

Shiny Web Applications in R

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R Shiny Workshop Setup

What is shiny and what is it good for?

Structure of a shiny application

User interface (UI)

Interactive tables and graphs

Reactivity and dynamic UI elements

Debugging shiny apps

R Shiny Workshop Setup

Required software

There are a few things you need to install in order to follow along with the examples and exercises.

- **R**: <https://cran.r-project.org>
- **RStudio**: <https://rstudio.com/products/rstudio/download/>
- **tidyverse, plotly, leaflet, and DT packages**:
`install.packages(c("tidyverse", "plotly", "DT"))`

Workshop materials and setup

- Download workshop materials from TODO and unzip.
- Start Rstudio
- Open `shiny_workshop_materials.Rproj` (*File → Open Project → shiny_workshop_materials.Rproj*)
- Open shiny cheatsheet (*Help → Cheat sheets → Web applications with shiny*)

What is shiny and what is it good for?

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- The whole R package ecosystem is available for use in your web app!
- If you already know R shiny makes it easy to build a website.

Shiny learning resources

A number of excellent tutorials and other resources are available, including:

- <https://www.linkedin.com/learning/building-data-apps-with-r-and-shiny-essential-training>
- <https://shiny.rstudio.com/tutorial/>
- <http://shiny.rstudio.com/articles/>
- <https://shiny.rstudio.com/images/shiny-cheatsheet.pdf>

Use cases and examples

- Exploratory data analysis:
<https://james.shinyapps.io/shinyHome/>
- Teaching and learning:
<http://www.statstudio.net/free-tools/dists/>
- Search and recommendation engine:
<https://public-service.vpal.harvard.edu/>
- Many more examples at <https://www.showmeshiny.com/>

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- Many more examples at <https://www.showmeshiny.com/>
- Some built-in examples accessible via `runExample()`

Sharing and deploying

- Shiny apps can be run locally using the `shiny` R package.



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- You (or your organization) can run a free version of Shiny Server on your own system, or pay for the full-featured *RStudio Connect* platform.

Structure of a shiny application

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Objectives:

- Learn the required components of a shiny application.
- Learn how to create shiny apps from a template.
- Start to think in terms of *inputs* and *outputs*.
- Practice creating apps using storm data as an example.

Shiny app components

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- Can be in a single **app.R** file or in separate **ui.R** and **server.R** files.
- The *ui* specifies the layout of elements on the page, including *input* and *output* elements.
- The *server* does all computations, *renders output* and sends it to the *ui*.

Example: Create new shiny app

There are two convenient ways to create a new shiny app.

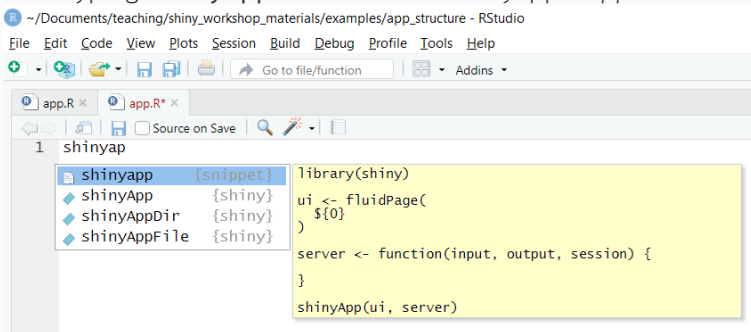
Option 1: Create a new shiny web app from example *File → New File
→ Shiny Web App*

Option 2: Create a new shiny app from a template *File → New File → R
Script; start typing shinyapp and select the shinyapp
snippet*

Exercise 1: Create a shiny app

Open the exercise file: *File* → *Open File*
→ *exercises/01_new_shiny_app.R*

1. Start typing **shinyapp** and select the shinyapp *snippet*



2. Save the file and click the “Run App” button. You should see a blank app and no errors!

Example project data

We will be using the `storms` data set distributed with the `dplyr` package as an example.

```
library(shiny)
```

```
library(dplyr)
```

```
data(storms)
```

```
names(storms)
```

```
## [1] "name"      "year"      "month"     "day"
## [5] "hour"      "lat"       "long"      "status"
## [9] "category"  "wind"      "pressure"  "ts_diameter"
## [13] "hu_diameter"
```

Our first goal is to **display the number of storms by year** in our shiny app.

UI and server elements

- The **ui** specifies the elements of your application and their arrangement.
 - Common elements include *inputs*, *outputs*, and *descriptive text*.
 - Elements can be easily arranged in panels and tabs.
- The **server** is responsible for all computation and output rendering.
 - The **server** monitors *inputs* and other *reactive* values.
 - When inputs change, rendered outputs are created or updated.

Outputs and Renderers

Outputs are the way generated content produced by R is displayed in shiny. Examples include:

- `textOutput()`
- `plotOutput()`
- `tableOutput()`

You can use

```
help.search("output", package = "shiny")
```

to find other output functions in shiny.

Outputs and Renderers

Each `*output()` function has a corresponding `render*()` function.
For example:

- `textOutput()` → `renderText()`

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For example:

- `textOutput()` → `renderText()`
- `plotOutput()` → `renderPlot()`
- `tableOutput()` → `renderTable()`

Example: render outputs

Start *examples/02_render_output.R*

Finished *examples/02_render_output_finished.R*

Exercise 2: Display number of storms by year.

Open the exercise file: *File* → *Open File*
→ *exercises/02_storms_by_year.R*

1. Add a table output element to the ui and a corresponding renderer to the server. The table should display the number of named storms in each year.
2. Add a plot output element to the ui, and a corresponding renderer to the server. The plot should display the number of named storms in each year.

Creating input elements

Inputs are form elements like check boxes, text fields, and sliders.

Examples include:

- `textInput()`
- `selectInput()`
- `fileInput()`

You can use

```
help.search("input", package = "shiny")
```

to find other input functions in shiny.

Accessing inputs

- Inputs are accessed in the *server* function via the *input* argument.
- Inputs are *reactive*, meaning that changes trigger updates.
- It is often helpful to **print** or use **str** to examine inputs in your server function so you know what you're dealing with.

Example: create and use input

Start *examples/03_input_output.R*

Finished *examples/03_input_output_finished.R*

Exercise 3: Display storms for a user-selected year.

Open the exercise file: *File* → *Open File*
→ *exercises/03_storms_filtered.R*

1. Add a `sliderInput` element to the `ui` .
2. Modify the `renderTable` expression to filter the year displayed to the one selected by the user.

User interface (UI)

User interface (UI)

Objectives:

- Learn the high-level layout features provided by shiny.
- Learn how to include html tags in your shiny app.
- Explore available shiny themes.
- Practice creating apps using different layouts.

Page layouts

Our storms app is functional, but not much to look at.

Top-level page layout functions in shiny include:

- `fluidPage()`
- `navbarPage()`
- `fixedPage()`
- `fillPage()`
- `bootstrapPage()`

`fluidPage` is the most commonly used, and `navbarPage` is useful for more complex apps with many elements.

See <https://shiny.rstudio.com/articles/layout-guide.html> for more.

Layout functions

Other layout functions include:

- `fluidRow()` / `fixedRow()`
- `column()`,
- `sidebarLayout()`
- `splitLayout()`
- `verticalLayout()`

These are often used inside the page layout functions.

See <https://shiny.rstudio.com/articles/layout-guide.html> for more.

In addition to the high-level layout functions you can also use low-level functions to generate html tags.

Directly available tag functions include:

- `h1()` .. `h6()` (headers)
- `p()` (paragraph)
- `a()` (link)
- `br()` (line break)
- `div()` (division)

See `?builder` for more.

Shiny themes

Shiny uses bootstrap (<https://getbootstrap.com/>) under the hood, providing easy access to a range of themes.

To use other themes, install the **shinythemes** package and use the **theme** argument to your page layout function.

More information at <https://rstudio.github.io/shinythemes/>

Example: Page and element layout

Start `examples/04_layout_appearance.R`

Finished `examples/04_layout_appearance_finished.R`

Exercise: Spiff up the storms app

Open the exercise file: *File* → *Open File* → *exercises/04_storms_pretty.R*

1. Lay out this application using **navbarPage** and `'tabPanel`. See <https://shiny.rstudio.com/articles/layout-guide.html> for examples.
2. Use html tags (e.g., `h2()`, `p()`, `a()`) to add some descriptive text to your application.
3. Use the **shinythemes** package (install if needed) to change the theme used by your app. See <https://rstudio.github.io/shinythemes/> for examples.

Interactive tables and graphs

Interactive graphs with plotly

Interactive maps with leaflet

- Tutorial available at <https://campus.datacamp.com/courses/interactive-maps-with-leaflet-in-r>

Reactivity and dynamic UI elements

Creating your own reactive values

Interdependent input elements

Delaying reactive element updates

Debugging shiny apps

Debug with `print`

Debug with breakpoints

Debug with shinyjs

Debug with `reactLog`