iNZight: a gui for learning statistics

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1 Introduction

- Scope out the need for iNZight
- R can be daunting for beginners/students (who may never have used or even see code before)
- Excel (Microsoft Corporation, 2018), SPSS/etc are rather complex with a not-insignificant learning curve to be able to produce basic exploratative plots and summary statistics
  - Do not provide any kind of a 'pathway' to learning R for data science purposes, either
- Other R-based GUIs:
  - Rcommander (Fox, 2005)
  - Jamovi (The jamovi project, 2020)
  - ???
- Other tools targeting students:
  - NZGrapher (Wills, 2020) uses PHP
- No obvious—simple—point-and-click interfaces for simple data analysis/visualisation that also provide a pathway to more complex, code-driven analyses

2 A history of iNZight

- Originally a simple implementation experimenting with R (R Core Team, 2020) and 'gWidgets' (now superceeded by 'gWidgets2', (Verzani, 2019)) for making graphs which react to the type of data (i.e., the user doesn't have to choose the graph type)

- Uses GTK (The GTK+ Team, 2020) to produce graphical interface, accessed via the 'RGtk2' R package (Lawrence and Temple Lang, 2010)
- The software uses the variable types (numeric or categorical) to determine the type of graph or summary produced
- Picked up by [. . . ?] and rolled out for use in NCEA Level 3 statistics in New Zealand (final year of high school)
- Redesigned in 2014 with gWidgets2 and reference classes (one of R's Object Oriented Programming approaches)
- Additionally uses a suite of complimentary R packages to separate form (the UI) from function (data processing, graphics, etc)
- Additionally modules for time series, model fitting, etc, and more recently added an add-on system
- Most of the work has been student-driven: "By students, for students" (rather than being created by computer scientists)

3 An overview of iNZight's structure

- Many of the features come from design-flexibility
- Separation of UI and data processing
- Relies mainly on 'gWidgets2' and 'gWidgets2RGtk2' (Verzani, 2019, 2020) to interface with the user, and reference classes to structure the code base
- internally, each component of the UI is represented by a single class - this makes it easy to extend and modify iNZight
- data/variable manipulation windows each are a single class, which connects to a helper function in another package (usually inside 'iNZightTools' (Elliott, 2020))
- A key design feature is that the UI asks the users for inputs, which are passed to a single function as arguments - this allows not only separation, but also for other GUIs (for example iNZight Lite) to connect to the same functions
- Additionally, those simple wrapper functions can be accessed by beginners not yet ready for the more complex coding required to do the same things

Table 1: iNZight R package family

Package	Description
iNZight	The main package for the GUI
iNZightPlots	Provides plot function ‘inzplot()‘ along with ‘inzsummary()‘ for descriptive statistics and ‘inzinference()‘ for inference and hypothesis testing.
iNZightTools	A suite of helper functions for data process and variable manipulation.

```
# A simple window to filter a level of a categorical variable
filterWin <- setRefClass('filterWin',
    fields = list(
        GUI = "ANY",
        data = "data.frame",
        variable = "ANY",
        level = "ANY"
    ),
    methods = list(
        initialize = function(gui) {
            initFields(GUI = gui, data = gui$getActiveData())
            win <- gwindow('Filter Level')
            cont <- gvbox(container = win)
            variable <<- gcombobox(names(data), container = cont)
            level <<- gedit("", container = cont)
            okbtn <- gbutton("Filter")
            addHandlerClicked(okbtn, function(h, ...) filterData())
        },
        filterData = function() {
            var <- svalue(variable)
            level <- svalue(level)
            newdata <- iNZightTools::filterLevels(data, var, level)
            GUI$set_data(newdata)
        }
    )
)
```

Listing 1: A simple reference class window to filter a level of a factor.

We see in listing 1 that ...

References

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Fox, J. (2005). The R Commander: A basic statistics graphical user interface to R. *Journal of Statistical Software*, 14(9):1–42.

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Microsoft Corporation (2018). *Microsoft Excel*. `https://office.microsoft.com/excel`.

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The GTK+ Team (2020). *GTK*. `https://www.gtk.org/`.

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Verzani, J. (2019). *gWidgets2: Rewrite of gWidgets API for Simplified GUI Construction*. R package version 1.0-8.

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