BIOF 076: Visualization with R

Creating publication quality figures and interactive web apps with the R programming language

Instructor: Vinay Swamy

March 1st-5th

Introduction

Creating compelling visualizations is an important aspect of biomedical research. The R programming language provides many libraries for creating beautiful figures and interactive web apps. As R is an open source project, it facilitates open science and reproducible research. R has been heavily used by bioinformaticians and data scientists for years, and has become increasingly easy to use. This course is designed to allow researchers to quickly dive into R and make visualizations for their own work. No previous experience in R is required.

After this course you will be able to:

- Load and prepare data for plotting
- Generate common scientific plots like Bar graphs, scatter plots, and heat maps using multiple plotting libraries
- Use git, GitHub and binder to share plots
- Use visualizations to explore new data
- Combine multiple plots to create publication quality figures
- Design interactive web apps with R-Shiny
- Integrate plots from R into posters and papers
- Complete a final project with your own data

Format

The workshop is structured as a series of interactive lessons, with a lecture and exercises components. There Our engagement during this workshop will take several forms:

- Class materials: All materials, including lecture slides and excercises will be availble on canvas, and the course Github repository
- All lessons will be held live over Zoom
- Communications: There will be a slack group created for the class.

Software and Materials

We will have two sessions to install all software before the course at **10am** and **4pm** on **Friday, February 26th**. Some of the main software we will be using:

- Software
  - R language base system - the core interpreter for the R language that runs the code we will write
  - Rstudio - an integrated devleopment environment(IDE) that makes it signficantly easier to write code
  - git - a version control system for writing code
  - GitHub - students will sign up for GitHub, an online repository for code.
  - GDAL - software for using maps in R
- Materials
  - A computer, ideally with administrative access. (you likely *do not* have administrative access on a government issued computer)
  - Multiple screens(2 monitors, computer + tablet/phone etc)

Schedule

Day	Time	Topic
Monday	9AM-9:50AM	Course Introduction/Basic Programming in R - Part 1
	10AM-10:50AM	Basic Programming in R - Part 2
	11AM-12PM	Basic Programming in R - Part 3
	12PM-1:00PM	Break
	1PM-1:50PM	Using the ggplot2 library - Basic Plots
	2PM-2:50PM	Using the ggplot2 library - Customizing themes and Aesthetics
	3pm-3:50PM	Office hours
Tuesday	9AM-9:50AM	Review / Conditional programming
	10AM-10:50AM	Manipulating Data with the tidyverse Part 1
	11AM-12PM	Manipulating Data with the tidyverse Part 2
	12PM-1:00PM	Break
	1PM-1:50PM	Manipulating Data with the tidyverse Part 3
	2PM-2:50PM	Using the ggplot2 library - Complex Plots
	3pm-3:50PM	Office hours
Wednesday	9AM-9:50AM	Extensions to ggplot
	10AM-10:50AM	Combining multiple plots to make Figures
	11AM-12PM	Plotting with Maps and making Animated plots
	12PM-1:00PM	Break
	1PM-1:50PM	Intro to R Markdown
	2PM-2:50PM	Making Copycat Plots - Building intuition for making novel plots
	3pm-3:50PM	Office Hours
Thursday	9AM-9:50AM	Review/Interactive plots with Plotly
	10AM-10:50AM	Intro To Shiny
	11AM-12PM	Shiny - UI
	12PM-1:00PM	Break
	1PM-1:50PM	Shiny - server
	2PM-2:50PM	Complex Shiny Apps
	3pm-3:50PM	Office Hours

	9AM-9:50AM	Course Summary
	10AM-10:50AM	Student Project Development
	11AM-12PM	Student Project Development
Friday	12PM-1:00PM	Break
	1PM-1:50PM	Student project presentations
	2PM-2:50PM	Student project presentations
	3pm-3:50PM	Office Hours

A note on the schedule

- We will try to cover presented in the schedule. However, it is very possible we will move slower than anticipated, and so any material we do not cover within the first 4 days will be covered on the final day(Friday) in lieu of the presentations

Office Hours

Office hours will be held at the end of each day from 3-4PM.

FAQ

Q. Do I need any Prior Experience in R

A. No, This class requires NO expreience in R. We will cover everything you need to know within the course.

Q. I don't have administrative access to my computer, how will I be able to install the necessary software?

A. While it's best to work on your own machine, a standalone cloud based environment will be available for people to use.