Create Applications using R and Shiny

AACC University 2020: Doing More with R

What is shiny?

shiny is a R package that can be used to create applications that can be hosted on a server. These applications are interactive and allow the user manipulate their data in real time as well as create reports of the data if the need arises. These applications are very customizable while still being relatively easy to use.

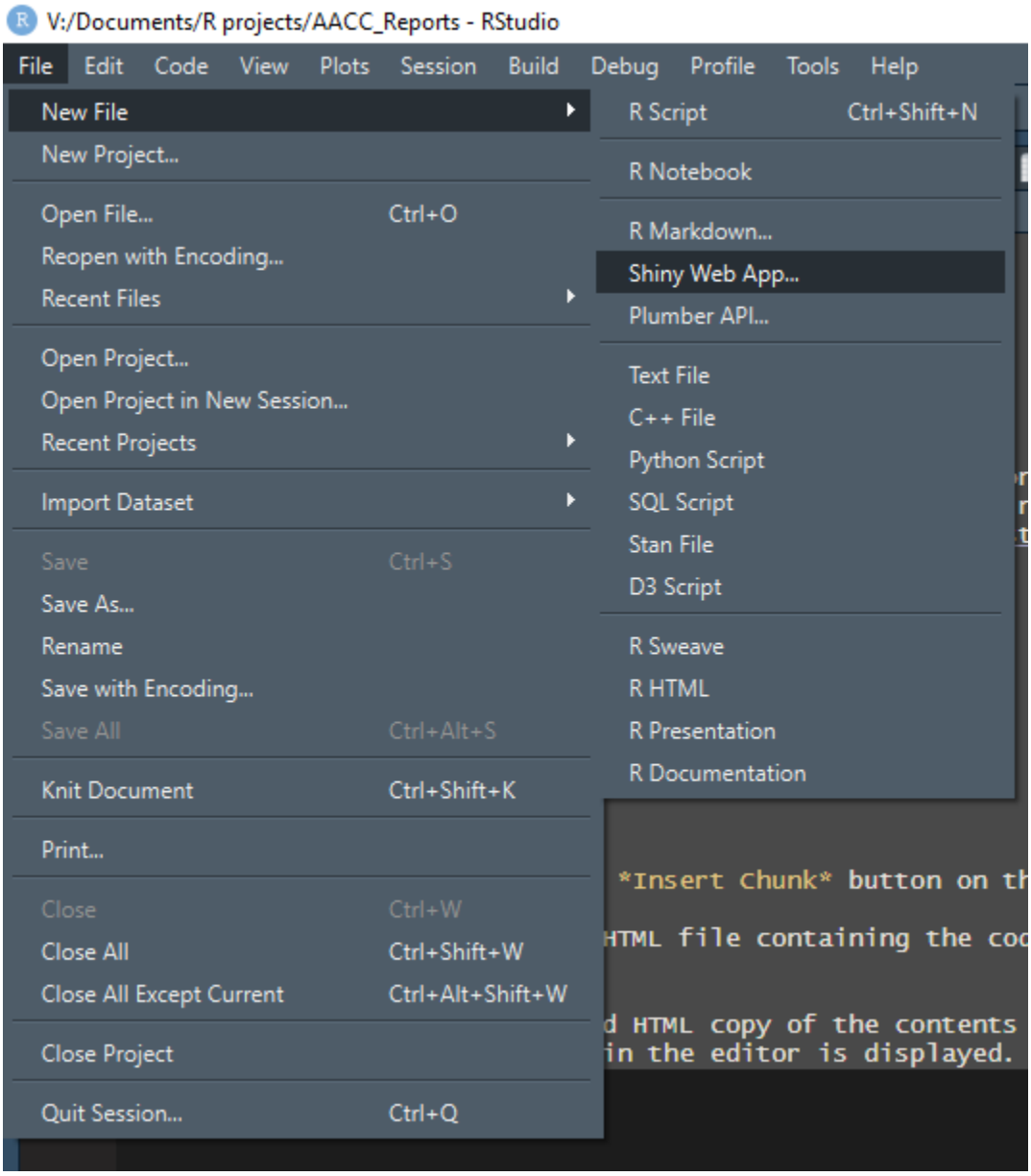
https://shiny.rstudio.com/gallery/.

Getting Started with Shiny

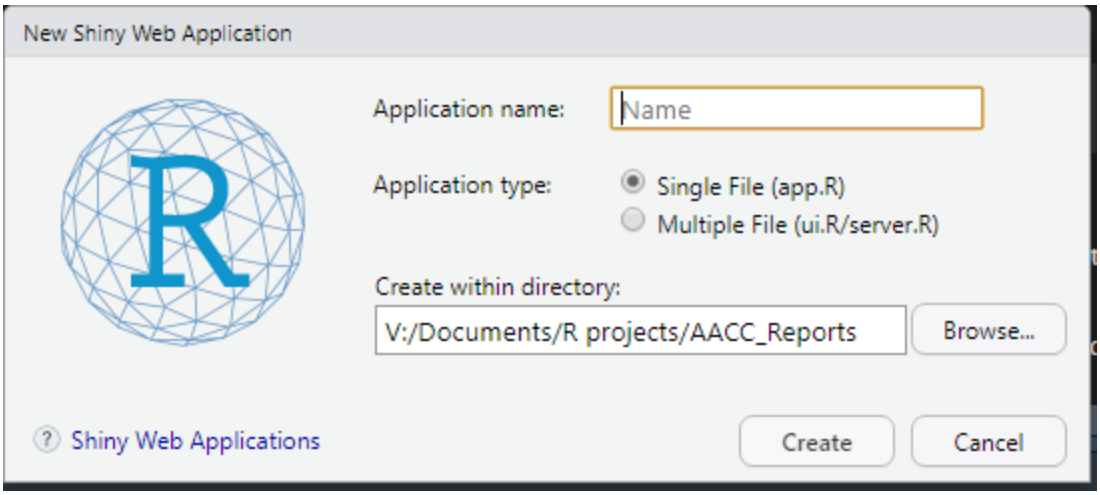
First you need to install the shiny package.

```
install.packages("shiny")
```

After the package is installed there will be the option to create a New File > Shiny Web App.



After selecting Shiny Web App, a pop-up will open.

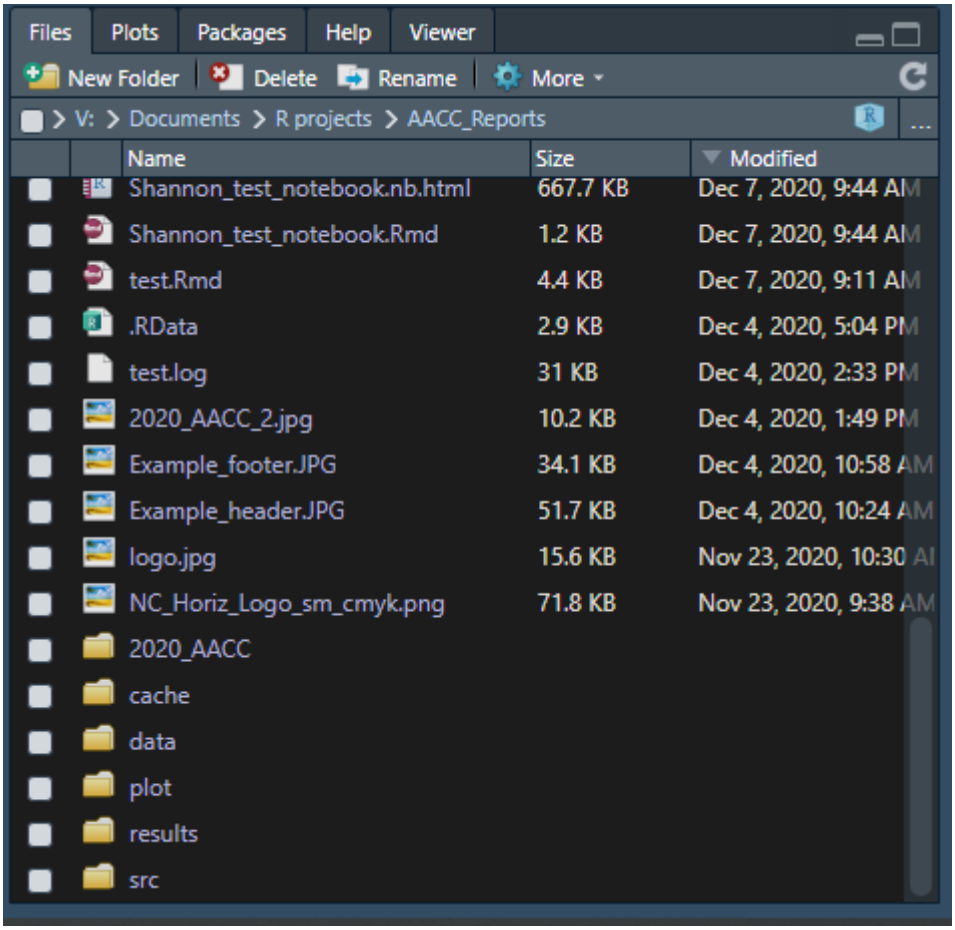


Application Name and dierctory is at the will of the user. However, Application Types has two options. Shiny Apps are composed of two components. The first is the user interface which includes how the app will look, what is included, and other UI issues. The second component is the server portion which connects to the server and updates the available information based on input from the UI side. Originally, Shiny Apps were composed of two indepent files (ui.R and server.R). Newer version of the shiny use a single file (app.R) that contains two section.

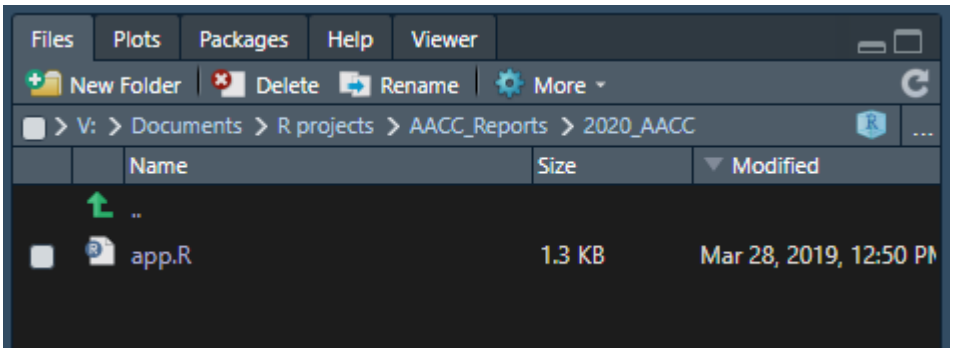
Shiny applications that run on a server will only run from an app.R or a ui.R/server.R files.

Select the single file option.

I named my app 2020_AACC. If you look in your file window you can see that a new folder was created to hold all of the data needed for the shiny application.



Currently, the only thing in the folder is app.R



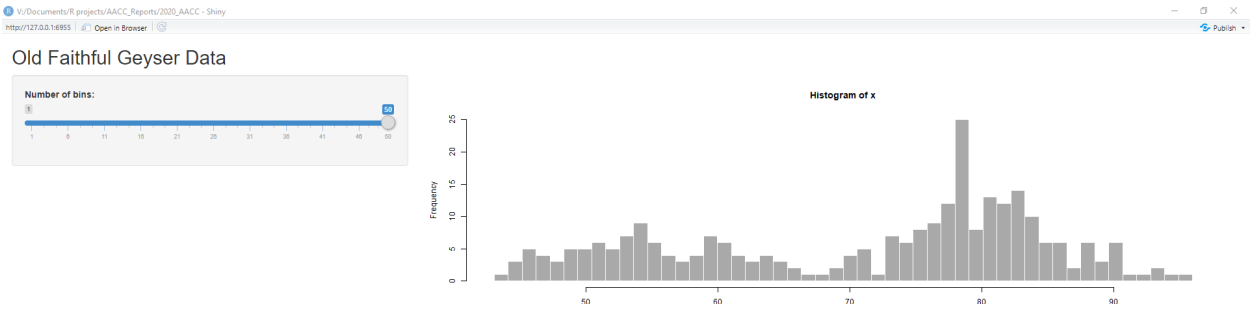
Upon opening a demo shiny app is created from which we can begin building our own,

app.R

```r
#
# This is a Shiny web application. You can run the application by clicking
# the 'Run App' button above.
#
# Find out more about building applications with Shiny here:
#
#    http://shiny.rstudio.com/
#

library(shiny)

# Define UI for application that draws a histogram
ui <- fluidPage(

    # Application title
    titlePanel("Old Faithful Geyser Data"),

    # Sidebar with a slider input for number of bins
    sidebarLayout(
        sidebarPanel(
            sliderInput("bins",
                        "Number of bins:",
                        min = 1,
                        max = 50,
                        value = 30)
        ),

        # Show a plot of the generated distribution
        mainPanel(
           plotOutput("distPlot")
        )
    )
)

# Define server logic required to draw a histogram
server <- function(input, output) {

    output$distPlot <- renderPlot({
        # generate bins based on input$bins from ui.R
        x    <- faithful[, 2]
        bins <- seq(min(x), max(x), length.out = input$bins + 1)

        # draw the histogram with the specified number of bins
        hist(x, breaks = bins, col = 'darkgray', border = 'white')
    })
}

# Run the application
shinyApp(ui = ui, server = server)

```

but before we begin let us run the current app as it is. Select the green arrow Run App to the top right corner where the run button usually is.

When you run the app a simple application runs that allows someone to change the number of bins used in a histogram for the frequency of Old Faithful Geyser eruptions.



Let us create our first shiny app

We are going to make a simple application for a single analyte that allows us to create Levey-Jennings Plots for different time periods as dictated by the user.

https://shiny.rstudio.com/images/shiny-cheatsheet.pdf

UI

Our code has to be able to capture user input. To do this we modify the UI portion of the shiny app. The basic shiny app UI portion is separated into 3 sections. The *titlePanel*, the *sidebarPanel*, and the *mainPanel*. The *titlePanel* hold the title of the application. The *sidebarPanel* is used for user inputs to the application. There are many inputs available to use such as the *sliderInput* used in the Old Faithful example. We are going to use *dateInput* to determine what time period to present on the LVchart. The final section is the *mainPanel* which is where outputs go which is where our LVchart will reside.

I am using the package *lubridate* to deal with date because it is easier to use than Base R. Below is the code for the UI. We could use *dateRangeInput* instead of *dateInput*.

Please try to adjust the code with *dateRangeInput*.

```
# Define UI for application that draws a histogram
ui <- fluidPage(

    # Application title
    titlePanel("Basic QC Chart"),


    # Sidebar with a slider input for number of bins
    sidebarLayout(
        sidebarPanel(
            dateInput(inputId = "start", label = "Start Date:",
                      min = lubridate::today()-365,
                      max = lubridate::today(),
                      value = lubridate::today()-45),
            dateInput(inputId = "end", label = "End Date:",
                      min = lubridate::today()-365,
                      max = lubridate::today(),
                      value = lubridate::today()-15)
```

```
            ),

        # Show a LVchart plot
        mainPanel(
            plotOutput(outputId = "LVPlot"),

        )
    )
)
```

One of things to point out about using *shiny* that took some time to internalize was the use of inputId and outputId. These are used to link the infromation from the UI and Server sections of the application together.

Server

The server side is a function that takes inputs and outputs to perform a function. The code for the server side is below.

```
server <- function(input, output) {

    output$LVPlot <- renderPlot({
        # read in the data
        active_data <- read.csv("ShinyData.csv")
        active_data$date <- as.Date(one_month$date)
        #User input of the dates
        active_data <- active_data %>%
            dplyr::filter(between(date, as.Date(input$start), as.Date(input$end)))

       active_data %>%
            group_by(qc_code) %>%
            mutate(value_scaled = (value-mean(value))/sd(value)) %>%
            ggplot( aes(x = date, y = value_scaled, color = qc_code, ymin = -1, ymax = 1)) +
            geom_ribbon( alpha = 0.3) +
            geom_ribbon(aes(ymin =-2, ymax = 2), alpha =0.2) +
            geom_ribbon(aes(ymin =-3, ymax = 3), alpha =0.1) +
            geom_line() +
            geom_point() +
            ggtitle("Levey-Jennings Chart") +
            xlab("Date") +
            ylab("SD Scaled Values")
    })
}
```

The server output is output$LVPlot which links back to the *mainPanel* for the plotOutput(outputId = "LVPlot"). Other UI outputs that are commonly used are *dataTableOutput*, *imageOutput*, *verbatimTextOutput*, and *tableOutput*.

The final part of a shiny app is the final command `shinyApp(ui = ui, server = server)` without this part the application will not run. From experience it will take a little bit of troubleshooting to find the mistake.

My final comment: *shiny* apps can be powerful, but they are also hard to troubleshoot.

The full code for the application is below.

```
#
```

```
# You should notice there is no YAML metadata for a shiny app
#

library(shiny)
library(tidyverse)
library(lubridate)

# Define UI for application that draws a histogram
ui <- fluidPage(

    # Application title
    titlePanel("Basic QC Chart"),


    # Sidebar with a slider input for number of bins
    sidebarLayout(
        sidebarPanel(
            dateInput(inputId = "start", label = "Start Date:",
                        min = lubridate::today()-365,
                        max = lubridate::today(),
                        value = lubridate::today()-45),
            dateInput(inputId = "end", label = "End Date:",
                      min = lubridate::today()-365,
                      max = lubridate::today(),
                      value = lubridate::today()-15)
            ),

        # Show a plot of the LVchart
        mainPanel(
            plotOutput(outputId = "LVPlot"),

        )
    )
)


server <- function(input, output) {

    output$LVPlot <- renderPlot({
        # read in the data
        active_data <- read.csv("ShinyData.csv")
        active_data$date <- as.Date(active_data$date)
        #User input of the dates
        active_data <- active_data %>%
            dplyr::filter(between(date, as.Date(input$start), as.Date(input$end)))

       active_data %>%
            group_by(qc_code) %>%
            mutate(value_scaled = (value-mean(value))/sd(value)) %>%
            ggplot( aes(x = date, y = value_scaled, color = qc_code, ymin = -1, ymax = 1)) +
            geom_ribbon( alpha = 0.3) +
            geom_ribbon(aes(ymin =-2, ymax = 2), alpha =0.2) +
            geom_ribbon(aes(ymin =-3, ymax = 3), alpha =0.1) +
            geom_line() +
```

```
            geom_point() +
            ggtitle("Levey-Jennings Chart") +
            xlab("Date") +
            ylab("SD Scaled Values")
    })
}

# Run the application
shinyApp(ui = ui, server = server)
```