STAT 406 Environmetrics Project

Riley Waters 18390138

November 30, 2017

R Shiny Temperature App

Instructions to run project:

1. Download and extract the RileyWatersSTAT406Proj.zip file
2. Open 'app.R' in R Studio
3. Press 'Run App'. It has a green arrow and is located near the top right of the Source pane
  Note: It will automatically install required packages on the first run. This may take some time.
  Note: Some plots may take time to load depending on the speed of your computer.
4. Press 'Open in Browser'. Project was designed for 1080p screens, so you may need to zoom out to see everything well.

Project Summary:

  This project is an interactive R Shiny app that allows the user to visualize and test climate data from weather stations in Vancouver, Kelowna, and Calgary. All data comes from Climate Canada, and has been cleaned and compiled into one file by me. The different tabs are as follows:

About:
  An introduction page to the project. Click the links in the paragraph for more information about the data.
UI: line 55
Data Explorer:
  Allows the user to sort and search the data table. Data goes back until Jan 1, 1900.
UI: line 97. Server: line 454.
Monthly:
  Quick comparisons between the city's chosen temperatures in each month, averaged over the chosen range of years. It also displays the lowest and highest recorded temperatures over the selected year range.
UI: line 128. Server: line 480
Monthly Advanced:
  Plots the highs and lows of each month as well as the average of the highs and lows, over the chosen year range.
UI: line 162. Server: line 550
Density:
  Plots the count of days at each temperature bucket for each city, as well as the density of days at each temperature. User can choose to graph the Mean, Max, or Min temperatures.
UI: line 184. Server: line 592

Histogram:

Plots a histogram of the number of days at each temperature. The user can choose the temperature band it displays.

UI: line 212. Server: line 642

Simple T-Tests:

Perform a One-Sample T-Test on the real data to test the true mean of a selected response at a selected city. Perform a Two-Sample T-Test on the real data to test the true mean of a selected response at two selected cities.

The p-value of any two cities is always low for Mean Temperature, indicating that there is not enough evidence that the true difference in means between the cities is zero. In other words, there is little evidence that any pair of the cities have the same true mean for Mean Temperature.

UI: line 233. Server: line 669

Prediction:

A seasonal time-series model was fit on the data. The user can view the results of this model and use it to predict a selected number of months into the future.

UI: line 299. Server: line 710

One-Sample Simulation:

Using the same time-series model, the user can generate simulated data for a chosen city and perform a one-sample T-Test on the simulated data.

UI: line 328. Server: line 736

Multiple Simulation:

User can generate simulated data for all three cities and perform a Two-Sample T-Test and an ANOVA Test on the Mean Temperatures. In most simulation cases, both tests will result in a small p-value indicating that there is not enough evidence that the true mean between the groups is zero. Occasionally there will be a simulation where there is a large p-value.

UI: line 355. Server: line 748

Generic Conclusion:

All three cities have different mean, max, and min temperatures. Vancouver tends to be the most moderate, with the lowest highs and highest lows. Kelowna gets the hottest in summer. Calgary gets the coldest in winter.

Additions:

I would like to add several modules to the app outside the scope of this course project. I am interested in fitting a neural network on the data to compare its predictions to those of my time-series model. I would like to test how some values such as precipitation and wind speed affect the temperature, but currently the data is only consistent in the temperature variables. I would also like to visualize how a certain year of temperatures differ from a given range of years, to see if one year was particularly hot/cold. I will continue adding to this project on
https://github.com/rileywaters/RockyCitiesWeather