Shiny: Part 1

The Johns Hopkins Data Science Lab

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What is Shiny?

- Shiny is a web application framework for R.
- Shiny allows you to create a graphical interface so that users can interact with your visualizations, models, and algorithms without needed to know R themselves.
- Using Shiny, the time to create simple, yet powerful, web-based interactive data products in R is minimized.
- Shiny is made by the fine folks at R Studio.

Some Mild Prerequisites

Shiny doesn't really require it, but as with all web programming, a little knowledge of HTML, CSS and Javascript is very helpful.

- HTML gives a web page structure and sectioning as well as markup instructions
- CSS gives the style
- Javscript for interactivity

Shiny uses Bootstrap (no relation to the statistics bootstrap) style, which (to me) seems to look nice and renders well on mobile platforms.

Availible Tutorials

If you're interested in learning more about HTML, CSS, and Javascript we recommend any one of the following resources:

- Mozilla Developer Network Tutorials
- HTML & CSS from Khan Academy
- Tutorials from Free Code Camp

Getting Started

- Make sure you have the latest release of R installed
- If on Windows, make sure that you have Rtools installed
- `install.packages("shiny")`
- `library(shiny)`
- Great tutorial at `http://shiny.rstudio.com/tutorial/`
- Basically, this lecture is walking through that tutorial offering some of our insights

A Shiny project

A shiny project is a directory containing at least two files:

- `ui.R` (for user interface) controls how your app looks.
- `server.R` that controls what your app does.

ui.R

```
library(shiny)
shinyUI(fluidPage(
  titlePanel("Data science FTW!"),
  sidebarLayout(
    sidebarPanel(
      h3("Sidebar Text")
    ),
    mainPanel(
      h3("Main Panel Text")
    )
  )
))
```

server.R

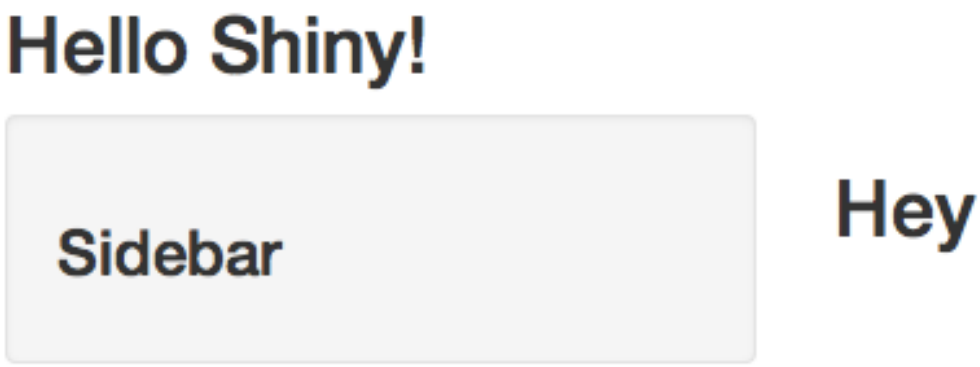
```
library(shiny)
shinyServer(function(input, output) {

})
```

To run it

- In R, change to the directories with these files and type `runApp()`
- or put the path to the directory as an argument
- It should open an browser window with the app running

Your First Shiny App



HTML Tags in Shiny

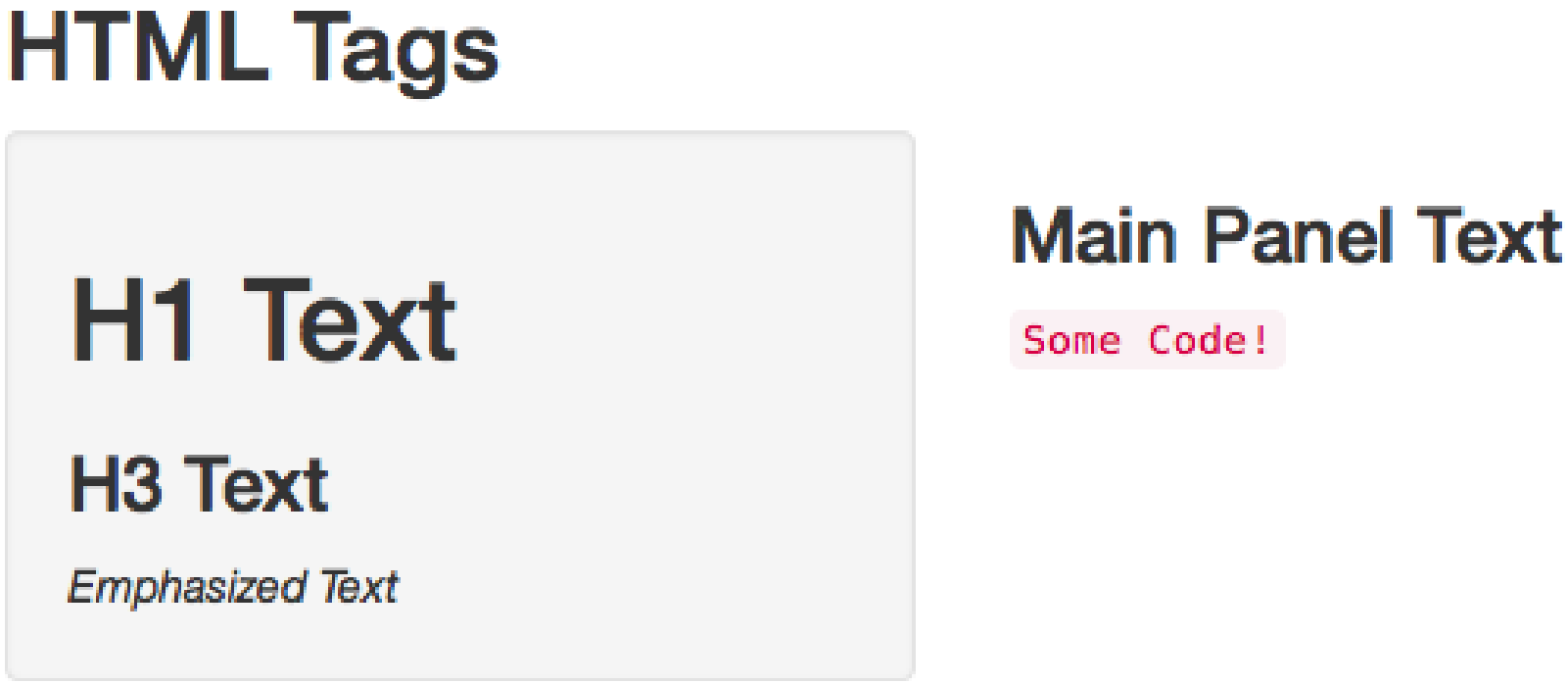
Shiny provides several wrapper functions for using standard HTML tags in your `ui.R`, including `h1()` through `h6()`, `p()`, `a()`, `div()`, and `span()`.

- See `?builder` for more details.

R Wrappers for HTML Tags

```
library(shiny)
shinyUI(fluidPage(
  titlePanel("HTML Tags"),
  sidebarLayout(
    sidebarPanel(
      h1("H1 Text"),
      h3("H3 Text"),
      em("Emphasized Text")
    ),
    mainPanel(
      h3("Main Panel Text"),
      code("Some Code!")
    )
  )
))
```

App with Many Tags



App with Inputs and Outputs

Now that you've played around with customizing the look of your app, let's give it some functionality! Shiny provides several types of inputs including buttons, checkboxes, text boxes, and calendars. First let's experiment with the slider input. This simple app will will display the number that is selected with a slider.

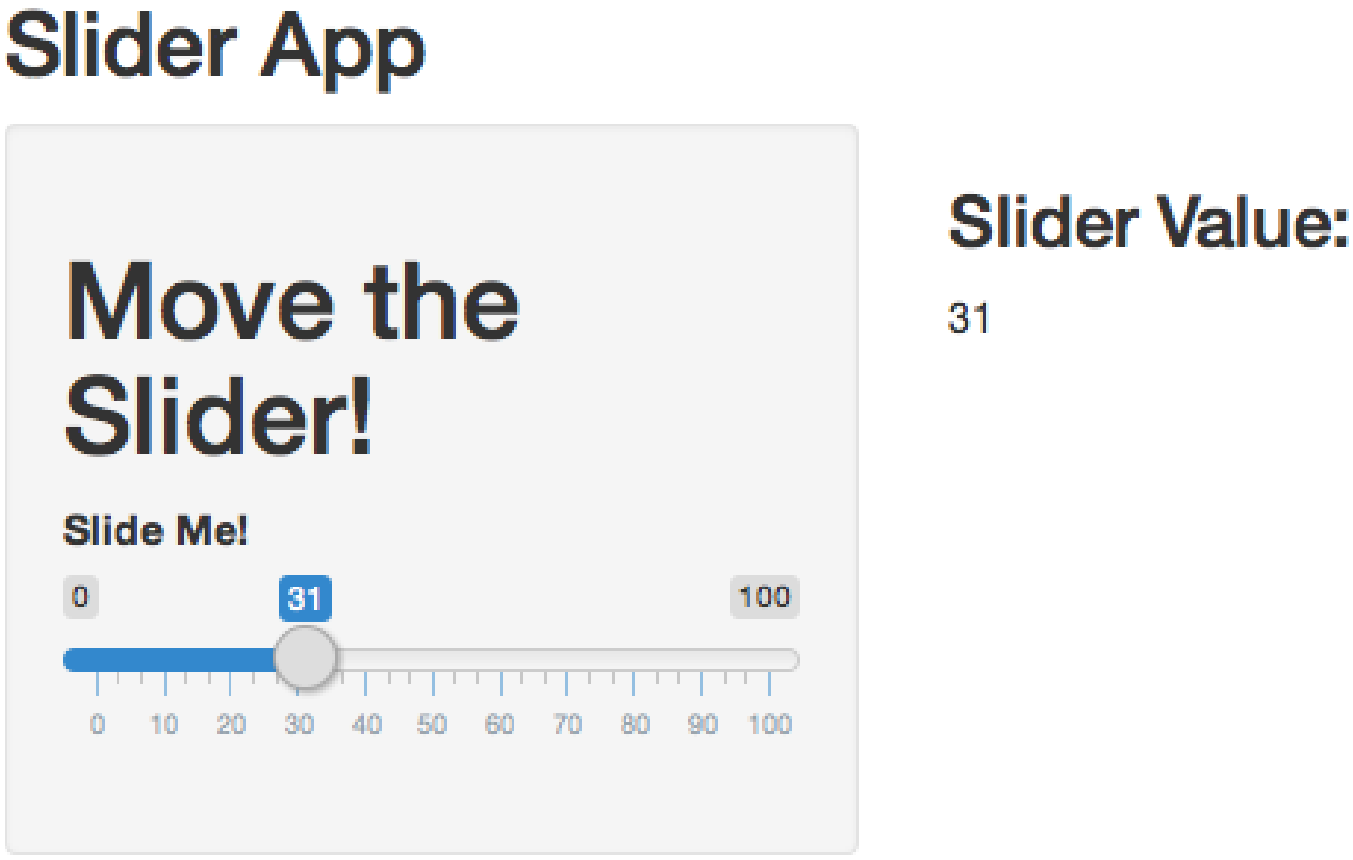
Slider App: ui.R

```
library(shiny)
shinyUI(fluidPage(
  titlePanel("Slider App"),
  sidebarLayout(
    sidebarPanel(
      h1("Move the Slider!"),
      sliderInput("slider1", "Slide Me!", 0, 100, 0)
    ),
    mainPanel(
      h3("Slider Value:"),
      textOutput("text")
    )
  )
))
```

Slider App: server.R

```
library(shiny)
shinyServer(function(input, output) {
  output$text <- renderText(input$slider1)
})
```

Slider App


Slider App
Move the Slider!
Slide Me!
0
31
100
0 10 20 30 40 50 60 70 80 90 100
Slider Value:
31

New Components in the Slider App

ui.R

- `sliderInput()` specifies a slider that a user can manipulate
- `testOutput()` displays text that is rendered in `server.R`

server.R

- `renderText()` transforms UI input into text that can be displayed.

Inputs and Outputs

Notice that in `ui.R` input and output names are assigned with strings (`sliderInput("slider1",...`, `textOutput("text")`) and in `server.R` those components can be accessed with the `$` operator: `output$text <- renderText(input$slider1)`.

Apps with Plots

Allowing users to manipulate data and to see the results of their manipulations as a plot can be very useful. Shiny provides the `plotOutput()` function for `ui.R` and the `renderPlot()` function for `sever.R` for taking user input and creating plots.

Plot App: ui.R Part 1

```
library(shiny)
shinyUI(fluidPage(
  titlePanel("Plot Random Numbers"),
  sidebarLayout(
    sidebarPanel(
      numericInput("numeric", "How Many Random Numbers Shou
                   value = 1000, min = 1, max = 1000, step
      sliderInput("sliderX", "Pick Minimum and Maximum X Va
                  -100, 100, value = c(-50, 50)),
# ...
```

Plot App: ui.R Part 2

```
# ...
      sliderInput("sliderY", "Pick Minimum and Maximum Y Va
                  -100, 100, value = c(-50, 50)),
      checkboxInput("show_xlab", "Show/Hide X Axis Label",
      checkboxInput("show_ylab", "Show/Hide Y Axis Label",
      checkboxInput("show_title", "Show/Hide Title")
    ),
    mainPanel(
      h3("Graph of Random Points"),
      plotOutput("plot1")
    )
  )
))
```

Plot App: server.R Part 1

```
library(shiny)
shinyServer(function(input, output) {
  output$plot1 <- renderPlot({
    set.seed(2016-05-25)
    number_of_points <- input$numeric
    minX <- input$sliderX[1]
    maxX <- input$sliderX[2]
    minY <- input$sliderY[1]
    maxY <- input$sliderY[2]
# ...
```

Plot App: server.R Part 2

```
# ...
    dataX <- runif(number_of_points, minX, maxX)
    dataY <- runif(number_of_points, minY, maxY)
    xlab <- ifelse(input$show_xlab, "X Axis", "")
    ylab <- ifelse(input$show_ylab, "Y Axis", "")
    main <- ifelse(input$show_title, "Title", "")
    plot(dataX, dataY, xlab = xlab, ylab = ylab, main = ma
         xlim = c(-100, 100), ylim = c(-100, 100))
  })
})
```

Apps with Plots

Plot Random Numbers

How Many Random Numbers Should be Plotted?

1000

Pick Minimum and Maximum X Values

-100 -50 50 100

-100 -80 -60 -40 -20 0 20 40 60 80 100

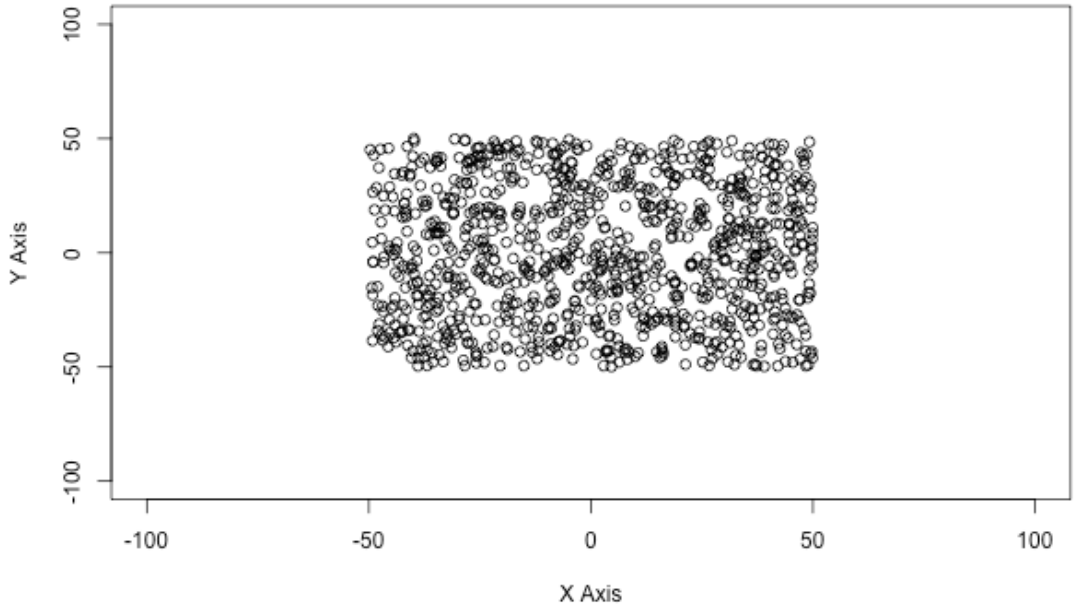
Pick Minimum and Maximum Y Values

-100 -50 50 100

-100 -80 -60 -40 -20 0 20 40 60 80 100

- [x] Show/Hide X Axis Label
- [x] Show/Hide Y Axis Label
- [ ] Show/Hide Title

Graph of Random Points



Apps with Plots

ui.R

- `numericInput()` allows the user to enter any number
- `checkboxInput()` creates boxes that can be checked
- `plotOutput()` displays a plot

server.R

- `renderPlot()` wraps the creation of a plot so it can be displayed

Next Lecture

- Reactivity
- Advanced UI
- Interactive Graphics

More about R and the Web

- OpenCPU by Jerome Ooms, is a really neat project providing an API for calling R from web documents