Interactive Visualizations in R

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Data Visualization and Manipulation through Scripting (ADSC1010)

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Topics

Introduction

- Adding interactivity to our visualisations can add an additional way to communicate your data.

- We may add *panning* or *zooming* capabilities.

- Get additional information by hovering over specific points.

- **We will need to knit our R Markdowns as HTML files to retain the interactivity.**

- Introduce three packages:
  1. *Plotly*
  2. *Bokeh*
  3. *Leaflet* (maps)

plotly

Plotly I

- **Plotly** *is visualisation software that provides open source libraries for creating interactive visualisations.*

- Available for many languages: R, Python, Matlab, and JavaScript.

- Plotly is an external package so we will need to install and then load it: `library(plotly)`

Plotly II

- There are two main ways to use *plotly* to create an interactive plot:

  1. We can *wrap* a *ggplot* object using the `ggplotly()` function.

  2. We can also use the `plot_ly()` function to build a visualisation from scratch.

ggplotly()

1. Ensure that your data frame contains the information you wish to include in your plot.

2. Use the functionality of *ggplot2* to generate a static visualisation.

3. Be sure to save your *ggplot* object in your workspace

4. Use the ggplotly() to make your plot interactive.

Example 1

1. Use the `ggplot()` function and the *iris* dataset to generate a scatterplot with x as the *Sepal.Width*, y as the *Sepal.Length*, and coloured by the *Species*.

2. Be sure to include the appropriate labels.

3. Use the `ggplotly()` to make your plot interactive.

4. What do you notice?

`plot_ly()`

- The `plot_ly()` function takes arguments on how the chart should be rendered.

- The functions for each aesthetic is added using $\sim$ (function of).

- You can use the `layout()` function to specify how the data will be rendered (titles, labels, ect.)
  - Need to *pipe* in the *plotly* object using %>%.

- **Generally, you should build off of the examples provided in the *plotly* documentation.**

Links to `plot_ly()` Examples

- Scatter and Line plots

- Boxplots

- Histograms

- Bar Charts

- Violin Plots

Example 2

1. Use the plot_ly() function and the example code provided to re-create the plot you created in Example 1.

Example 3

1. Use the plot_ly() function, the *iris* dataset, and the example code provided to create an interactive violin plot for *Petal.Width* faceted by *Species*. Be sure to include appropriate labels.

rbokeh

Bokeh I

- Provides a similar set of interactive features at Plotly.

- Was originally developed for Python.

- An R package is available and it may be easier to work with than *Plotly* for some people.

- rbokeh is an external package so we will need to install and then load it: `library(rbokeh)`

Bokeh II

- Create a new plot with Bokeh using the `figure()` function.

- This creates a new plotting area that you can add layers to.

- Each layer is created using a different function starting with `ly_`.

- We add the layers by piping `%>%` the plot into different functions.

- `hover = list(x, y))` to add a hover option.

Bokeh Layers

- **Check out the documentation for all of the layers and functions**

    - Histogram: `ly_hist()`
    - Boxplot: `ly_boxplot()`
    - Scatterplot: `ly_points()`
    - Bar chart: `ly_bar()`

Example 4

1. Use the figure() function, the *iris* dataset, and the example code provided to create an interactive scatterplot for with x as the *Sepal.Width*, y as the *Sepal.Length*, and coloured by the *Species*. Be sure to include appropriate labels.

leaflet

The leaflet Package

- **Leaflet** is an open source JavaScript library for building interactive maps.

- We can use the *leaflet* package to build maps in R.

- Leaflet is used to generate many interactive maps you will find on websites.

- leaflet is an external package so we will need to install and then load it: `library(leaflet)`

Generating a Map I

- We use the leaflet() function to create a blank map.

- We then *pipe* (%>%) layers onto the map.
    - Map tiles, markers, lines, and polygons.

- **Map tiles** are the most important layer to add and we use the addTiles() function.
    - Map tiles are a series of small square images (tiles) to create the larger map.

- leaflet will automatically load and show the appropriate tiles as you move and zoom with your map.

Generating a Map II

- By default Leaflet uses tiles from *OpenStreetMap*.
    - You can choose which tile set to use by passing the name of the tile set in the addTiles() function.

- You can also use the addProviderTiles() function to select a different tile provider.

- The setView(lng =, lat =, zoom =) function specifies where to centre the map (including zoom).

- Can add markers: addMarkers(lng=, lat=, popup="Label")

- Can add circles: addCircles(lng=, lat=, popup="Label", radius = , stroke = FALSE)

Example 5

- Use the example code found under the *Leaflet* heading to create an interactive map that contains the location of Thompson Rivers University and The University of British Columbia - Okanagan Campus.

- Be sure to add a legend to your map.

- Assume:
    - TRU latitude = 50.6708
    - TRU longitude = -120.3660
    - TRU enrollment = 27700

    - UBC-O latitude = 49.9394
    - UBC-O longitude = -119.3948
    - UBC-O enrollment = 11562

Exercise 1

- The best way to improve your understanding of the plotting functions in *plotly*, *bokeh*, and *leaflet* is to take some time to generate some plots or maps, make customisations, and think about what your visualisations actually mean.

- We have only covered a small portion of the functionality in each of these packages. Take some time on the websites to play around with different functions and arguments.

- I encourage you to take some time with your project data (or other real data) and try to generate some insightful plots using *plotly*, *bokeh*, and *leaflet*.

Exercise 2

- Use the example code found under the *Leaflet* heading and Example 5 to create an interactive map that contains the locations of the 5 largest universities (by enrollment) in British Columbia.

- Be sure to add a legend to your map.

- Can you add additional information about the universities to the map?

- Try to use the `addProviderTiles()` function to get different tiles for your map.
  - *Hint: Use the leaflet github page to find more information*

References & Resources

1. Michael Freeman, Joel Ross, *Programming Skills for Data Science: Start Writing Code to Wrangle, Analyze, and Visualize Data with R*, 2019, ISBN-13: 978-0-13-513310-1

- https://ggplot2.tidyverse.org/
- https://plotly.com/r/
- https://cloud.r-project.org/web/packages/rbokeh/index.html
- https://hafen.github.io/rbokeh/articles/rbokeh.html
- https://rstudio.github.io/leaflet/
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