What makes R Shiny so shiny?

A step-by-step introduction to interactive dashboards in R

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Learning objectives

After this workshop, you should be able to:

1. Understand the basic components of a Shiny app: ui and server
2. Use reactivity to create dynamic tables and plots
3. Setup a basic dashboard with multiple tabs of content
4. Get an idea of the tools available to extend the functionality of your dashboard

Data and scripts for today's workshop

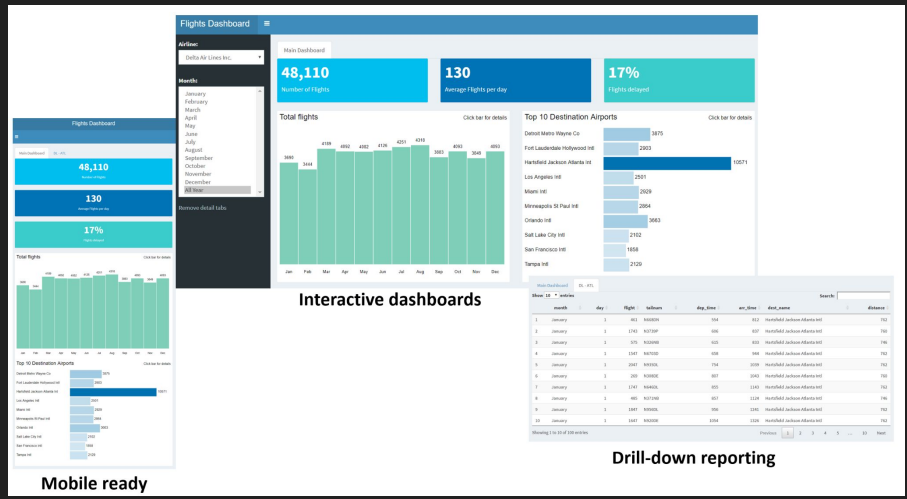
All R scripts used in this workshop are available in the following GitHub repository:

tinyurl.com/cssc2021shiny

The R scripts and slides are available for asynchronous learning at your own pace.

What is R Shiny?

Shiny: A framework for building interactive web apps in R

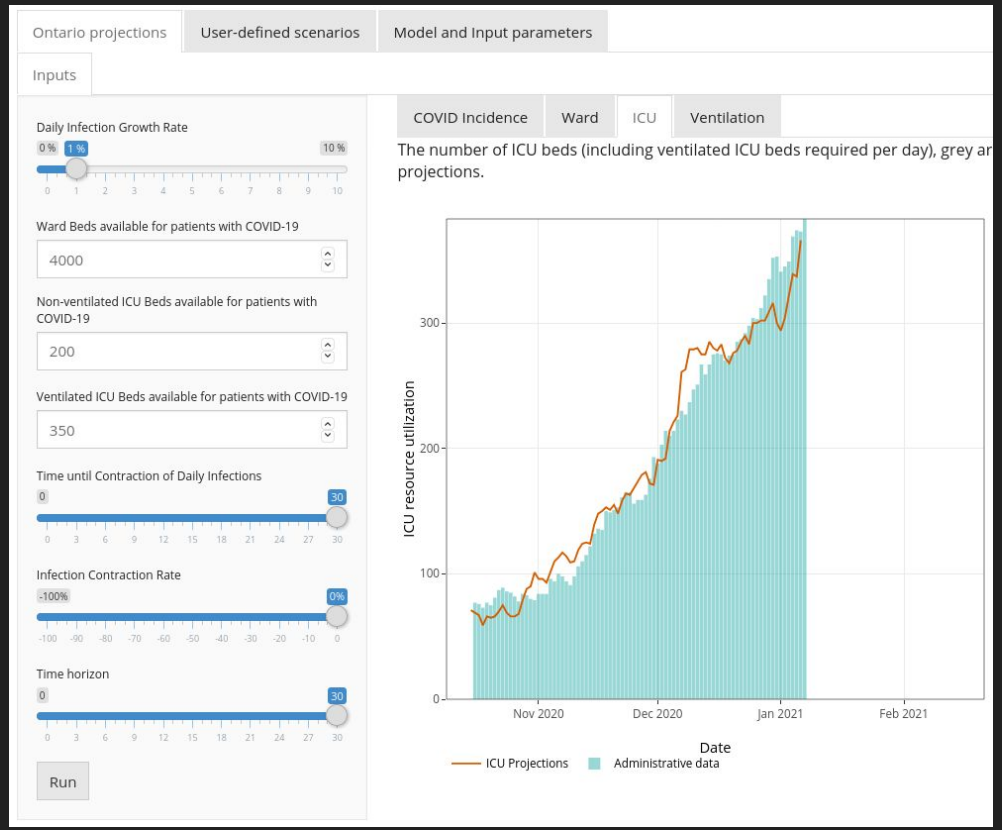


Why make an interactive data visualization?

One use of interactive data visualization is to allow the user to test the assumptions of your model & adapt it to different scenarios.

One excellent example:

https://www.covid-19-mc.ca/interactive-models/hospital-resources



IMDB dataset

We will be using two datasets derived from the IMDB dataset:

- All movies (horror and non-horror): average rating, total votes, runtime
- Horror movies: average rating, total votes, runtime, actor and director info

Raw dataset and data dictionary available: https://www.imdb.com/interfaces/

The two basic components of a Shiny app

UI

- What your app looks like
- Basic building blocks are “render” functions
- Also accepts raw HTML

Server

- What your app does
- Basic building blocks are “output” functions
- Uses reactive programming

Dashboard 1: Your first Shiny app

In dashboard 1, we will:

- Generate a functional, static webpage with two plots and some text
- Demonstrate basic usage of “ui” and “server”
- Use server to generate outputs that are displayed by ui

UI: Basics

- fluidPage contains fluidRow(s)
- fluidRow contains 12 column(s)
- column contains your dashboard elements (text, plots, buttons, etc.)
- Defining all of these structures for every part of your Shiny app is not strictly necessary, but it does help maintain a consistent look across devices.

Server: Basics

- Input: Access user-selected inputs (e.g., sliders, dropdown menu, text boxes)
- Output: Access objected generated in the server file (e.g., plots, text, UI elements)
- Session: Access information about the browser running the Shiny app

Dashboard 2: Adding user input and reactivity

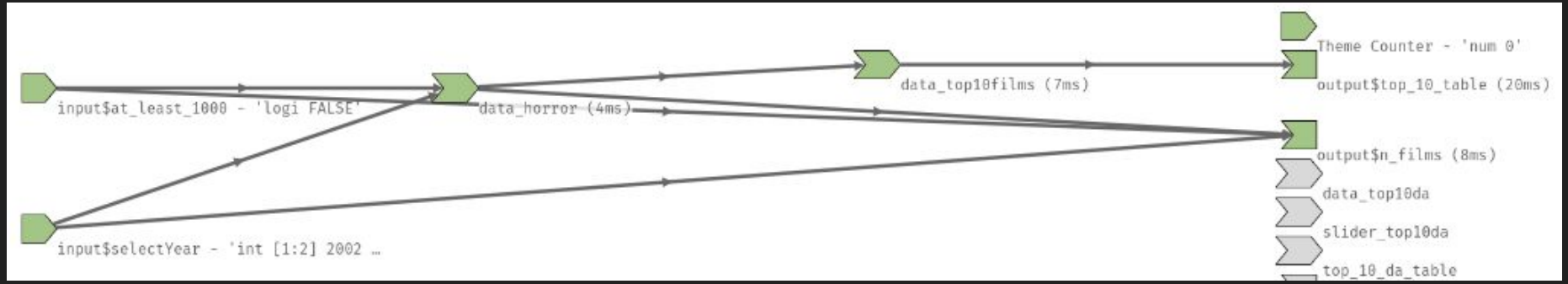
In dashboard 2, we will:

- Generate a functional, interactive webpage with a table that responds to user input
- Demonstrate basic usage “input” functions to accept user input
- Use these inputs inside the server function to generate a reactive “output” table that is displayed in ui

Reactivity

- Under the hood, Shiny uses a “reactive graph” to invalidate and update outputs in response to user inputs

- Shiny can generate a “reactlog” for you and show step-by-step how the underlying variables of your dashboard change in response to user input



Dashboard 3: shinydashboard

In dashboard 3, we will:

- Use the “shinydashboard” package to convert dashboard 2 into a proper Shiny dashboard (header, body, sidebar)

- Use the “dashboardthemes” package to customize the appearance of our dashboard

Dashboard 4: Tabs and tabsets

In dashboard 4, we will:

- Build on dashboard 3 through the addition of multiple “tabs” of content accessible through the dashboard sidebar

- Demonstrate how to make multiple “panels” of contact available on a single tab through the use of “tabset panels”

Tabs and tabsets

Tabs allow you to have multiple pages of content in your dashboard, accessible from the sidebar. Tabs are defined in two places:

- Sidebar: sidebarMenu contains menuItem(s)
- Body: tabItems contain tabItem(s), which define actual content

Tabset panels allow you to have multiple “panels” of content on the same page. Tabset panels are defined within fluidPage(s):

- tabsetPanel contains tabPanel(s)

Dashboard 5: Extending your R Shiny dashboard

In dashboard 5, we will:

- Show how various R packages can be used to seamlessly integrate with R Shiny

- Demonstrate the use of the JavaScript library “plotly”

Check out the examples available in htmlwidgets for R:
http://www.htmlwidgets.org/

Common mistakes

Avoid the following common mistakes, which can cause your Shiny app to fail silently:

- Never duplicate IDs (e.g., you cannot use plotOutput("plot_1") in two places, even if you want to show the same plot on different pages)
- Render functions go in server and must be assigned to output (e.g., output$plot_id <- renderPlot(plot(y~x)))
- Output functions go in ui (e.g., plotOutput(“plot_id”)
- Double check that IDs match exactly in render and output functions

Best practices

Organizing your code:

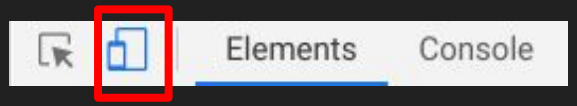
- global.R (runs first; objects accessible by both ui and server)
- ui.R (define how your app looks)
- server.R (define what your app does)
- app.R (use “source” to read in the above and launch app)

Optimizing for mobile:

- Use “device toolbar” in Chrome/Chromium browser
- Visit local host:

```
Listening on http://127.0.0.1:6124
```

- F12 →



Acknowledgements and additional resources

- Mastering Shiny (Hadley Wickham): https://mastering-shiny.org/index.html
- Analyzing IMDb Data The Intended Way, with R and ggplot2 (Max Woolf): https://minimaxir.com/2018/07/imdb-data-analysis/
- Shiny code examples: https://shiny.rstudio.com/gallery/
- My GitHub has several Shiny dashboards: https://github.com/jeanpaulrsoucy
- Short-term Mortality Fluctuations [English, code available]: https://mpidr.shinyapps.io/stmortality/
- Real-time mortality (Portugal) [Portuguese]: https://evm.min-saude.pt/

Alternatives to R Shiny

Open source alternatives

- R Markdown
- flexdashboard (R)
- d3 (JS)

Proprietary alternatives

- Tableau
- Power BI
- IBM Cognos

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My research is focused on infectious disease epidemiology, particularly **COVID-19**, **antimicrobial resistance** and the use of **emerging data sources** for infectious disease surveillance.

Please feel free to reach out to me.