

Inter-Rater Reliability Essentials

Practical Guide in R

Alboukadel KASSAMBARA

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Preface

0.1 What you will learn

This R Statistics book provides a solid step-by-step practical guide to **inter-rater reliability** analyses using R software. The **inter-rater reliability** are statistical measures, which give the extent of agreement among two or more raters (i.e., “judges”, “observers”). Other synonyms are: **inter-rater agreement**, **inter-observer agreement** or **inter-rater concordance**.

This book is designed to get you doing the analyses as quick as possible. It focuses on implementation and understanding of the methods, without having to struggle through pages of mathematical proofs.

You will be guided through the steps of basic explanations of the test formula and assumptions, performing the analysis in R, interpreting and reporting the results.

0.2 Key features of this book

You will learn the basics and how to compute the different statistical measures for analyzing the inter-rater reliability. These include:

- **Cohen’s Kappa**: It can be used for either two nominal or two ordinal variables. It accounts for strict agreements between observers. It is most appropriate for two nominal variables.
- **Weighted Kappa**: It should be considered for two ordinal variables only. It allows partial agreement.
- **Light’s Kappa**, which is the average of Cohen’s Kappa if using more than two categorical variables.
- **Fleiss Kappa**: for two or more categorical variables (nominal or ordinal)
- **Intraclass correlation coefficient** (ICC) for continuous or ordinal data

You will also learn how to visualize the agreement between raters.

The book presents the basic principles of these tasks and provide examples in R. This book offers solid guidance in statistics for students and researchers.

Key features:

- Covers the most common statistical measures for the inter-rater reliability analyses
- Key assumptions are presented
- Short, self-contained chapters with practical examples.

In each chapter, we present R lab sections in which we systematically work through applications of the various methods discussed in that chapter.

0.3 How this book is organized ?

This book contains 7 chapters. After a quick introduction to R for analyzing categorical data (Chapter 1), we describe Cohen's kappa, Weighted kappa, Fleiss Kappa, Intraclass Correlation Coefficient in Chapter 2 to 5, respectively. Finally, we show how to visualize the inter-rater agreement 6 and provide quick start R codes for computing the different measures for examining the inter-rater reliability 7.

0.4 Book website

Datanovia: <https://www.datanovia.com/en>

0.5 Executing the R codes from the PDF

For a single line R code, you can just copy the code from the PDF to the R console.

For a multiple-line R codes, an error is generated, sometimes, when you copy and paste directly the R code from the PDF to the R console. If this happens, a solution is to:

- Paste firstly the code in your R code editor or in your text editor
- Copy the code from your text/code editor to the R console

Additionally, if your pdf reader has a select tool that allows you to select text in a rectangle, that works better in some readers.

0.6 Acknowledgment

I sincerely thank all developers for their efforts behind the packages that this book depends on, namely, bookdown and more.

0.7 Colophon

This book was built with R 3.3.2 and the following packages :

##	name	version	source
## 1	bookdown	0.9.1	Github:rstudio/bookdown
## 2	datarium	0.1.0.999	local
## 3	DescTools	0.99.23	CRAN
## 4	irr	0.84.1	CRAN
## 5	psych	1.8.12	CRAN
## 6	tidyverse	1.2.1.9000	Github:tidyverse/tidyverse
## 7	vcd	1.4-3	CRAN

About the author

Alboukadel Kassambara is a PhD in Bioinformatics and Cancer Biology. He works since many years on genomic data analysis and visualization (read more: <http://www.alboukadel.com/>).

He has work experiences in statistical and computational methods to identify prognostic and predictive biomarker signatures through integrative analysis of large-scale genomic and clinical data sets.

He is the author of:

- 1) the bioinformatics tool named **GenomicScape** (www.genomicscape.com), an easy-to-use web tool for gene expression data analysis and visualization.
- 2) the **Datanovia** (<https://www.datanovia.com/en/>) and **STHDA** (<http://www.sthda.com/english/>) websites, which contains many courses and **tutorials** on data data mining and statistics for decision supports.
- 3) many popular **R packages** for multivariate data analysis, survival analysis, correlation matrix visualization and basic data visualization (<https://rpkgs.datanovia.com/>).
- 4) many **books** on data analysis, visualization and machine learning (<https://www.datanovia.com/en/shop/>)

Chapter 1

Introduction to R for Inter-rater Reliability Analyses

R is a free and powerful statistical software for **analyzing** and **visualizing** data. If you want to learn easily the essential of R programming, visit our series of tutorials available on STHDA: <http://www.sthda.com/english/wiki/r-basics-quick-and-easy>.

In this chapter, you will learn:

- a very brief **introduction to R**, for installing R/RStudio as well as importing your data into R and installing required libraries.
- **introduction to categorical data structure**
- **basics of creating contingency tables**

1.1 Install R and RStudio

1.1.1 Standard installation

R and RStudio can be installed on Windows, MAC OSX and Linux platforms. RStudio is an integrated development environment for R that makes using R easier. It includes a console, code editor and tools for plotting.

1. R can be downloaded and installed from the Comprehensive R Archive Network (CRAN) webpage (<http://cran.r-project.org/>)
2. After installing R software, install also the RStudio software available at: <http://www.rstudio.com/products/RStudio/>.
3. Launch RStudio and start use R inside R studio.

1.1.2 R Online

R can be also accessed online without any installation. You can find an example at <https://rdr.io/snippets/>. This site include thousands add-on packages.