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JMASM 50: A Web-based Shiny Application for Conducting a Two Dependent Samples Maximum Test (R)

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A web-based Shiny application written in R statistical language was developed and deployed online to calculate a new two dependent samples maximum test as presented in Maggio and Sawilowsky (2014b). The maximum test allows researchers to conduct both the dependent samples *t*-test and Wilcoxon signed-ranks tests on same data without raising concerns associated with Type I error inflation and choice of statistical tests (Maggio and Sawilowsky, 2014a). The maximum test in R statistical language provides a friendly user interface.

Keywords: Maximum test, Wilcoxon signed-ranks test, Type I error inflation, R programming, Shiny application, Dependent samples t-test

Introduction

The dependent samples *t*-test is used if data are known or expect to be normally distributed. If not, and it is assumed that the treatment alternative is a shift in means then the Wilcoxon Signed-Ranks (WSR) test is to be used (Blair & Higgins, 1985; Bridge & Sawilowsky, 1999; Gerke & Randles, 2010; Wiederman & Alexandrowicz, 2011). Researchers that conduct both tests on the same data unavoidably increase the experiment-wise Type I error rate.

A new maximum test excel calculator was introduced by Maggio and Sawilowsky (2014b). It is based on the maximum of the dependent samples t-test and the Wilcoxon Signed-Ranks (WSR) test. The critical value was previously obtained from the joint sampling distribution for the two tests, thereby eliminating concern for Type I error inflation (Maggio & Sawilowsky, 2014a) when

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conducting both tests. This new test also eliminates choice of one test over another thus allowing multiple tests on same data either serially or in parallel.

Purpose

The purpose of this article is to provide a web-based Shiny application written in R that calculates the two dependent samples maximum test as in Maggio and Sawilowsky (2014a). This application allows for column names (headers) and separators such as commas, semicolons, or tabs. The locations of the data columns for dependent samples can also be indicated by providing an appropriate column number for Series 1 and Series 2 as shown in Figure 1.

Methodology

The application is available online at https://datawise.shinyapps.io/maxtest/. A screenshot of the application in R located in Figures 1 and 2.

Input

The process of obtaining the maximum test *p*-values, critical values and a determination of whether or not to "reject" or "fail to reject" a null hypothesis is as follows:

1. As shown in Figure 1, upload a comma separated values (CSV) file by clicking on the "Choose File" button.
2. Select the significant levels such as 0.05 or 0.01
3. Select one-tail test or two-tail test.

Conclusion

The application reports in the second tab "Data" displays the uploaded data for visual confirmation. In the third tab "*t*-test" reports the output for the *t*-test (statistic, *p*-value, and degrees of freedom). The fourth tab reports the output of the "Wilcoxon Signed Rank Test" (statistic and *p*-value). The fifth tab "Maximum Test Output" reports the maximum of the two tests, critical values of the dependent samples *t*-test and WSR test, maximum test critical value, effective

significance level of the tests, and the decision whether to reject the null or fail to reject the null.

The maximum test can be used in lieu of choice between the dependent samples *t*-test and the WSR where "both the classical parametric and non-parametric tests can be safely conducted on the same data, with the maximum of the two refereed to the new table of critical values that are designed to maintain the Type I error rate to nominal α while guaranteeing the maximum power of the two tests" (Maggio & Sawilowsky, 2014b, p.4).

Critical values for a two tailed test and an example to follow was provided for in Maggio and Sawilowsky (2014a). An easy to use calculator in excel was provided in Maggio and Sawilowsky (2014b).

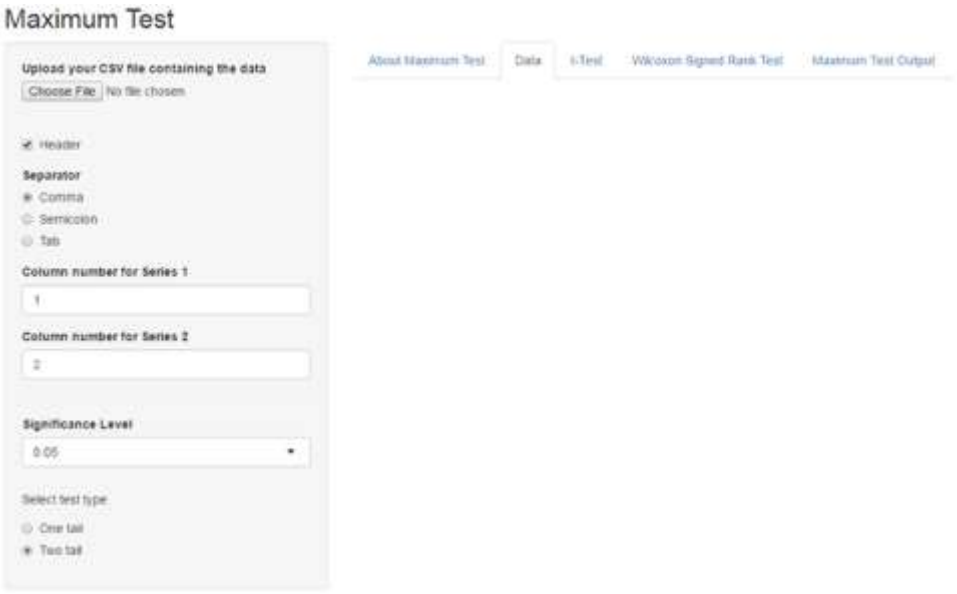

Figure 1. Interface of the web-based application

Figure 2. Example of an out from the Maximum test

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