Shiny

Lecture 17

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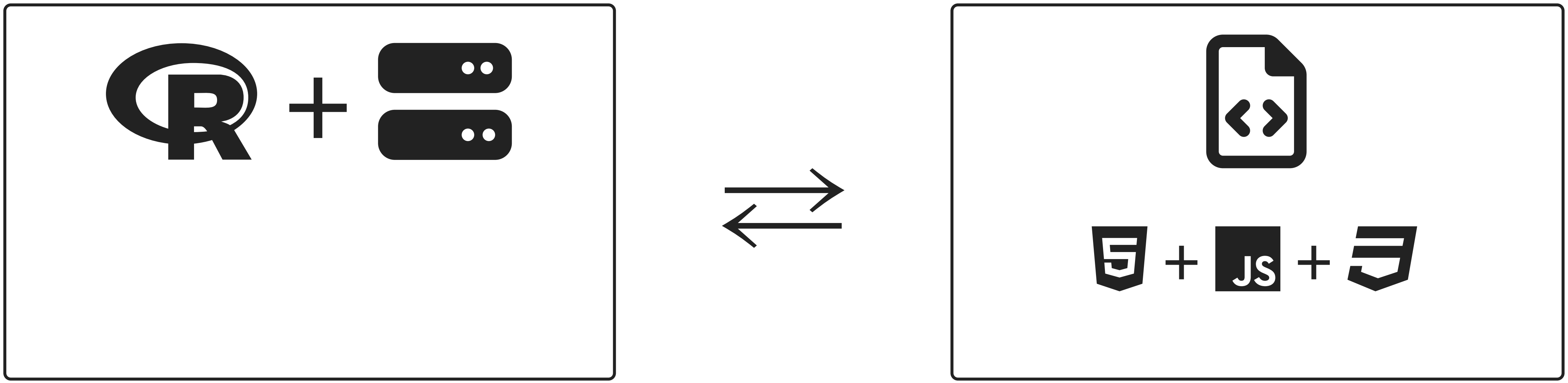
Shiny

> Shiny is an R package that makes it easy to build interactive web apps straight from R. You can host standalone apps on a webpage or embed them in R Markdown documents or build dashboards. You can also extend your Shiny apps with CSS themes, htmlwidgets, and JavaScript actions.

Shiny App

Server

Client / Browser



bslib

The bslib R package provides a modern UI toolkit for Shiny, R Markdown, and Quarto based on Bootstrap.

We will be talking more about this package and its features in a future lecture.

For now we will be loading it alongside Shiny and using some of its layout features today.

Anatomy of an App

```r
library(shiny)
library(bslib)

ui = list()

server = function(input, output, session) {

}

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

Shiny Layouts

https://shiny.posit.co/r/layouts/

Shiny Widgets Gallery

https://shiny.posit.co/r/gallery/widgets/widget-gallery/

A brief widget tour

rundel.shinyapps.io/widgets/

App background

I’ve brought a coin with me to class and I’m claiming that it is fair (equally likely to come up heads or tails).

I flip the coin 10 times and we observe 7 heads and 3 tails, should you believe me that the coin is fair? Or more generally what should you believe about the coin’s fairness now?

Model

Let y be the number of successes (heads) in n trials then,

Likelihood:

$$\begin{aligned}
y|n,p &\sim \text{Binom}(n,p) \\
f(y|n,p) &= \binom{n}{y} p^y (1-p)^{n-y} \\
&= \frac{n!}{y!(n-y)!} p^y (1-p)^{n-y}
\end{aligned}$$

Prior:

$$\begin{aligned}
p &\sim \text{Beta}(a,b) \\
\pi(p|a,b) &= \frac{\Gamma(a+b)}{\Gamma(a)\Gamma(b)} p^{a-1} (1-p)^{b-1}
\end{aligned}$$

Posterior

From the definition of Bayes' rule:

$$
\begin{aligned}
f(p|y,n,a,b) &= \frac{f(y|n,p)}{\int_{-\infty}^{\infty} f(y|n,p)\,dp} \pi(p|a,b) \\
&\propto f(y|n,p)\,\pi(p|a,b)
\end{aligned}
$$

We then plug in the likelihood and prior and then simplify by dropping any terms not involving p,

$$
\begin{aligned}
f(p|y,n,a,b) &\propto \left(\frac{n!}{y!(n-y)!} p^y (1-p)^{n-y} \right) \left(\frac{\Gamma(a+b)}{\Gamma(a)\Gamma(b)} p^{a-1} (1-p)^{b-1} \right) \\
&\propto \left(p^y (1-p)^{n-y} \right) \left(p^{a-1} (1-p)^{b-1} \right) \\
&\propto p^{y+a-1} (1-p)^{n-y+b-1}
\end{aligned}
$$

Posterior distribution

Based on the form of the density we can see that the posterior of p must also be a Beta distribution with parameters,

$$p|y, n, a, b \sim \text{Beta}(y + a, n - y + b)$$