R for teaching Ecology

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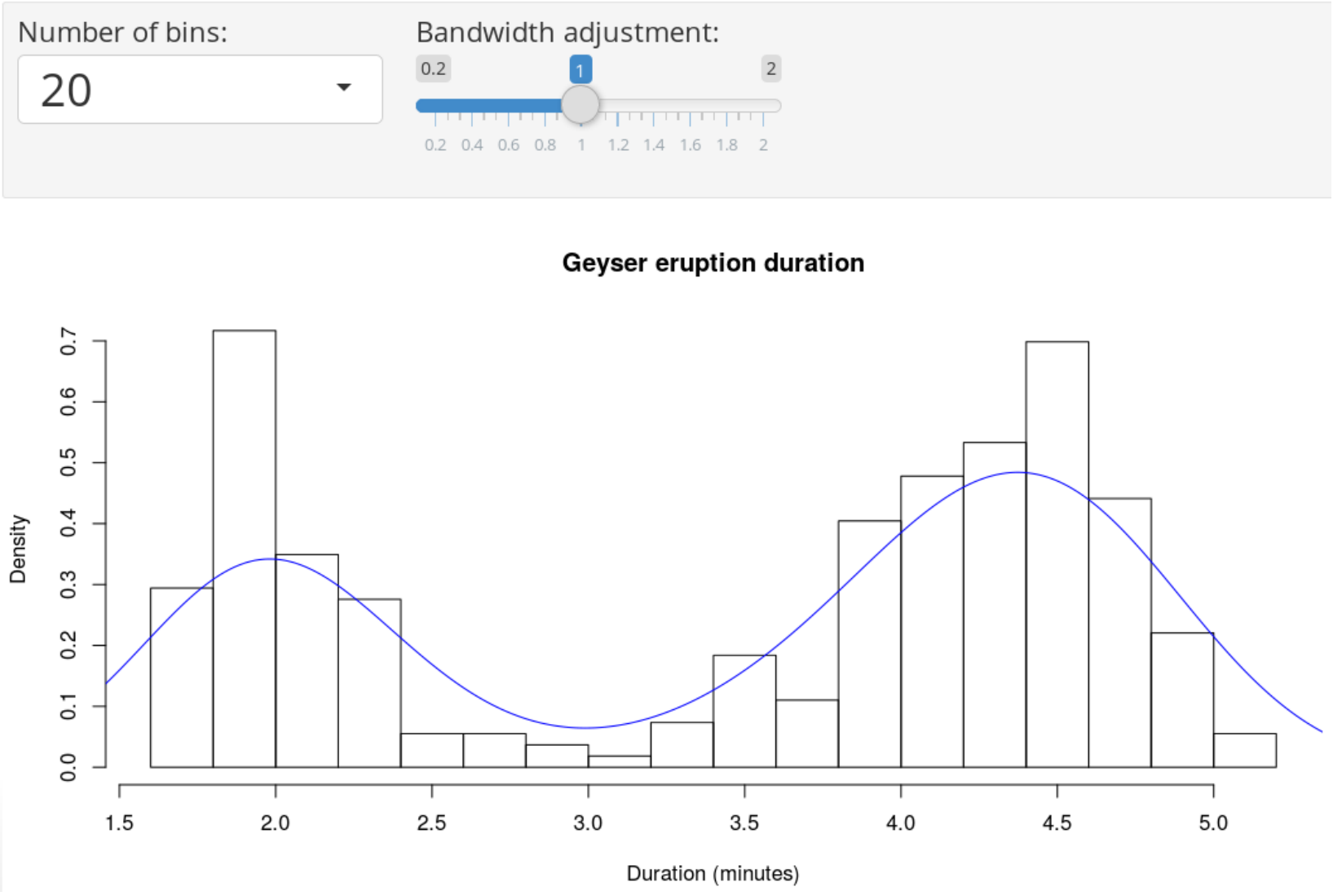
Interactive apps with `shiny` and `R`



Anatomy of a shiny app

Part 1: User Interface (ui.R)

```
selectInput("n_breaks", label = "Number of bins:",
            choices = c(10, 20, 35, 50), selected = 20,
            ...)
```

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```
selectInput("n_breaks", label = "Number of bins:",
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            ...)
```

Part 2: Server-side computations (server.R)

```
hist(faithful$eruptions, probability = TRUE,
     breaks = as.numeric(input$n_breaks),
     xlab = "Duration (minutes)",
     main = "Geyser eruption duration")

dens <- density(faithful$eruptions,
                adjust = input$bw_adjust)
lines(dens, col = "blue")
```

Using Shiny apps for teaching ecology

Population ecology has at its core a series of theoretical models that describe how populations consume resources and interact with other species

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e.g. Lotka-Volterra Competition

$$\frac{1}{N_1}\frac{dN_1}{dt} = r_1(1 - \alpha_{11}N_1 - \alpha_{12}N_2)$$

$$\frac{1}{N_2}\frac{dN_2}{dt} = r_2(1 - \alpha_{22}N_1 - \alpha_{21}N_1)$$

Using Shiny apps for teaching ecology

See https://gauravsk.shinyapps.io/lotka

All code available online

Possible EEB-177 Projects

Lots of models in population and community ecology...

- Coexistence of competing species via R* rule
- Island biogeography
- Predator-Prey models
- Infectious disease dynamics

Modify code from Lotka-Voterra app to simulate these or other models.

This would involve using Differential Equation solvers in `R` and/or writing for-loops

Possible EEB-177 Projects

e.g. Discerete-time stage structured population growth

A single population comprises juvinile, adult, and senescent individuals. Model the dynamics of each group given birth rates, death rates, transition rates from one group to another, etc.

e.g. Infectious disease models

An infection spreads through a population of individuals, some of which are susceptible, some of which are already infected, and some of which are immune. Model the dynamics of the disease to find out whether it will spread throughout the population (an outbreak) or be contained to just a few individuals.