Rbox: an integrated R package for ATOM Editor

Saeid Amiri

Department of Natural and Applied Sciences, University of Wisconsin-Green Bay, Green Bay, WI, USA

Abstract

R is a programming language and environment that is a central tool in the applied sciences for writing programs. Its impact on the development of modern statistics is inevitable. Current research, especially for big data, may not be done solely using R and will likely use different programming languages; hence, having a modern integrated development environment (IDE) is very important. Atom editor is modern IDE that is developed by GitHub, it is described as "A hackable text editor for the 21st Century". This report is intended to present a package deployed entitled Rbox that allows Atom Editor to write and run codes professionally in R.

Keywords: programming; IDE; Jupyter; JavaScript; Web-based interface.

1 Introduction

Because of computational advances, technological modernization, substantial cost-reductions, and the broad proliferation of modern cloud services, the use of data has rapidly increased over the past decade. The explosion of data (size, complexity, heterogeneity, scale, and incongruence) parallels enormous methodological, analytical and visualization developments. For instance, big data can serve as a powerful proxy for various observed phenotypes and diagnostic traits; enable the forecasting, modeling, and prediction of disease prevalence; and impact our understanding of human health and disease. Typically, such large amount of biomedical and health data are high-dimensional, and finding underlying patterns, associations, latent relations, causal effects, etc. is challenging. In addition, the computational burden of processing complex multi-source data is heavy and often leads degenerative-statistics, violations of parametric assumptions, lack of convergence, and ultimately biased scientific inference. New efficient, and reliable techniques are necessary to cope with the

1 saeid.amiri1@gmail.com
https://atom.io/packages/rbox

1
increase in data volume and complexity. Having highly efficient programing tools for carrying out advanced statistical projects is essential.

R is a popular programming language platform used by many researchers and scientists because of its functionality, reliability, scalability, open-sourceness, and crowd source support. R is the de facto standard for data analysis; anyone can download, view, contribute and expand codes, protocols or scripts via its infrastructure CRAN. R is helping to develop the modern movement in data science, because statistics researchers with little programming knowledge can easily write codes and evaluate their theories numerically. Accompanying code supplements with the paper is an efficient method of introducing the novelty of methods to other disciplines, see Gentleman and Temple Lang. (2007). Rstudio impacts the attractiveness using R, and developing new libraries, but it lacks in-line running code. In-line coding allows the effective exploration and rerunning of code. Jupyter is a set of open-source software tools for interactive and exploratory computing. Its main application is the Jupyter Notebook, a web-based interactive computing platform that interweaves written analysis and coding, it allows users to author computational narratives that combine live code, equations, narrative text, interactive user interfaces, and other rich media see Perez and Granger (2015), which make it very useful for collaborating on the numerical aspects of research. It is also used with tremendous frequency among code educator. The Jupyter command shell used with R is called IRkernel. It not only provides an enhanced shell, but also facilitates parallel computing in Python and accessibility as an interactive computation environment. The IRKernel is R’s counterpart to IPython and provides an interactive environment for scientific computing, built with the purpose of developing an interactive environment for accessing R for scientific computing.1

With the current developments in data sciences, coding in several programing languages is inevitable, and programming can not relay solely on R. For instance Python is a core language in machine learning development, also received attention from statisticians. There are several IDE and one, Rodeo looks similar Rstudio, although it is not comparable to Atom editor. When working on a project, finding an editor with access to several programming languages is desirable. Atom editor is a free and modern IDE developed by the GitHub community and is used as an editor for coding, debugging, and managing projects in several programming languages, including R and Python. Atom editor is

1https://jupyter.org/
equally responsive to users’ needs for both writing and running codes, and it is quickly making its way as a new modern editor that supports a number of programming languages, along with other code editors; such as Visual Studio Code, Sublime, and vim.

The goal of this paper is to present a package entitled Rbox designed for running R in Atom editor. Before focusing on Atom editor, it is beneficial to discuss why R will remain among the top programs used for working with data. It has very advanced libraries for running the parallel computations, which can be used for computer-intensive methods and working with big data, see Section 2. The use of R codes in web-based interfaces has not been widely adopted, this possibility is discussed in Section 3. Section 4 outlines R’s ability to interact with other software. Section 5 presents Rbox and discusses Atom editor.

2 Parallel calculation

Scalability in running an algorithm is essential. R has the ability to run calculations in parallel, which is important for complicated and advanced computation. For instance, in the statistical texts, the ensembling has received much attention. The idea of ensembles is to assume that there is a fixed large model, for which the modeling (prediction) can be done by pooling the results from carefully chosen smaller models. The final model can be found by a consensus value of the submodels and can provide better performance than any one of the components used to form it see Amiri et al. (2017). The ability to run the ensemble calculations in parallel is essential; otherwise, they might not be scalable. Modern PCs and laptops have multi-core processors that allow the computation to be done in parallel. Several libraries in R implemented to run computations in parallel, for instance, see parallel, foreach, doParallel. More details about the packages developed for parallel computation can be found on parallelr’s website. Parallelizing codes in R is very simple and does not require advanced programming skills.

It may be impossible to work with big data without using parallel computation, cluster computers, and supercomputer. Running parallel computations in R using cluster computers and supercomputers using Linux and Unix-like kernels, for instance Slurm, SGE, and LSF, is very easy and helps statisticians

1http://www.parallelr.com/
with little knowledge of programming run big projects.

3 Web-based interface

Some of the released functions in the R libraries might not be user-friendly, and it may be quite overwhelming for users to grasp and correctly use all methods and packages. Practitioners are expected to be familiar with the manual, assumptions, and syntax of R, which may be time consuming and challenging for interdisciplinary researchers. To overcome these problems, many developers have begun to build and share graphical user interfaces that lower the amount of initial knowledge required to use R. This goal motivated researchers to design, deploy, and support a web-based interface that users can quickly, efficiently and effectively run without the need for a complex R computational platform. Here we review a number of services, interfaces, and APIs prior to developing the web interface.

- Shiny: Rstudio has developed a web application framework for R that is a simple way to turn Rs codes into a web-based console. The website version in Shiny’s server is not integrated with non-Shiny clients; the free account has limitations on running times and on the number of websites that can be built, and allocates memory inefficiently. As Ooms (2014) discussed, Shiny lacks interoperability. Because it is, in essence, a remote R console, it does not specify any standardized interface for calling methods, data I/O, etc.

- OpenCPU, see Ooms (2013), is a system for turning an R package into a deployable web application that is based on JavaScript. It can be run from GitHub, which is a free repository for open-source projects. This development motivated efforts to design, deploy, and support a web-based interface that users can quickly, efficiently, and effectively run without the need for a complex R computational platform.

4 Interactivity with other software

R is a shell script language that is designed to be run by a command-line interpreter. This property helps make R interactive and accessible software. Many of the codes behind R are written in Fortran and C. Several libraries in
R are packed to handle codes from other software; for instance, rPython runs Python codes from R. R has very powerful tools for generate advanced and unique graphs on which users can work interactively; the graphical ability of R is well-known, and many libraries in R achieve amazing graphical presentations. Researchers develop advanced graphs, and while deploying them using R’s technology might not be trivial, R works interactively with other technology. For instance, advanced graphs are developed in Plotly (an open source JavaScript graphing library [plotly.js]), and an R package entitled "Plotly" can create interactive web graphics.

Having a shell script helps make R favorite piece of software for running code inside other software; for instance, Azure Machine Learning Studio programs with R and Python. R has its own kernel that allows it to be run inside other software.

5 Modern IDE

R studio provides an advanced editor for R with several tools, especially for deploying libraries. One of the downsides of R studio is that it is designed solely for R, and working with several programming languages is inevitable. Therefore, having modern editors with access to advanced programming languages and coding abilities is essential.

Atom editor is actually a web application that looks like a regular app. It is based on JavaScript; hence, its user interface can be changed with a few lines of codes and is highly configurable, and the user can take control of the editor. The model for the development of Atom editor is the same as that for R; it has a core that is powered by GitHub's team, and packages are added to develop the editor for different applications; it has a repository and developers can deploy and update packages. Because Atom editor has very modern tools that can be used by statisticians and that outperform R studio in exploring codes, the author of this paper collected a toolbox, entitled “Rbox” for running R under Atom editor. It can be downloaded directly from its website. Once the main software is installed, the necessary packages can be installed using the shell commands `apm install packagename` or Atom’s package installer; Atom> Preferences> Install (in Win: File> Settings> Install).

1https://plot.ly/r/
2https://atom.io/packages
3atom.io
To work with R in Atom editor, install Hydrogen, termination, Rbox. Rbox defines the R grammar in Atom editor to work and facilitate with snippets. Atom editor is one of many IDEs aimed at providing a powerful and modern environment with access to autocompletions. A package entitled ”Autocompletion-R” with access to helps is available. The user can add own snippets to expedite coding. Autocompletion is very useful when the user is working with different programming languages. To accept the suggestion provided by Atom press the tab enter key. The down arrow key can be used to select the right option.

To write script, R must be chosen from the Grammar in the editor using Shift+Ctrl+L or by clicking the current grammar name in the status bar, Atom editor then knows the coding language and accesses the snippets available in Rbox for R. The scripts can be run in the terminal without leaving Atom editor, as the editor accesses to the terminal, and the code can be transferred to it. This can be done using clicking on the plus sign on the bottom left to open a terminal (Shift+Cmd+T in macOS or Shift+Alt+T in Win). The terminal will access R when R is typed. To transfer the code to the terminal, select code and press Shift+Alt+R in macOS (or Alt+R in Win), the code can also be executed line by line as well. Several terminals can be opened at once. Atom editor Grammar has access to several programming languages, and by opening new tabs, or new windows one can run different codes without their interacting with each other. Atom editor is designed for professional coders or anyone who needs to work with codes, and there are many useful packages. One of these is atom-beautify, which tidies the codes, when the code is selected and Ctrl+Alt+B is pressed.

Alternatively, the code can be run in-line. Access to the in-line technique can alter programming quite dramatically. The Hydrogen package provides a modern approach, using Jupyter kernels in Atom editor. It allows user to choose which codes (the whole file, a single line, or a selection) will be run. The combination of Hydrogen and Atom editor creates a unique tool for running code in-line and in real time when developing scripts. This is because it can keep track of objects and rerun. The user can add several tabs (Ctrl+N) with access to the same kernel, so they have access to the same objects and

---

1https://atom.io/packages/Hydrogen  
2https://atom.io/packages/termination  
3https://atom.io/packages/rbox  
4http://stat.ethz.ch/R-manual/R-patched/library/  
5https://atom.io/packages/atom-beautify
functions that have already loaded in the executed kernel. However, opening new windows launches new kernels independent of the ones already loaded. When R is selected from Grammar menu, Hydrogen automatically recognize the kernel. Select a chunk of codes and press \texttt{Cmd+Enter} (\texttt{Ctrl+Enter} in Win) to run the code. R’s kernel can also be activated manually from Rbox’s menu or through pressing \texttt{Shift+Ctrl+K}. The result of the run can be presented in another window (\texttt{Shift+Ctrl+O}). Hydrogen can open small windows, called watch, in which the user can type and run code without interfering with the main code (\texttt{Shift+Ctrl+W}) and keep track of variables, which helps provide great insight into value of variables. Rbox provides an interactive tool for coding that offers an effective method for debugging; it is also an appropriate environment in which to run a graph. These abilities are very powerful tools for developing codes.

6 Conclusion

A considerable amount of research has been done to create a milestone statistical software, R offers an enhanced ease of use that has received increasing attention from algorithm developers without degrees in computer science. Supplementing article with well-written code helps researchers find new applications for such tools in applied sciences where they have access to large amount of data. Because researchers are able to discover novel applications for the methods, more contact between method developers and users helps us to draw better understandings.

Modern researchers in statistics must use R in conjunction with other software; hence, access to an advanced editor is necessary, and Atom editor provides such a tool. Here, we present a package for running R in this editor. Atom editor and its packages provide a modern method of running codes; the codes can be run using access terminals in Atom, or it can be executed in-line, providing instant feedback on how users’ data is structured. This design provides an exploratory tool for developing code at different levels of detail and plays a very important role when coupled with testing and validating code in different languages. This author assembled a series of codes to provide the best possible interactive environment for R users carrying out projects with a modern IDE, whether the projects are scientific or not. In short, this packages provides a high standard package for conducting research and developing codes.
This package will be kept updated, and further investigation and improvement are planned to its performance. Unlike in Rstudio, the user can see almost all of the code in Atom and its packages and change it. R users are encouraged to participate and leave comments to aid in the development of this package for R users.

| Action                  | Shortcut keys | macOS   | Win    |
|-------------------------|---------------|--------|--------|
| Select Grammar          | Shift+Ctrl+L  | Shift+Ctrl+L |
| Select Kernel           | Shift+Ctrl+K  | Shift+Ctrl+K |
| Run code                | Cmd+Enter     | Ctrl+Enter |
| Add Watch               | Shift+Ctrl+W  | Shift+Ctrl+W |
| Remove Watch            | Shift+Ctrl+E  | Shift+Ctrl+E |
| Show the result in new window | Shift+Ctrl+O | Shift+Ctrl+O |
| Run code in-line        | Ctrl+Enter    | Ctrl+Enter |
| Interrupt R             | Ctrl+C        | Ctrl+C   |
| Quit or shutdown R      | Shift+Ctrl+Q  | Shift+Ctrl+Q |
| Restart R               | Shift+Ctrl+R  | Shift+Ctrl+R |
| Paste scripts in Terminal | Alt+R        | Alt+R    |
| Sort the codes          | Ctrl+Alt+B    | Ctrl+Alt+B |

Acknowledgments

Author is grateful to Leila Alimehr who has been very supportive in doing this project from beginning.

References

Amiri, S., Clarke, B, & Clarke, J. (2017). Clustering categorical data via ensembling dissimilarity matrices. Journal of Computational and Graphical Statistics. Doi: 10.1080/10618600.2017.1305278.

Gentleman, R., & Temple Lang, D. (2007). Statistical analyses and reproducible research. Journal of Computational and Graphical Statistics, 16(1), 1-23.

Perez, F., & Granger, B. E. (2015). Project Jupyter: Computational narratives as the engine of collaborative data science. Technical Report. Technical report, Project Jupyter.
Ooms, J. (2013). OpenCPU: Producing and Reproducing Results. URL http://www.opencpu.org.

Ooms, J. (2014). The OpenCPU system: Towards a universal interface for scientific computing through separation of concerns. arXiv preprint arXiv:1406.4806