Book Review

Introduction to Statistical Computing and Visualization Using R

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The R programming language is specifically designed for statistical computing and data visualization. It is utilized globally by data analysts, statisticians, and machine learning developers for predictive modeling, data analysis, and the creation of data mining applications (Paradis, 2022). As a powerful, open-source tool, R offers an extensive array of packages and functions for diverse data mining tasks and mathematical computations. Essentially, R operates as a comprehensive collection of specialized packages containing various methods and functions. Furthermore, it boasts a user friendly graphical interface and is backed by a highly active, supportive online community.

The first chapter, “Introduction,” outlines the core functions and features of R, including basic progr-amming constructs, the R command prompt, and various operators, all presented with clear tables. The author also explains fundamental data types and structures. To reinforce learning, the chapter concludes with knowledge testing exercises, sample R code, and an extensive list of references.

Chapter two, “Programming Constructs,” emphasizes that control structures are essential to any programming language, dictating the order of execution. While most languages rely on three primary constructs sequence, selection, and iteration R provides robust facilities for managing code execution. This chapter details decision making, iterative statements, loop control expressions, R scripts, and functions, supported by ample examples. It also includes illustrative sample programs and practice exercises for the reader.

Chapter three focuses on data structures, emphasizing that a strong understanding of these structures and their operations is crucial for building advanced models in R (Mehta & Sahni, 2004). The author explains how variables efficiently store data by allocating specific memory locations upon initialization. Because R is an object oriented language, all data structures are treated as objects to organize data for further processing. The chapter presents vectors and other structures in tabular form, followed by an exceptionally detailed explanation of matrix creation. Subsequent sections cover lists and data frames. A core contribution of this chapter is the inclusion of various practice problems, complete with explained solutions, to test the reader’s comprehension.

The fourth chapter is dedicated to string handling. In R, text is processed using the ‘character’ class. While users can input strings using either single or double quotes, R internally standardizes them us-ing double quotes. This chapter provides researchers and students with deep insights into string manipulation, covering relevant packages, pattern matching, regular expressions, and word clouds. These concepts are illustrated with clear examples and a detailed case study. Like the preceding chapters, it concludes with exercises, review questions, and references.

Chapter five, “Data Import and Export,” covers file handling the procedures and functions used to manage local or remote files, directories, and data reading/writing (Villalobos Alva, 2024). This functionality is essential for loading datasets for analysis and saving computational results. R’s flexibility is highlighted through its built in functions for handling various formats, including CSV, text, and Excel files. The author provides clear illustrations of importing and exporting CSV and Excel data, followed by detailed explanations for XML and JSON formats. The chapter culminates in data analyses for two practical case studies.

The chapter on data visualization begins with a clear introduction to the fundamentals. Data visualization uses graphical representations such as charts, graphs, and maps to help users easily identify trends, outliers, and patterns (Mauludina et al., 2024). In data analytics, this is a critical step that transforms complex datasets into accessible, informative visuals, thereby simplifying interpretation, revealing hidden trends, and facilitating the communication of findings. The author practically demonstrates how R translates code into diverse visual outputs, ensuring the process is easily understood. The chapter also includes the generation of various maps, supported by clear illustrations.

The final chapter, “Real World Applications,” aligns with the ultimate goal of the learners by showcasing R’s practical utility. In the ever evolving landscape of data science, R serves as a comprehensive tool for professionals and researchers across diverse fields. This chapter highlights R’s real world impact in industries such as healthcare, finance, environmental science, and the social sciences (Alexander, 2023). Through practical examples and case studies, the author demonstrates how R’s robust statistical and graphical capabilities drive decision making, generate insights, and foster innovation. Key applications discussed include predictive model development, dynamic visualization, and complex data analysis, illustrating how R solves real world problems and advances domain specific understanding.

Ultimately, this book is designed to enable readers to learn R independently, without the need for supplemental instruction. This self paced learning is facilitated by the extensive provision of illustrations and examples, which significantly enhance the educational experience.

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Book Review

Becoming an Agent-Based Modeller

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This book is structured more like a course than a traditional textbook or reference manual. At its core is an extended tutorial that introduces the NetLogo programming language. Using an epidemic as a case study, it explores how an agent based model incorporating social influence, situational awareness, and the contextual decisions individual agents make regarding protective behaviour can help us understand plausible epidemic trajectories.

This book is the culmination of over a decade of collaboration between us, developing and delivering a course titled *Agent-based Modelling for the Social Scientist*. Our goal was to support a "learn by doing" approach, guiding participants through the dual shift in perspective required to build their own models: adopting agent centric thinking and learning computer programming. Programming itself comprises multiple strands, including explicitly designing the program's intended behaviour (which overlaps with agent-centric thinking), adhering to good programming practices such as continuous verification, and mastering the specific keywords and syntax of the chosen language. These three strands are seamlessly woven throughout the NetLogo tutorial.

Jen subsequently took the initiative to develop the entire tutorial into a comprehensive online resource for self-directed learning in agent based modelling. However, while online resources are highly valuable, they often receive less visibility than they deserve. Recognising this, we eventually decided to use the tutorial as the foundation for a formal textbook on agent-based modelling, integrating the broader curriculum of our course.

The tutorial material mirrors the pedagogical structure of our course. Topics are introduced strictly in the order they are needed for the model. New concepts are explained immediately before they are implemented and coded into the model to provide a concrete example. Readers are expected to run the model at multiple stages as the code evolves. While this structure inevitably leads to some repetition and means that conceptually similar topics are introduced at different stages rather than grouped together, it serves a specific pedagogical purpose.

The advantage of this incremental approach is that novice readers experience the process of building a NetLogo model exactly as they would build their own: step by step. The trade off is that the book is less suited for advanced agent based modellers, as it presents only limited theory. Our intention is not to provide an exhaustive guide, nor even to offer a broadly comprehensive and balanced introduction. Instead, our goal is to equip novices with the practical skills necessary to navigate their own model development and to know where to find more advanced, specialised materials as needed. We hope this book serves as a practical catalyst for novice modellers seeking to develop expertise in agent based modelling within their respective disciplines.

To adapt the tutorial for this textbook, we incorporated the theoretical foundations that were absent from the original online resource. These topics are largely drawn from our course but are expanded with greater detail and include pointers to supplementary materials for deeper study. Additionally, we have included a more extensive discussion on research ethics and further reflections on the epistemology of agent based modelling.

Building an agent based model is not merely a technical exercise in writing syntactically and logically correct code; it requires a specific mindset for conceptualising the system being represented. Adopting this perspective is central to becoming a proficient agent-based modeller. This conceptual approach is reflected in our choice of cover image. Origami involves creating representations of real world objects through a deliberate, step by step process of paper folding. Furthermore, the image serves as a nod to James M. Sakoda, whose pioneering work uniquely bridges the fields of agent based modelling and the art of origami.

The book is divided into three parts: Part I, *Conceptualising Agent-based Models*; Part II, *Building Agent-based Models*; and Part III, *Working with Agent-based Models*. It also features an extensive bibliography and a comprehensive index.

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