

# Web Application Development for Inferential Statistics using R Shiny

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## ABSTRACT

The rapid development of world technology has a major influence in the world of education and can be used to support learning activities. Regarding the rapid advancement of computers, statistics learning can be done with many online computer simulations. Computer simulation and visualization in supporting statistics learning is necessary to design program well. This can increase interest, motivation and understanding in learning statistics both theory and application, so it is not boring. Many frameworks can be used to build website-based applications; one of them is the Shiny Web Framework. Shiny is a package of the R programming language that makes the users easily build web-based applications. By using R-shiny, the users are not required to master R program because it has friendly and interactive web-based menus. Therefore, R-shiny is very good as a complement in statistic learning that the users are able to focus more on statistical concepts without being limited their ability to master statistical software.

**Keywords:** RShiny, open-source, Software R

## 1. INTRODUCTION

R is a language and environment for statistical computing and graphics [1]. R is one of the open source software that is popular and has become "lingua franca" or standard language for the purposes of computing the current statistics [2]. Many advantages are offered by this software, for example multiplatform (available for Windows, Linux, Macintosh and Unix operating systems), reliability of good software, availability of updates and a complete library, free support for users, and so on.

R which has been known in its current version (last version June 22, 2020 is 4.0.2) is a statistical analysis system that is relatively complete. Currently the R kernel source code is developed by the R Core Team, which consists of members of a number of statisticians from around the world, and by statistical societies around corners of the world who contribute to the code, report bugs and build documentation for R [3]. The associated source code can be obtained at CRAN-archive and allowed to be modified as needed.

Although R prioritizes the use of programming languages, the users who are in average level of statistical methods and programming languages can take advantage of the libraries that have been prepared to perform certain

data analysis [3]. One of the libraries, which can be easily used is R-Commander. By enabling the library R-Commander, users can perform statistical data processing easily through the menus provided in the R-Commander window, as easy as using SPSS, Minitab or other licensed statistical software.

For the purposes of simple inferential statistical analysis, it is quite complete packages or libraries from R with interactions in the form of R-CLI (Command Line Interface), such as the stats library and PASWR. However, for teaching purposes, the use of R-CLI is felt less friendly and relatively difficult to be used in comparison with similar commercial packages that already have a good GUI (such as SPSS software, Minitab). In this paper, we will introduce and discuss the use of R to compare means, which is one of the standards analysis introduced in inferential statistics.

## 2. R SHINY

R is a highly flexible and powerful tool for analyzing and visualizing data. Shiny is the perfect companion to R, making it quick and simple to share analysis and graphics from R that users can interact with and query over the Web [4]. Shiny is an R package that allows you to easily create rich, interactive web apps [5]. Shiny allows you to take your work in R and expose it via a web

browser so that anyone can use it. Shiny makes you look awesome by making it easy to produce polished web apps with a minimum amount of pain. For example package based on the shiny and can be run locally or on a server is Radiant. Radiant is an open-source platform-independent browser-based interface for business analytics in R [6]

In the past, creating web apps was hard for most R users because need a deep knowledge of web technologies like HTML, CSS and JavaScript. Furthermore, making complex interactive apps requires careful analysis of interaction flows to make sure when an input changes, only the related outputs are updated. Shiny makes it significantly easier for the R programmer to create web apps by providing a careful curated set of user interface functions that generate the HTML, CSS, and JavaScript that you need for common tasks. This means that you do not need to know the details of HTML/CSS/JS until you want to go beyond the basics that Shiny provides for you.

Introducing a new style of programming is called reactive programming, which automatically tracks the dependencies of a code chunk. This means that whenever an input changes, Shiny can automatically figure out how to do the smallest amount of work to update all the related outputs. People use shiny to create prototypes of web applications, as the development in R is often much faster but it is difficult to scale. Briefly, Shiny gives you the ability to pass some of your R superpowers to anyone who can use a web browser. Shiny does not limit you to create trivial or prefabricated apps: its user interface components can be easily customized or extended, and its server uses reactive programming to let you create any type of backend logic you want.

Since the launch of R-Shiny by R-Studio & Inc (2018), many R users have created sample applications using R which are mostly visualizations of simulations. Due to the advantages of R-Shiny, it can be accessed via web (to see visualization and statistical simulations in order to improve understanding) without having to use a

computer containing R. By using this web model, it can be easier for the users due to the more flexibility in accessing via tablets or smartphones

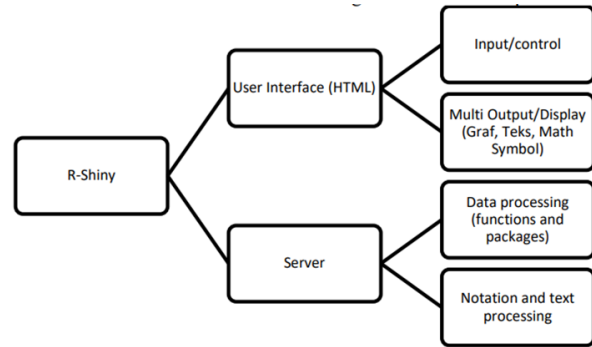


Figure 1 Component Structure R Shiny.

The Shiny web application is comprised of 3 components [7]:

- i. User Interface (ui.R), the UI is the frontend that accepts user input values and object controls, the layout and appearance of application
- ii. Server function (server.R), the server is the backend that process these input values to finally produce the output results that are finally displayed on the website
- iii. ShinyApp function, the application itself that combines the UI and server components together.

### 3. R SHINY FOR INFERENTIAL STATISTICS

Figure 2 shows the application interface, the section mainPanel tab is divided into Compare Means, Nonparametric tests, Contingency Tables, Linear Regression, Logistic Regression and Dimensional Analysis. The application provides a tab to upload data file of users from local devices. Furthermore, some example datasets are embedded in the interface for users to choose.

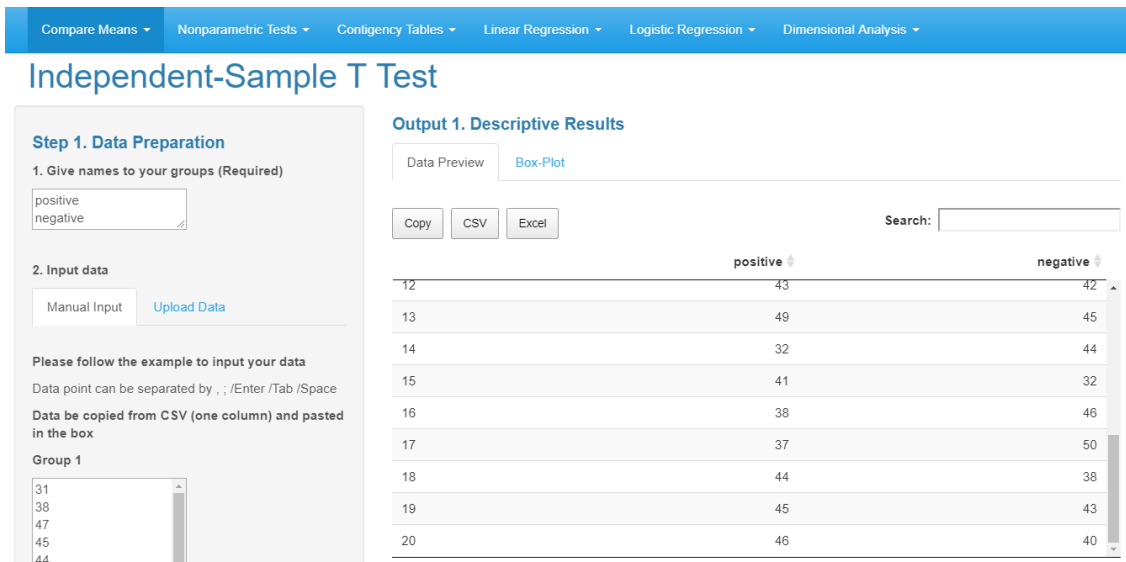


Figure 2. Data preparation and data preview

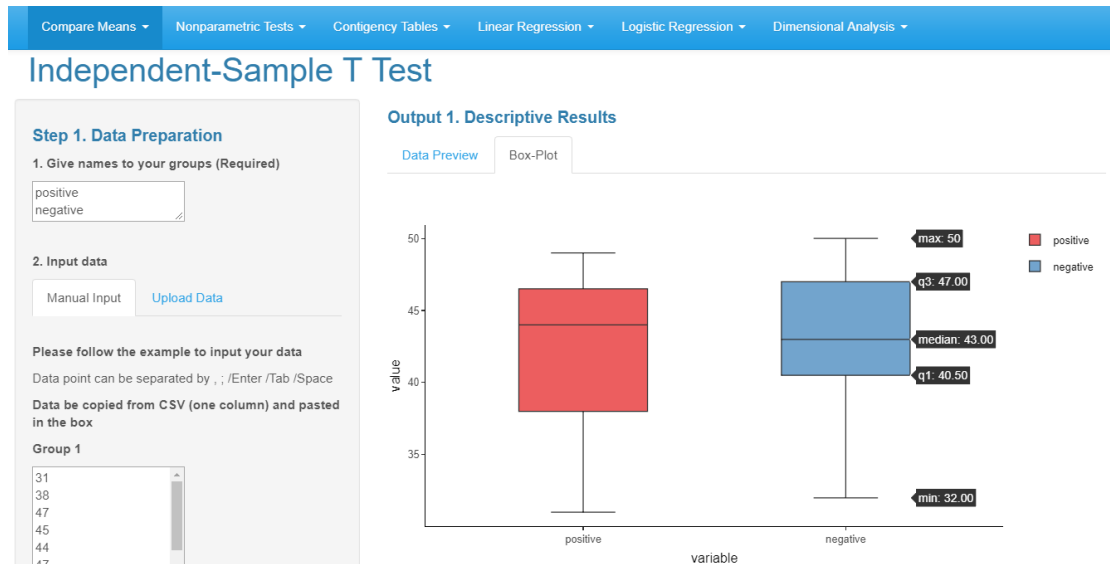


Figure 3. Descriptive results box-plot

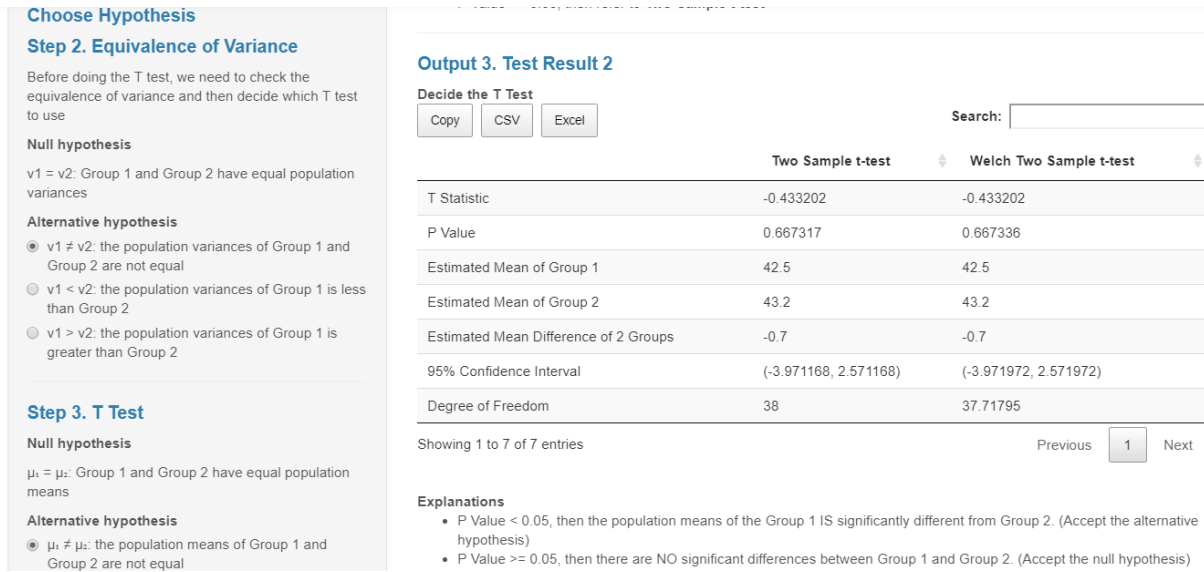


Figure 4. Output Independent-Samples T Test

We compared the application with another software namely Statistical Package for the Social Science or known as SPSS. The menu and output on SPSS is given in Figure 5 and Figure 6.

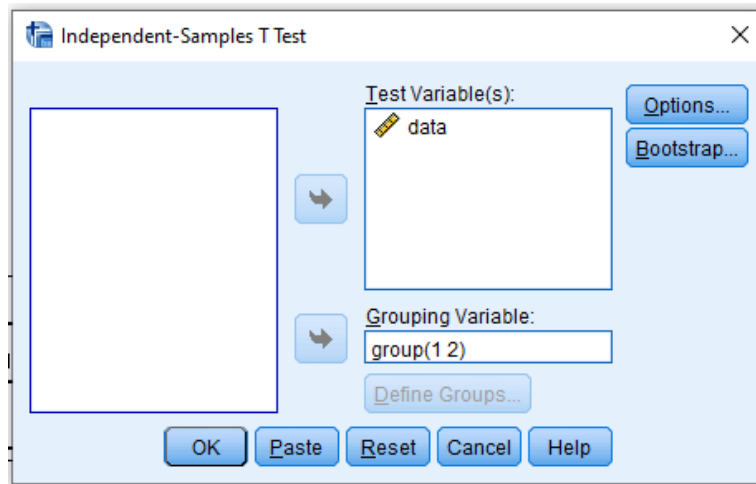


Figure 5. Dialog Window Independent-Samples T Test SPSS

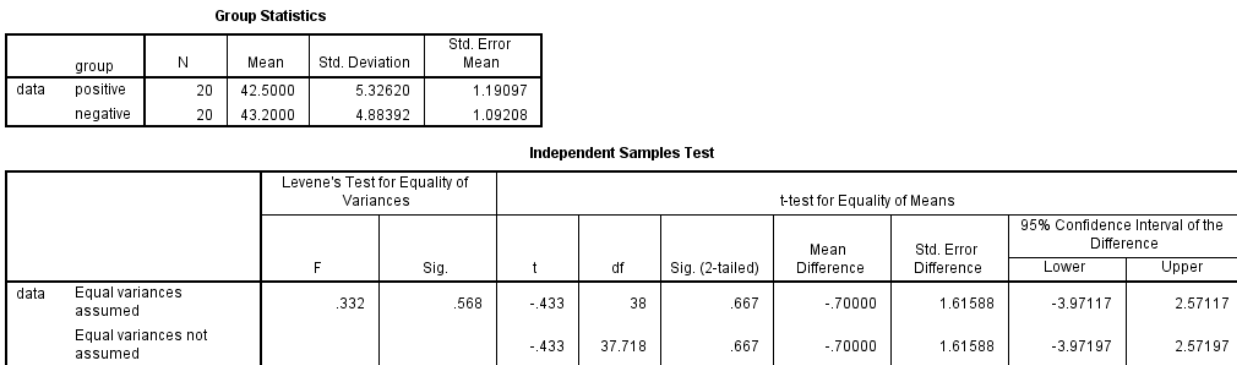


Figure 6. Output Independent-Samples T Test SPSS

Presenting via the Shiny offers some advantages over SPSS software. When using this application, the R

console is not shown as R works completely in the background and interactively with Shiny. All

adjustments in the app are done by moving sliders or clicking buttons and corresponding updates to the output plot that are virtually instantaneous. This leads to a much more fluid and dynamic presentation. The important advantage of the R Shiny is it can be deployed to a server so that it can be accessed online via a web browser. Thus, users can experiment with the app on their own without having to know anything about R programming.

#### 4. CONCLUSION

The web application has been successfully developed using shiny framework for inferential statistics. The advantages of R-Shiny which can be accessed via the web to see visualization and statistical simulations in order to improve understanding without having to use a computer containing R. With this web model it can make it easier for users to be more flexible in accessing via tablets or smartphones.

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