

MEDICAL STATISTICS IN THE R SOFTWARE ENVIRONMENT

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Knjiga „Medicinska statistika u R programskom okruženju” autora Trajković G. i Bukumirić Z., u izdanju Medicinskog fakulteta Univerziteta u Beogradu, jeste nezavisna publikacija u posleddiplomskom usavršavanju i istraživačkim naporima u oblasti medicine i zdravstvenih nauka. Na stručan i jednostavan način, autori koji su dokazani eksperti u oblasti medicinske statistike i informatike, omogućavaju čitaocima aktivno učenje uz rešavanje realnih problema, korak po korak, u R programskom okruženju. Osnovna poglavlja obuhvataju *Medicinsku statistiku* (opis različitih statističkih metoda, objašnjavanje analize i interpretacije rezultata) i *R programsko okruženje* (svi primeri se izvode u R-u, uz detaljna objašnjenja za pisanje kôda i vizuelizaciju, koja obezbeđuje jednostavno korišćenje). Cilj autora nije bio da prikažu sve mogućnosti R-a, već njegovu

The book *Medical Statistics in the R Software Environment*, written by Trajković G. and Bukumirić Z., published by the Faculty of Medicine of the University of Belgrade, is a publication of essential value for graduate education as well as for research efforts in the area of medicine and health sciences. In a professional and straightforward manner, the authors, who are recognized experts in the area of medical statistics and informatics, provide the readers with an opportunity for active learning whilst resolving real problems, step by step, in the R software environment. The main chapters are - *Medical Statistics* (describing different statistical methods, explaining results analysis and interpretation) and *R Software Environment* (all examples are carried out in R software, with detailed explanations for code writing and visualization, which enables easy

praktičnu primenu u rešavanju realnih problema iz oblasti medicinske statistike i grafičke prezentacije podataka.

Statistička metodologija je u savremenom životu deo opšteg obrazovanja, može se reći i opšte kulture, jer svaka struka susreće se sa situacijama gde je neophodno poznavanje određenih osnovnih ključnih statističkih pojmova, a pogotovo statističkog načina mišljenja. Upotreba različitih statističkih softverskih alata pomaže nam u primeni statističkih metoda. Jedan od sve češće primenjivanih statističkih softverskih alata u medicini je *R* programski jezik i okruženje, koji predstavlja najsveobuhvatniji statistički softverski alat, sa mogućnošću analize klasičnih i naprednih tehnika, i koji ima najnaprednije grafičke mogućnosti za vizualizaciju kompleksnih podataka. Ova publikacija je namenjena, kako polaznicima koji se po prvi put susreću sa okruženjem programskog jezika *R*, ali i sa primenom statističkih metoda, tako i iskusnim korisnicima.

Poglavlja knjige osmišljena su tako da obuhvataju teorijske osnove i praktičnu primenu statističkih procedura kroz *R* programsko okruženje:

- Poglavlje *R programsko okruženje* sadrži uputstva o instaliranju i osnovama korišćenja ovog statističkog softverskog alata.
- U poglavlju *Razvoj i dokumentovanje baze podataka*, sadržane su informacije o načinu organizacije prikupljenih podataka u formu podesnu za kasniju analizu u *R* programskom okruženju.
- Slede poglavlja koja se odnose na statističku deskripciju i analizu podataka: *Deskriptivna statistika; Analiza empirijskih raspodela; Grafičko prikazivanje podataka i rezultata primenjenih statističkih analiza; Ocenjivanje populacionih parametara na osnovu uzorka; Testiranje hipoteza za raspodele, aritmetičke sredine i medijane*.
- U knjizi su sadržana i poglavlja koja se odnose na složenije statističke analize, odnosno statističko modelovanje, i način njihovog izvođenja u ovom statističkom programu: *Ispitivanje odnosa između varijabli; Generalni linearni modeli; i Kontrola pridruženosti*.
- Pojmovi valjanosti i pouzdanosti merenja, kao i performanse dijagnostičkih testova obrađeni su u okviru poglavlja *Adekvatnost merenja*.
- U okviru poglavlja *Meta-analiza*, prikazane su procedure objedinjavanja publikovanih rezultata, kao i njihovo modelovanje kroz meta-regresiju.

Poseban kvalitet publikacije je njen koncept i specifičan dizajn. Autori su uz publikaciju ponudili i baze podataka i *R* skripte sa komandama za rešavanje svih

use). The authors' goal was not to present all the possibilities of the *R* software, rather its practical application in the resolution of real problems in the area of medical statistics and graphic data representation.

In contemporary life, statistical methodology is a part of general education, one could say general knowledge, as, in every profession, one encounters situations where knowledge of certain basic key statistical concepts, and especially of the statistical way of thinking, is necessary. The application of different statistical software tools helps us in the application of statistical methods. One of the statistical software tools applied more and more frequently in medicine is the *R* programming language and environment, which is the most comprehensive statistical software tool that enables the analysis of standard and advanced techniques, and which has the most advanced graphic solutions for the visualization of complex data. This publication is intended, not only for people encountering the *R* programming language environment, as well as the application of statistical methods, for the first time, but also for experienced users.

The chapters of the book have been designed to cover the theoretical bases as well as the practical application of statistical procedures through the *R* software environment:

- The chapter *R Software Environment* contains instructions on the installation and the bases for the application of this statistical software tool.
- The chapter *The Development and Documenting of the Database* contains information on the method of organizing collected data into a form appropriate for subsequent analysis in the *R* software environment.
- The chapters that follow are related to statistical description and data analysis: *Descriptive Statistics; Analysis of Empirical Distributions; Graphic Presentation of Data and Results of Applied Statistical Analyses; Sample Based Assessment of Population Parameters; Testing Hypotheses for Distributions, Arithmetic Means and Medians*.
- The book also includes chapters related to more complex statistical analyses, i.e., statistical modelling, and the method of their execution in this statistical program: *Testing Relationships amongst Variables; General Linear Models; and Association Control*.
- The terms of validity and reliability of measurement, as well as the performance of diagnostic tests, are dealt with within the chapter *Measurement Adequacy*.
- Within the chapter *Meta-analysis*, the procedures of collating the published results, as well as their modelling, through meta-regression, are presented.

primera. Na ovaj način, korisnici mogu ponoviti analizu, korak po korak, i imati pristup kompletnim izlaznim rezultatima u digitalnom – elektronskom okruženju. Baze podataka i R skriptovi mogu se preuzeti sa internet stranice knjige: <http://cibid.med.bg.ac.rs/publikacije/med.stat.R>.

Takođe, autori su postigli i dodatnu vrednost primenjujući koncizan, razumljiv i jasan stil pisanja, a postojeća saznanja o primeni statističkih metoda i njihovo izvođenje uz upotrebu R programskog okruženja, izneli su sistematično i logičnim redosledom. Tekstovi autora predstavljaju rezultat njihovog višegodišnjeg naučnog i stručnog rada, proverenog kroz više generacija studenata na više fakulteta. U publikaciji se ogleđaju originalnost i naučni i stručni doprinosi što je čini nezaobilaznim delom svake stručne biblioteke i značajnom literaturom na koju se uvek vraćaju, ne samo studenti osnovnih i posle diplomskih studija, već i istraživači medicinskih i zdravstvenih nauka, kao i lekari svih specijalnosti.

Publikacija je štampana nakon iznenadne smrti prof. dr Gorana Trajkovića, jednog od autora, koji i na ovaj način nastavlja da nesebično prenosi svoje znanje drugima.

U Beogradu 25.05.2021.

Recenzenti

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A particular quality of the publication is its concept and its distinctive design. Within this publication, the authors have also offered databases and R scripts with commands for solving all the examples. In this way, the users can repeat analysis, step by step, and have access to complete output results in the digital – electronic environment. Databases and R scripts can be downloaded from the publication webpage: <http://cibid.med.bg.ac.rs/publikacije/med.stat.R>.

Furthermore, the authors have achieved additional value with their concise, understandable and clear writing style, while the existing knowledge on the application of statistical methods and their execution with the use of the R software environment has been presented systematically, in logical order. The author's texts are the result of their many years of research and professional work, which has been tested by multiple generations of students at a number of different faculties. The publication is original and its scientific and expert contribution is evident, which is what makes it an essential part of any specialized library and an important reference which, not only university students at the undergraduate and graduate levels, but also researchers in the field of medicine and health sciences, as well as doctors of all specialties, can always go back to and rely on.

The publication came out of print after the sudden death of one of the authors, Professor Goran Trajković, PhD, who continues, in this way, to generously share his knowledge.

Belgrade, 25.05.2021.

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