    sidebarPanel(
      # Select variable for y-axis
      selectInput(inputId = "y", label = "Y-axis:",
                  choices = c("imdb_rating", "imdb_num_votes", "critics_score", "audience_score", "runtime"),
                  selected = "audience_score"),
      # Select variable for x-axis
      selectInput(inputId = "x", label = "X-axis:",
                  choices = c("imdb_rating", "imdb_num_votes", "critics_score", "audience_score", "runtime"),
                  selected = "critics_score")
    ),

    # Output: Show scatterplot
    mainPanel(
      plotOutput(outputId = "scatterplot")
    )
  )
```

```r
# Define UI
ui <- fluidPage(

  # Sidebar layout with a input and output definitions
  sidebarLayout(
    # Inputs: Select variables to plot
    sidebarPanel(
      # Select variable for y-axis
      selectInput(inputId = "y", label = "Y-axis:",
                  choices = c("imdb_rating", "imdb_num_votes", "critics_score", "audience_score", "runtime"),
                  selected = "audience_score"),
      # Select variable for x-axis
      selectInput(inputId = "x", label = "X-axis:",
                  choices = c("imdb_rating", "imdb_num_votes", "critics_score", "audience_score", "runtime"),
                  selected = "critics_score")
    ),

    # Output: Show scatterplot
    mainPanel(
      plotOutput(outputId = "scatterplot")
    )
  )
)
```

Create fluid page layout

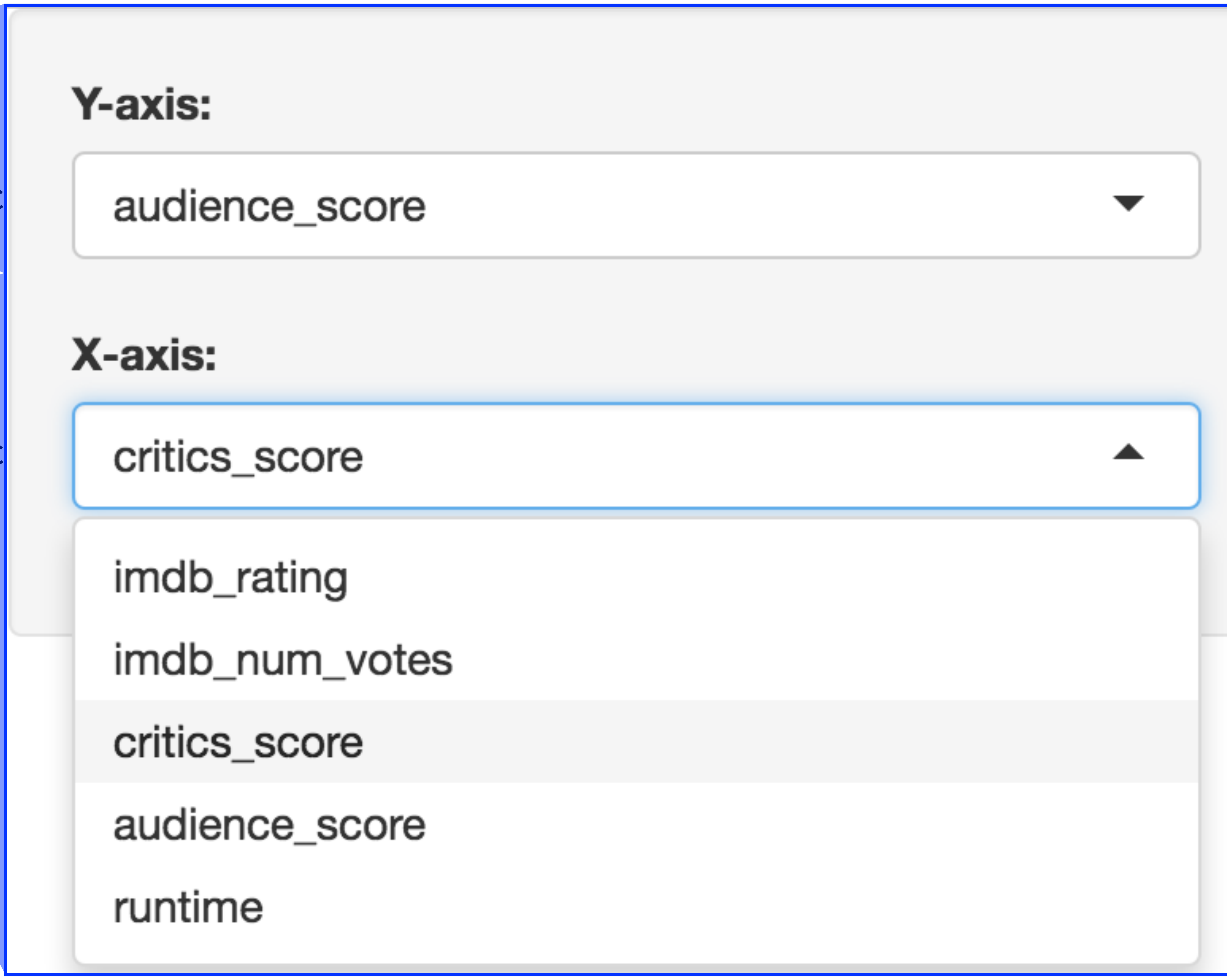
```r
# Define UI
ui <- fluidPage(

  # Sidebar layout with a input and output definitions
  sidebarLayout(
    # Inputs: Select variables to plot
    sidebarPanel(
      # Select variable for y-axis
      selectInput(inputId = "y", label = "Y-axis:",
                  choices = c("imdb_rating", "imdb_num_votes", "critics_score", "audience_score", "runtime"),
                  selected = "audience_score"),
      # Select variable for x-axis
      selectInput(inputId = "x", label = "X-axis:",
                  choices = c("imdb_rating", "imdb_num_votes", "critics_score", "audience_score", "runtime"),
                  selected = "critics_score")
    ),

    # Output: Show scatterplot
    mainPanel(
      plotOutput(outputId = "scatterplot")
    )
  )
)
```

Create a layout with a sidebar and main area

```r
# Define UI
ui <- fluidPage(

  # Sidebar layout with a input and output definitions
  sidebarLayout(
    # Inputs: Select variables to plot
    sidebarPanel(
      # Select variable for y-axis
      selectInput(inputId = "y", label = "Y-axis:",
                  choices = c("imdb_rating", "imdb_num_votes", "critics_score", "audience_score", "runtime"),
                  selected = "audience_score"),
      # Select variable for x-axis
      selectInput(inputId = "x", label = "X-axis:",
                  choices = c("imdb_rating", "imdb_num_votes", "critics_score", "audience_score", "runtime"),
                  selected = "critics_score")
    ),

    # Output: Show scatterplot
    mainPanel(
      plotOutput(outputId = "scatterplot")
    )
  )
)
```

Create a sidebar panel containing **input** controls that can in turn be passed to `sidebarLayout`

```
# Define UI
ui <- fluidPage(

  # Sidebar layout with a input and output definitions
  sidebarLayout(
    # Inputs: Select variables to plot
    sidebarPanel(
      # Select variable for y-axis
      selectInput(inputId = "y", label = "Y-axis:",
                  choices = c("imdb_rating", "imdb_num_votes", "c
                  selected = "audience_score"),
      # Select variable for x-axis
      selectInput(inputId = "x", label = "X-axis:",
                  choices = c("imdb_rating", "imdb_num_votes", "c
                  selected = "critics_score")
    ),

    # Output: Show scatterplot
    mainPanel(
      plotOutput(outputId = "scatterplot")
    )
  )
)
```



Y-axis:

audience_score

X-axis:

critics_score

imdb_rating
imdb_num_votes
critics_score
audience_score
runtime

```
# Define UI
ui <- fluidPage(

  # Sidebar layout with a input and output definitions
  sidebarLayout(
    # Inputs: Select variables to plot
    sidebarPanel(
      # Select variable for y-axis
      selectInput(inputId = "y", label = "Y-axis:",
                  choices = c("imdb_rating", "imdb_num_votes", "critics_score", "audience_score", "runtime"),
                  selected = "audience_score"),
      # Select variable for x-axis
      selectInput(inputId = "x", label = "X-axis:",
                  choices = c("imdb_rating", "imdb_num_votes", "critics_score", "audience_score", "runtime"),
                  selected = "critics_score")
    ),

    # Output: Show scatterplot
    mainPanel(
      plotOutput(outputId = "scatterplot")
    )
  )
)
```

Create a main panel containing **output** elements that get created in the server function can in turn be passed to `sidebarLayout`

Server

```r
# Define server function
server <- function(input, output) {

  # Create the scatterplot object the plotOutput function is expecting
  output$scatterplot <- renderPlot({
    ggplot(data = movies, aes_string(x = input$x, y = input$y)) +
      geom_point()
  })
}
```

```r
# Define server function
server <- function(input, output) {

  # Create the scatterplot object the plotOutput function is expecting
  output$scatterplot <- renderPlot({
    ggplot(data = movies, aes_string(x = input$x, y = input$y)) +
      geom_point()
  })
}
```

Contains instructions needed to build app

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

  # Create the scatterplot object the plotOutput fun
  output$scatterplot <- renderPlot({
    ggplot(data = movies, aes_string(x = input$x, y     input$y))
      geom_point()
  })
}
```

Renders a **reactive** plot that is suitable for assigning to an output slot

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

  # Create the scatterplot object the plotOutput function is expecting
  output$scatterplot <- renderPlot({
    ggplot(data = movies, aes_string(x = input$x, y = input$y)) +
      geom_point()
  })
}
```

Good ol' ggplot2 code,
with **input**s from UI

UI + Server

```r
# Create the Shiny app object
shinyApp(ui = ui, server = server)
```

Putting it all together…

`movies-apps/movies-01.R`

DEMO

Your turn

- Add new select menu to color the points by
  - `inputId = "z"`
  - `label = "Color by:"`
  - `choices = c("title_type", "genre", "mpaa_rating", "critics_rating", "audience_rating")`
  - `selected = "mpaa_rating"`
- Use this variable in the aesthetics of the `ggplot` function as the color argument to color the points by
- Run the app in the Viewer Pane
- Compare your code / output with the person sitting next to / nearby you

5m 00s

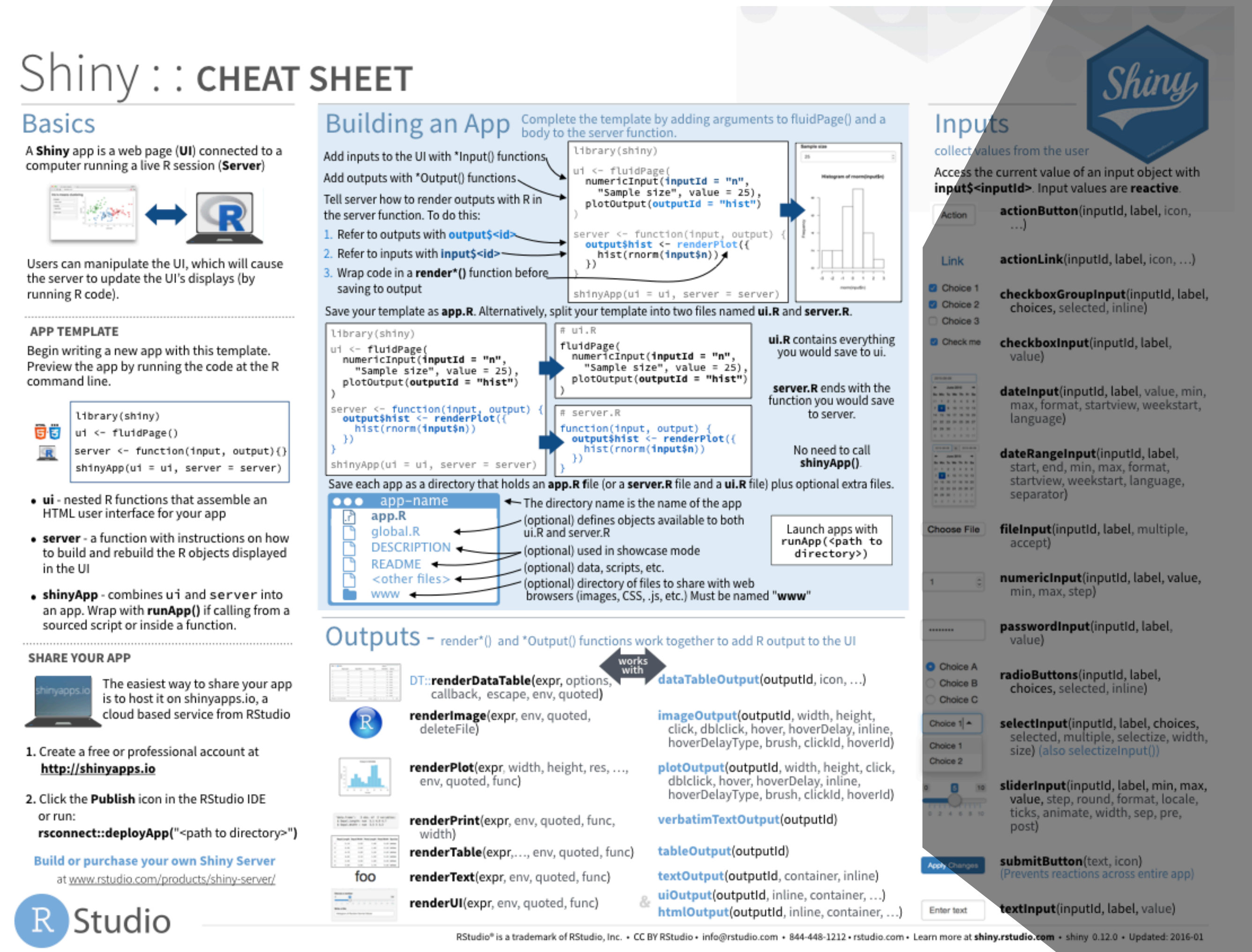
Solution to the previous exercise

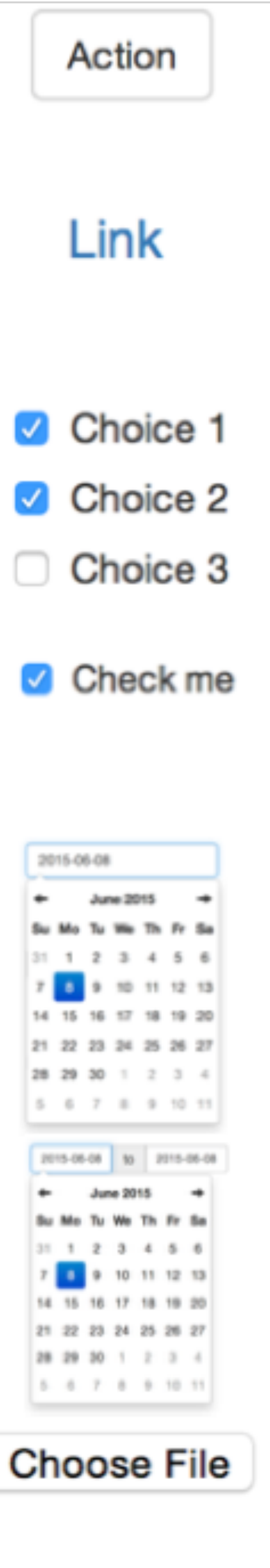
`movies-apps/movies-02.R`

✓

SOLUTION

Inputs


Shiny : : CHEAT SHEET



actionButton(inputId, label, icon, …**)**

actionLink(inputId, label, icon, …**)**

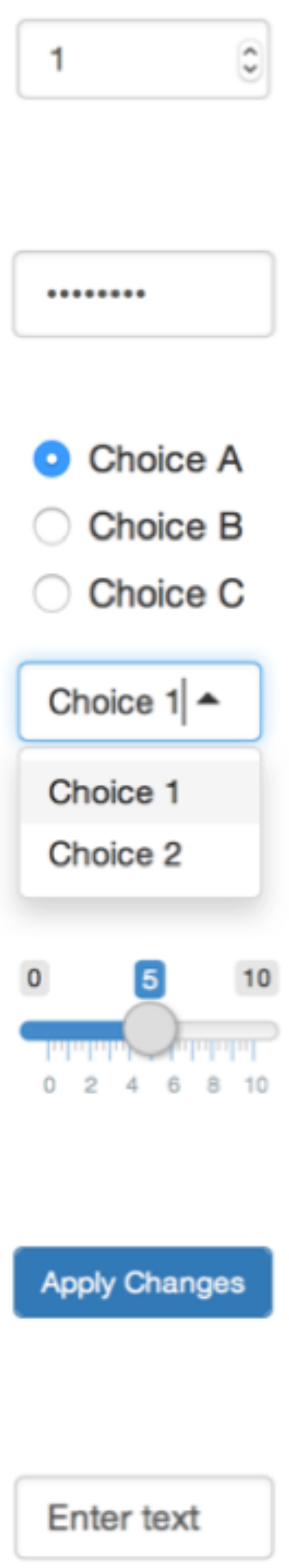
checkboxGroupInput(inputId, label, choices, selected, inline**)**

checkboxInput(inputId, label, value**)**

dateInput(inputId, label, value, min, max, format, startview, weekstart, language**)**

dateRangeInput(inputId, label, start, end, min, max, format, startview, weekstart, language, separator**)**

fileInput(inputId, label, multiple, accept**)**



numericInput(inputId, label, value, min, max, step**)**

passwordInput(inputId, label, value**)**

radioButtons(inputId, label, choices, selected, inline**)**

selectInput(inputId, label, choices, selected, multiple, selectize, width, size**)** (also **selectizeInput()**)

sliderInput(inputId, label, min, max, value, step, round, format, locale, ticks, animate, width, sep, pre, post**)**

submitButton(text, icon**)**
(Prevents reactions across entire app)

textInput(inputId, label, value**)**

Your turn

- Add new input variable to control the alpha level of the points
  - This should be a `sliderInput`
    - See shiny.rstudio.com/reference/shiny/latest/ for help
  - Values should range from 0 to 1
  - Set a default value that looks good
- Use this variable in the geom of the `ggplot` function as the alpha argument
- Run the app in a new window
- Compare your code / output with the person sitting next to / nearby you

5m 00s

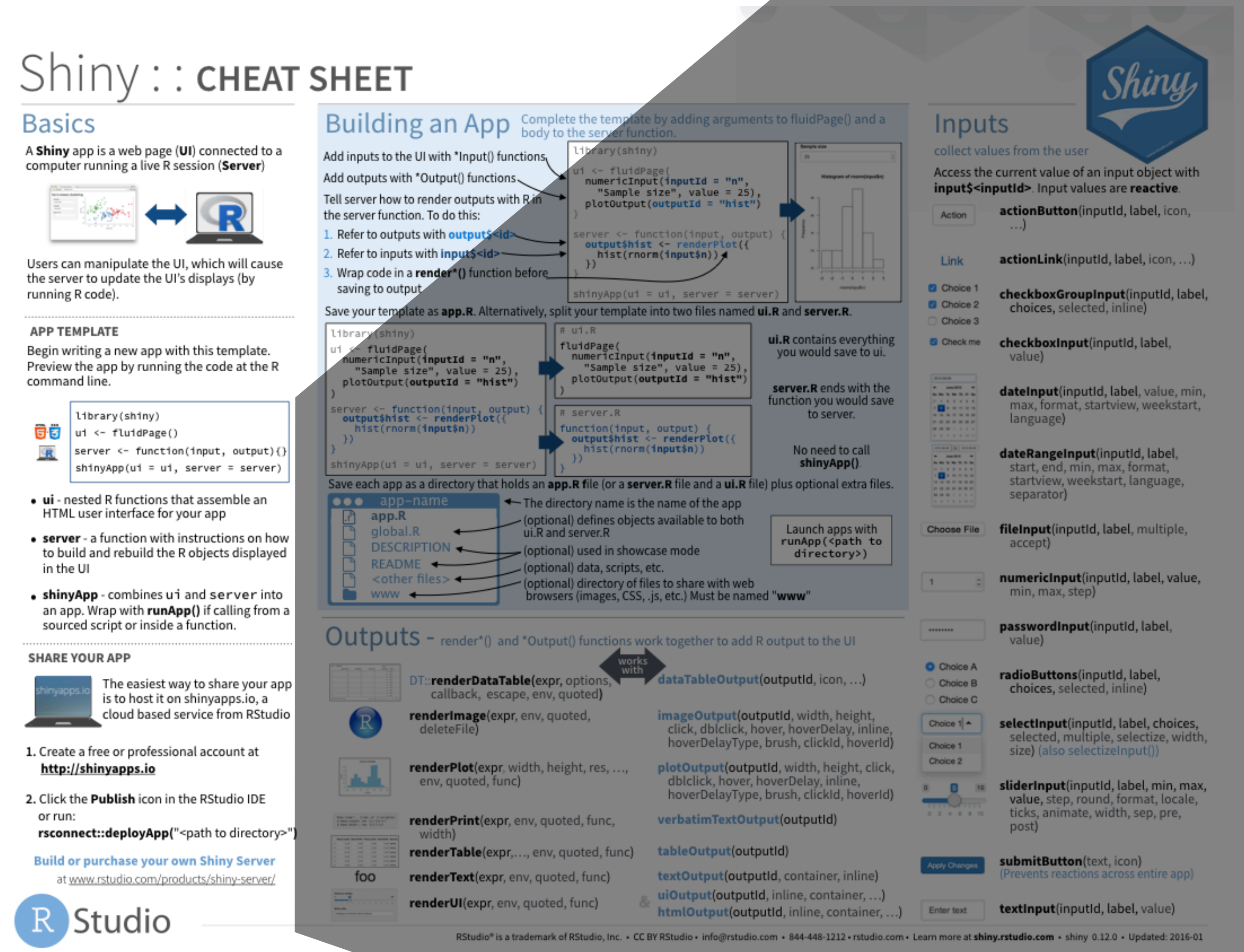
Solution to the previous exercise

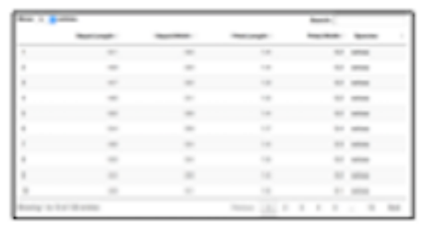
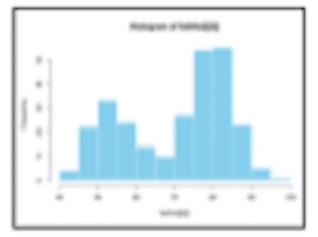
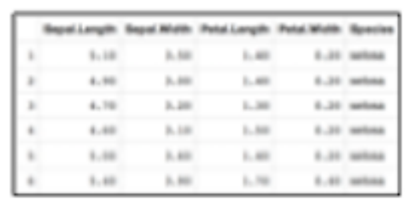
`movies-apps/movies-03.R`

✓

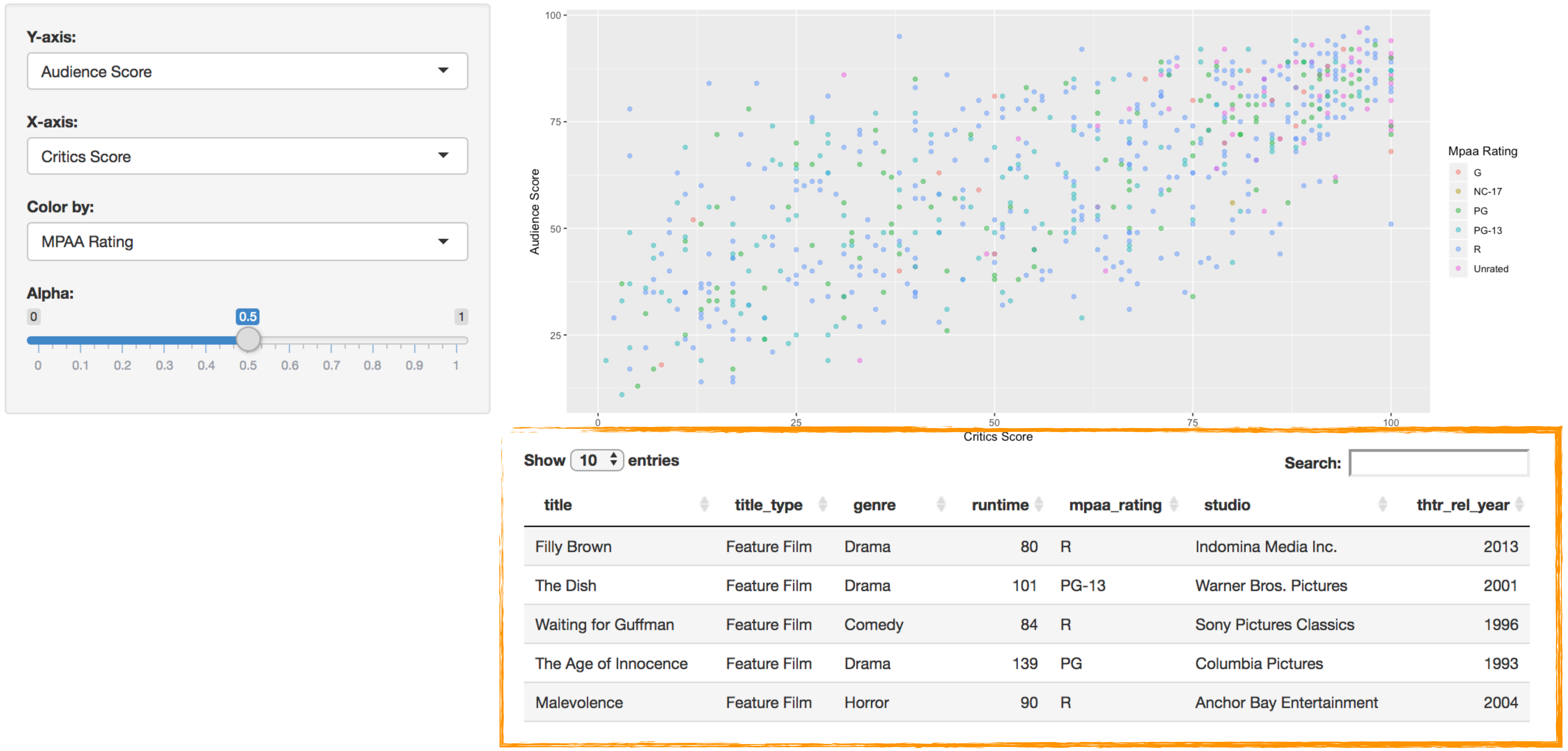
SOLUTION

Outputs



	DT::**renderDataTable(expr**, options, callback, escape, env, quoted**)**	works with	**dataTableOutput(outputId**, icon, ...**)**
	renderImage(expr, env, quoted, deleteFile**)**		**imageOutput(outputId**, width, height, click, dblclick, hover, hoverDelay, hoverDelayType, brush, clickId, hoverId, inline**)**
	**renderPlot(expr**, width, height, res, ..., env, quoted, func**)**		**plotOutput(outputId**, width, height, click, dblclick, hover, hoverDelay, hoverDelayType, brush, clickId, hoverId, inline**)**
'data.frame': 3 obs. of 2 variables: $ Sepal.Length: num 5.1 4.9 4.7 $ Sepal.Width : num 3.5 3 3.2	**renderPrint(expr**, env, quoted, func, width**)**		**verbatimTextOutput(outputId)**
	**renderTable(expr**,..., env, quoted, func**)**		**tableOutput(outputId)**
foo	**renderText(expr**, env, quoted, func**)**		**textOutput(outputId**, container, inline**)**
	renderUI(expr, env, quoted, func**)**		**uiOutput(outputId**, inline, container, ...**)** & **htmlOutput(outputId**, inline, container, ...**)**

Which `render*` and `*Output` function duo is used to add this table to the app?



title	title_type	genre	runtime	mpaa_rating	studio	thtr_rel_year
Filly Brown	Feature Film	Drama	80	R	Indomina Media Inc.	2013
The Dish	Feature Film	Drama	101	PG-13	Warner Bros. Pictures	2001
Waiting for Guffman	Feature Film	Comedy	84	R	Sony Pictures Classics	1996
The Age of Innocence	Feature Film	Drama	139	PG	Columbia Pictures	1993
Malevolence	Feature Film	Horror	90	R	Anchor Bay Entertainment	2004

?

```
library(shiny)
library(tidyverse)
load(“data/movies.Rdata")
ui <- fluidPage(

    DT::dataTableOutput()

)


server <- function(input, output) {


    DT::renderDataTable()


}


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

Your turn

- Create a new output item using `DT::renderDataTable`.
- Show first seven columns of movies data, show 10 rows at a time, and hide row names, e.g.
  - `data = movies[, 1:7]`
  - `options = list(pageLength = 10)`
  - `rownames = FALSE`
- Add a `DT::dataTableOutput` to the main panel
- Run the app in a new Window
- Compare your code / output with the person sitting next to / nearby you
- **Stretch goal:** Make the number of columns visible in the table a user defined input

5m 00s

Solution to the previous exercise

`movies-apps/movies-04.R`

✓

SOLUTION

Your turn

- Add a title to your app with `titlePanel`, which goes before the `sidebarLayout`
- Prettify the variable names shown as input choices. Hint:
  - `choices = c("IMDB rating" = "imdb_rating", …)`
- Prettify the axis and legend labels of your plot. Hint: You might use
  - `stringr::str_replace_all()` (loaded with tidyverse)
  - `tools::toTitleCase()`

5m 00s

Solution to the previous exercise

`movies-apps/movies-05.R`

SOLUTION

Helper functions

As you add functionality to your app, the server function becomes more complex.

You can refactor redundant and/or complicated code into helper functions that can be sourced in from an R script.

- Write a function called `prettify_labels()`

- Save this function in an R script called `helpers.R`

- Source this script in the app

`movies-apps/movies-06.R`

DEMO

Execution

Where you place code in your app will determine how many times they are run (or re-run), which will in turn affect the performance of your app, since Shiny will run some sections your app script more often than others.

```
library(shiny)
library(tidyverse)
load("movies.Rdata")

ui <- fluidPage(
...
)

server <- function(input, output) {

    output$x <- renderPlot({
    ...
    })

}

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

Run once when app is launched

```
library(shiny)
library(tidyverse)
load("movies.Rdata")

ui <- fluidPage(
...
)

server <- function(input, output) {

    output$x <- renderPlot({
    ...
    })

}

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

Run once
each time a user
visits the app

```
library(shiny)
library(tidyverse)
load("movies.Rdata")

ui <- fluidPage(
...
)

server <- function(input, output) {

    output$x <- renderPlot({
    ...
    })

}

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

Run once
each time a user
changes a widget that
output$x depends on

How would you improve the performance of the app from the previous step, `movies-06.R`?

?

Solution to the previous exercise

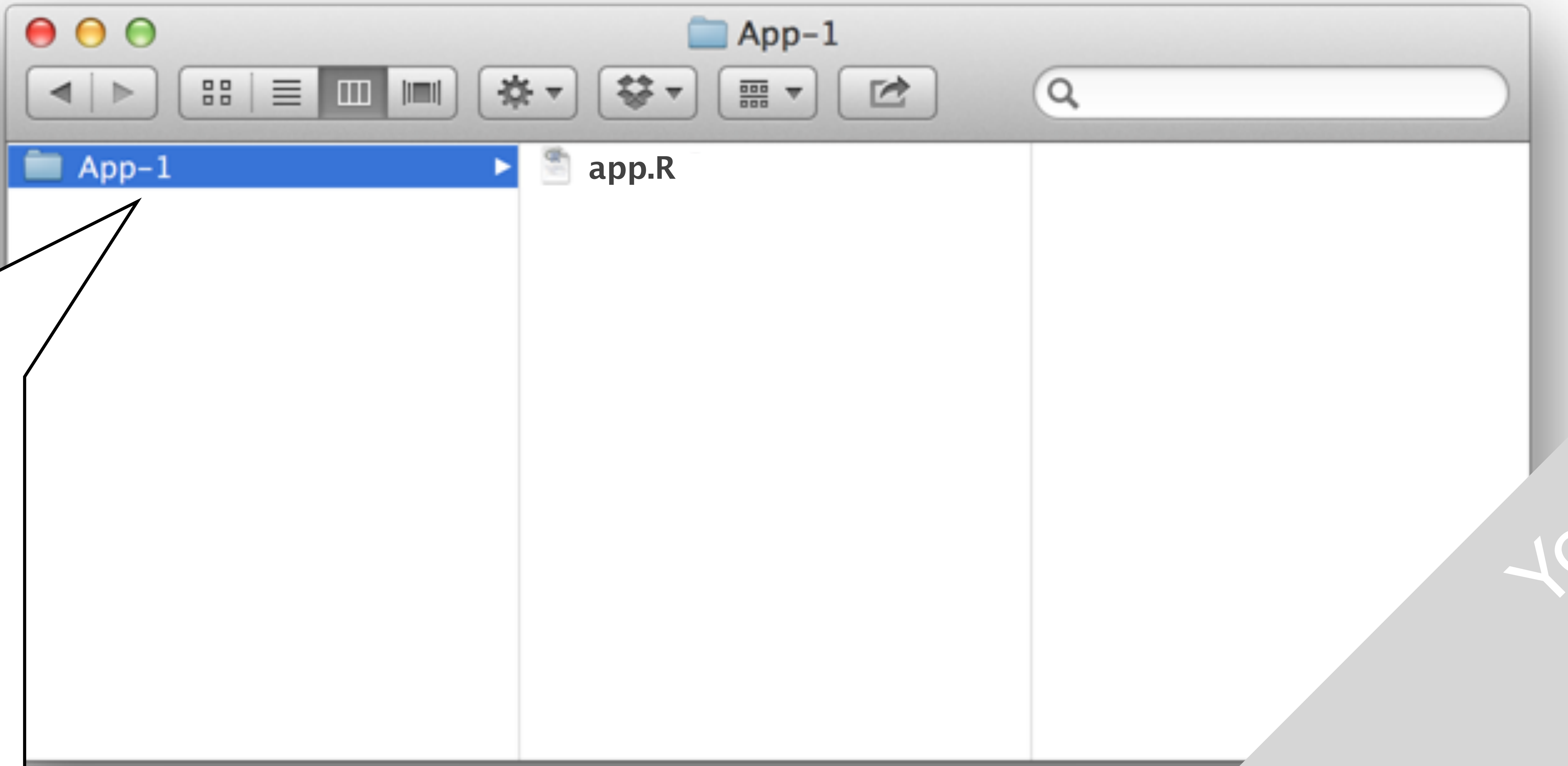
`movies-apps/movies-07.R`

SOLUTION

File structure

Single file

- 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.

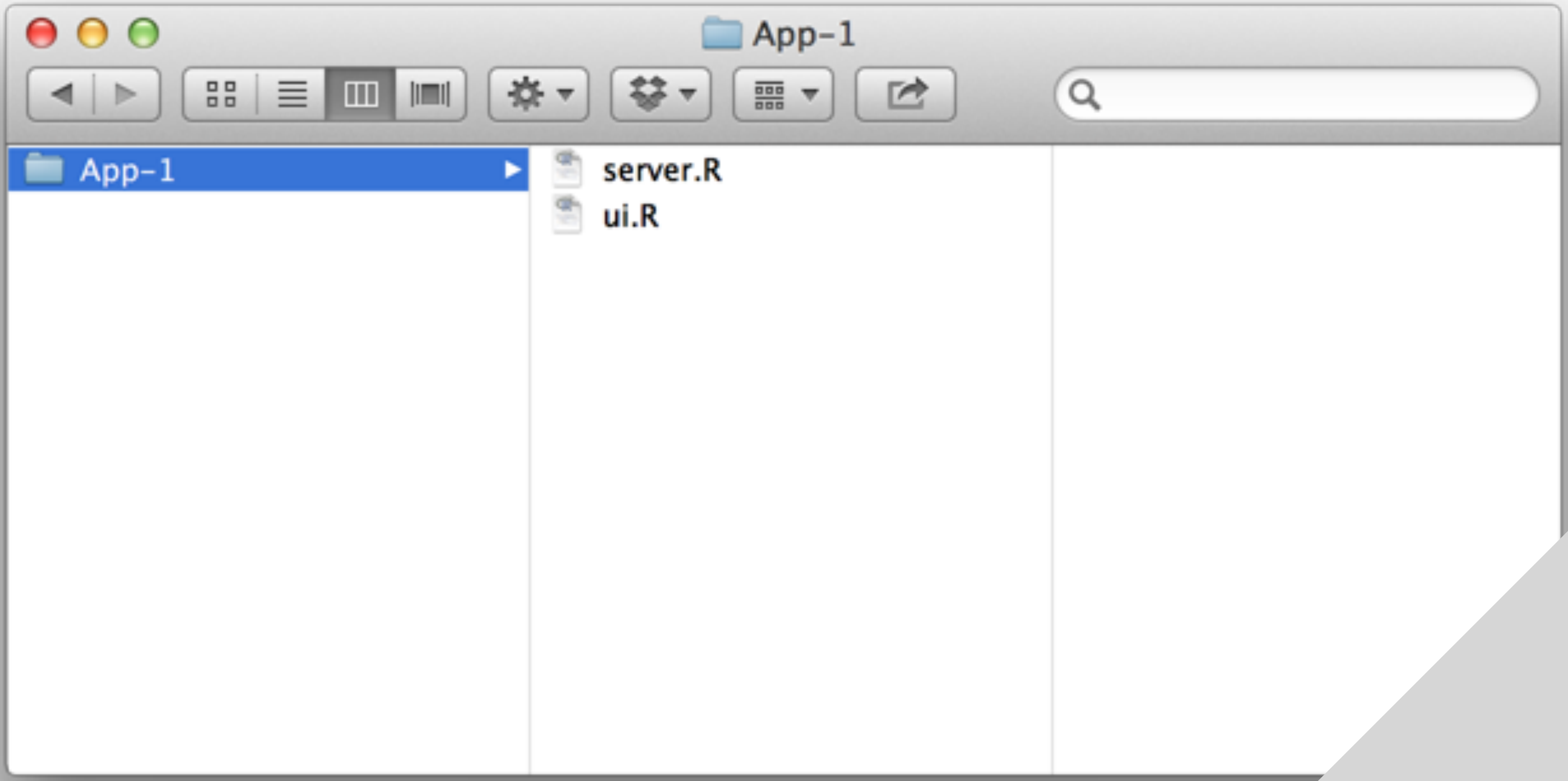


We will focus on the single file format throughout the workshop

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

Multiple files

- One directory with every file the app needs:
  - `ui.R` and `server.R`
  - datasets, images, css, helper scripts, etc.



You must use these exact names

Deploying your app

shinyapps.io

- A server maintained by RStudio
- Easy to use, secure, and scalable
- Built-in metrics
- Free tier available

Shiny Server

- Free and open source
- Deploy Shiny apps to the internet
- Run on-premises: move computation closer to the data
- Host multiple apps on one server
- Deploy inside the firewall

Shiny Server Pro / RStudio Connect

- Secure access and authentication
- Performance: fine tune at app and server level
- Management: monitor and control resource use
- Direct priority support

Over break

if you like…

- Create a folder called `movie-browser`
- Move any one of the movies app R scripts you worked on into this folder, and rename it as `app.R`
- Also move (1) `helpers.R` and (2) the `movies.Rdata` file into this folder in a subfolder called `data`
- Run the app
- Go to shinyapps.io and create a free account. Follow the instructions and deploy your first app.