# MINISTRSTVO ZA NOTRANJE ZADEVE RS

PRIPOROČAM OGLED HTML RAZLIČICE, ZNOTRAJ KATERE OBE APLIKACIJI DELUJETA!
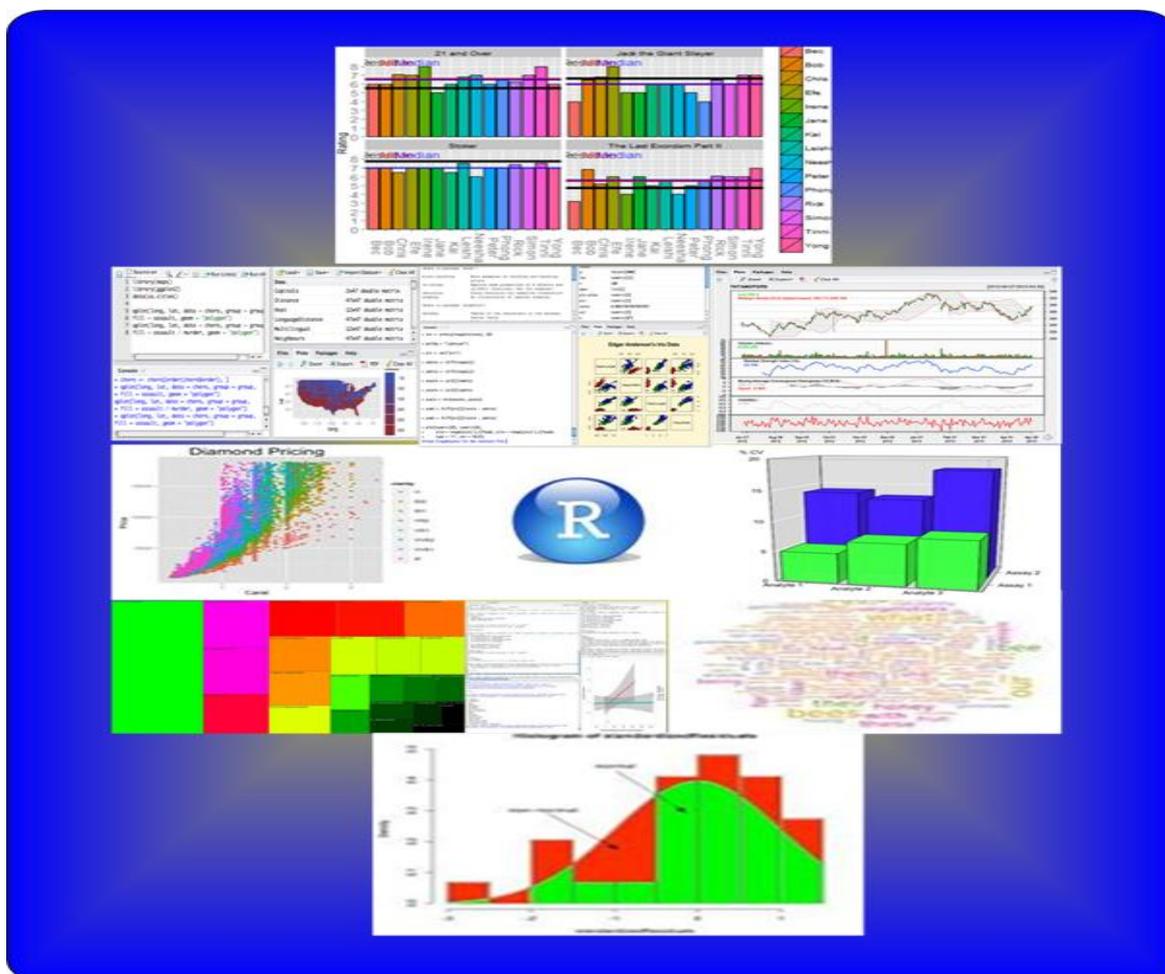
Statistično programsko okolje R in Rstudio za analizo ter vizualizacijo podatkov

Avtor: dr. Karl Petrič

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1 Uvod

R je tako programsko orodje kot tudi programski jezik, ki se uporablja za statistično in vizualno analizo podatkov. Z R lahko delamo znotraj različnih operacijskih sistemov kot npr. Linux, Mac OS X in Windows (obstaja različica paketa R za Windows 7 / 64 in 32 bit). Velika prednost R je v tem, da že obstajajo številne razširitve, s katerimi je možno rešiti standardne statistične probleme. Omenjene razširitve je možno zlahka namestiti in s tem nadgraditi glavni del programskega orodja R. Različne funkcionalnosti kot npr. uvoz podatkov, upravljanje s podatki, vizualizacije programsko orodje R poskuša reševati s pomočjo programskih kod, kar predpostavlja pisanje programov, ki zmorejo hitro in učinkovito kompleksne postopke ponoviti. Po eni strani s od uporabnika R zahteva, da prvotno vloži nekoliko več truda, vendar po drugi

strani s tem pridobi mnogo večji obseg različnih funkcionalnosti, ki se lahko nenehno razširjajo tudi s pisanjem lastnih razširitev. Tega seveda orodja kot npr. Excel ne omogočajo. Komercialna orodja kot npr. SPSS, Statistica ponujajo številne razširitve in drugih možnosti, vendar so tovrstna programska orodja cenovno gledano sorazmerno neugodna, medtem ko je R brezplačen (brezplačne so tudi številne razširitve, knjižnice skriptov ipd.). Kot primer bi zgolj na kratko opisal pozitivno izkušnjo, ki jo imam z R. Pred časom sem iskal brezplačno programsko orodje za vizualizacijo drevesnih map iz posameznih .xls, .txt idr. datotek, vendar sem našel zgolj plačljiva orodja. V nadaljevanju iskanja sem našel skript za vizualizacijo podatkov s pomočjo drevesne mape. Omenjen skript sem vstavil v statistično programsko okolje R in na ta način dosegel zaželeno. Pomanjkljivo delovanje R lahko opazimo pri določenih interaktivnih aplikacijah in vizualizacijah, ki zahtevajo izjemno visoko stopnjo kakovosti (npr. zahteven informacijski dizajn). R je krasno orodje tako za hiter zajem in preučevanje podatkov kot tudi za globljo analizo, ki zahteva razumevanje različnih kompleksnih povezanosti. Glede namestitve R na računalnik je potrebno pripomniti, da je priporočljivo namestiti najsodobnejšo različico R in Rstudio. Rstudio je grafični uporabniški vmesnik za R, ki vsebuje še dodatne funkcije in je povrhu tega dosegljiv v dveh oblikah, t.j namizni in strežniški Rstudio. V vsakem primeru je modro poleg R namestiti Rstudio, ker je delo z njim bolj pregledno kot z R konzolami. Z načinom namestitve R in Rstudia se v tem delu ne mislim ukvarjati, ker obstajajo na spletu številna navodila, ampak se bom bolj osredotočal na različne možnosti uporabe Rstudia.

1.1 Namen

Prikaz raznovrstnih možnosti uporabe programskega orodja Rstudio.

2 Možnosti uporabe Rstudia

V tem poglavju bodo predstavljene različne možnosti uporabe Rstudia v smeri analize, vizualizacije, simulacije in menedžmenta podatkov ter aplikacij. V ta namen bo prikazan poseben model oziroma diagram s spletnimi povezavami.
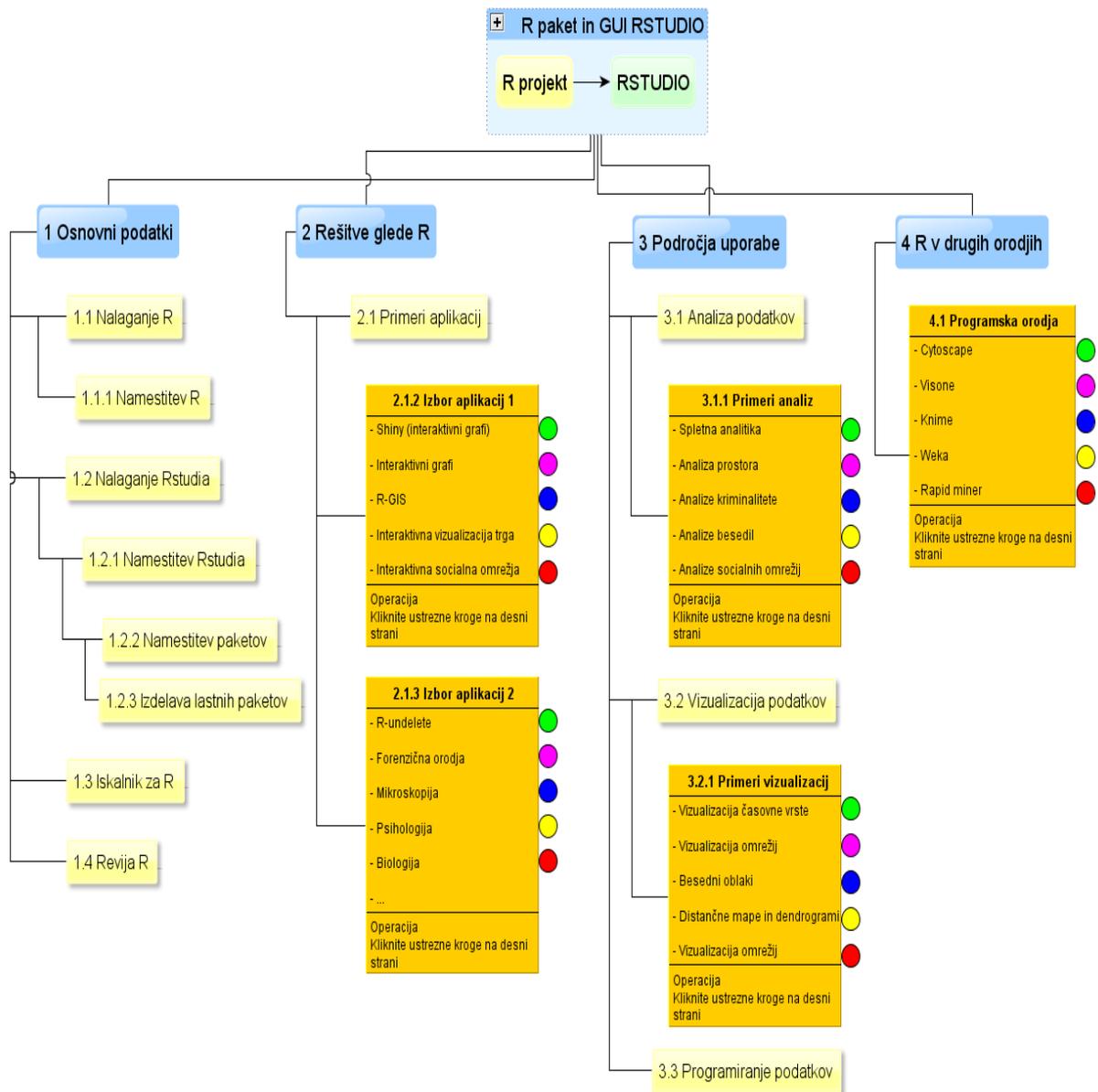
2.1 Slika 1: Klikalni diagram o R in Rstudio s poudarkom na nekatere možnosti uporabe

Slika 1 prikazuje klikalni diagram o R in Rstudio s poudarkom na nekatere možnosti uporabe. Omenjen diagram s spletnimi povezavami do koristnih vsebin je zaradi boljše orientacije bralca po posameznih točkah smiselno opisati:

[Gor](#)

0 R paket in GUI RSTUDIO

a. RSTUDIO - omogoča dostop do glavne strani Rstudio

b. R projekt - omogoča dostop do glavne strani R projketa

1 Osnovni podatki - dostop do osnov na osnovi poizvedbe znotraj R iskalnika

1.1 Nalaganje R - dostop do spletne strani za nalaganje (downloadanje) R. Na voljo so R za Linux, Windows (trenutna verzija dne 03.10.2013 je R 3.0.2 tj. za 32/64 bitni računalnik, velikost datoteke je okoli 52 MB) in Mac OS X.

1.1.1 Namestitev R - dostop do navodil, na kakšen način namestiti programsko orodje R?

1.2 Nalaganje Rstudia - dostop do datoteke Rstudio desktop (trenutna verzija dne 03.10.2013 je Rstudio 0.97.551 Windows XP/Vista/7/8, velikost datoteke je okoli 32,5 MB).

1.2.1 Namestitev Rstudia dostop do navodil, na kakšen način namestiti programsko orodje Rstudio?

1.2.2 Namestitev paketov - izdelana je bila poizvedba na Google s poudarkom na namestitev paketov z Rstudio.

1.2.3 Izdelava lastnih paketov - navodila za izdelavo lastnih paketov. Na tej spletni strani je tudi opis o izdelavi R razširitev, R paketov ipd.

1.3 Iskalnik za R - zelo zanimiv iskalnik, ki je izdelan na osnovi storitve prirejenega Google iskalnika. Poizvedbe so zelo natančne, saj je ta iskalnik osredotočen na vsebine v zvezi z R in Rstudio. Povrhu tega so izidi poizvedb organizirani v obliki pasic.

1.4 Revija R - Izvirno ime revije je The R journal, ki omogoča dostop do polnih besedil zelo kakovostnih znanstvenih člankov. Dejavnik vpliva revije za leto 2012 je bil 0,825!

2 Rešitve glede R - zanimiva spletna stran, ki v slikovni obliki (storitev Pearltrees) ponuja osnovne podatke in rešitve v zvezi z R

2.1 Primeri aplikacij - izvedena poizvedba v iskalniku R v zvezi z aplikacijami.

2.1.2 Izbor aplikacij 1 - gre za zelo zanimive primere interaktivnih spletnih aplikacij kot npr. Shiny (kliknite zeleni krogec). Tovrstnih in še boljših primerov je zelo velikega števila in zato priporočamo uporabo iskalnika R.

2.1.3 Izbor aplikacij 2 - predstavljena so le nekatera področja uporabe R kot npr. R-undelete (aplikacija za obnavljanje izgubljenih datotek - kliknite zeleni krogec), R aplikacija za psihološke raziskave (kliknite rumeni krogec) idr.

3 Področja uporabe - pripravljena poizvedba o uporabi R znotraj R iskalnika

3.1 Analiza podatkov - dostop do zadetkov z R iskalnika.

3.1.1 Primeri analiz - dostop do spletne strani (kliknite zeleni krogec), ki vsebuje skripte oziroma R kode za spletno analitiko, analizo geografskega prostora (kliknite roza krogec), analize kriminalitete s pomočjo R-GIS (kliknite moder gumb), analize besedil (kliknite rumeni krogec) idr.

3.2 Vizualizacija podatkov - dostop do zadetkov z R iskalnika s poudarkom na vizualizacijo podatkov.

3.2.1 Primeri vizualizacij - ob klikih na barvne krogce je možno spoznati del pestrosti bogatih vizualizacij, ki jih ponuja programsko orodje R oziroma Rstudio npr. drevesne mape, dendrogrami, besedni oblaki.

3.3 Programiranje podatkov - dostop do zadetkov z R iskalnika s poudarkom na programiranju podatkov.

4 R v drugih orodjih - tudi druga programska orodja, ki se ukvarjajo z odkrivanjem zakonitosti v podatkih, besedilih, omrežjih idr. je možno povezati z R.

4.1 Programska orodja - s pomočjo R vtičnikov, ki jih vgradimo v ustrezna programska orodja je možno doseči povezljivost med R in drugimi kot npr. Cytoscape, Visone, Knime, Weka, Rapid miner, Bioconductor idr. (za dostop do teh vsebin kliknite barvne krogce).

3 Nekaj primerov vizualizacij

Rstudio omogoča tako prikaz številnih znanih in manj znanih vizualizacijskih tehnik (npr. raztreseni diagrami, drevesne mape, zapletena omrežja) kot tudi prirejene po scenariju določenega uporabnika. Nekateri primeri vizualizacijskih tehnik bodo prikazane v nadaljevanju.
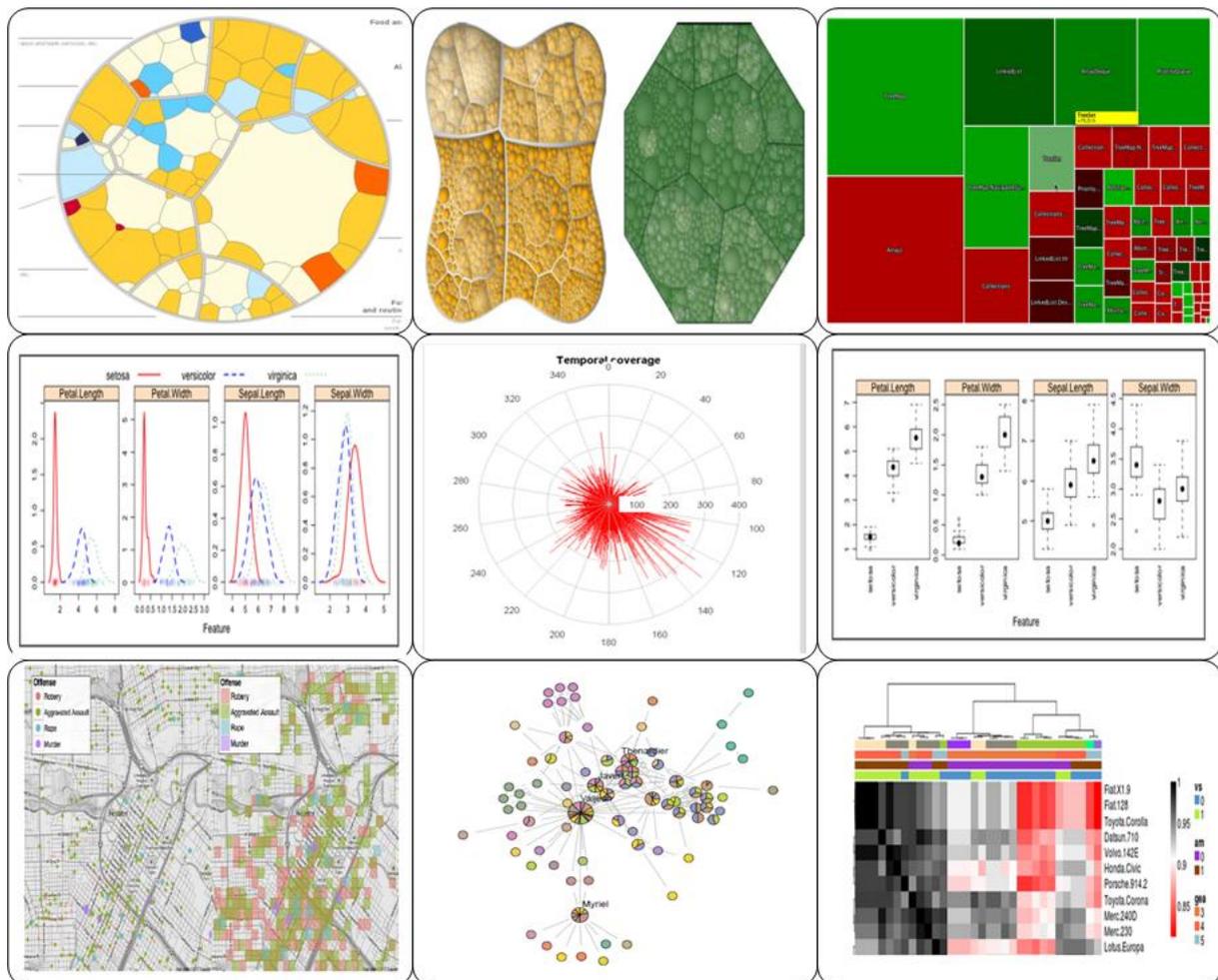
3.1 Slika 2: Nekatere možne vizualizacije s pomočjo Rstudia

Slika 2 prikazuje nekatere možne vizualizacije, ki jih je možno izvesti s pomočjo programskega orodja Rstudia. Vizualizacije so naslednje (z leve proti desni strani):

a. Levo zgoraj: Cenovni kalejdoskop (angl.: CPI diagram),

b. Voronoi drevesna mapa ali drevesni zemljevid (angl.: Voronoi tree map),

c. hierarhična drevesna mapa ali drevesni zemljevid (angl.: hierarchical tree map),

d. diagrami gostote (angl.: density plots),

e. polarni diagram (angl.: polar diagrams),

f. diagrami prikaza kvartilov (angl.: box plots),

g. prostorski zemljevid s podatki (angl.: data spatial map),

h. mrežni graf s tortnimi diagrami (angl.: network diagram with pie charts),

i. toplotni graf (ali distančna mapa) z dendrogramom (angl.: heat map with dendrogram).

4 Zaključek

Programsko orodje R (tako kot grafični uporabniški vmesnik Rstudio) je zastonj (odprta koda). R oziroma Rstudio se uporablja za statistične analize, bogate vizualizacije podatkov in celo za izdelavo aplikacij. Mnoga druga programska orodja omogočajo povezljivost s tem orodjem (navadno preko posebnega vtičnika). Glede na to, da je R oziroma Rstudio brezplačen in tako zmogljiv (ali celo zmogljivejši) kot IBM SPSS, za katerega plačujemo v državni upravi in šolstvu licenčnino, je vsekakor primerno opozarjati na veliko koristnost programa R (četudi ne bodo vsi želeli / znali pisati skriptov za izvajanje analiz in vizualizacij). Na Ministrstvu za notranje zadeve in organov v sestavi bi bila uporaba tega orodja koristna še zlasti npr. za Urad za organizacijo in kadre, Urad za finančne zadeve in nabavo, Direktorat za policijske in druge varnostne naloge, kriminalistično policijo in Policijsko akademijo.

5 Viri

Na Google učenjaku je bila s pomočjo programskega orodja Publish or perish izvedena poizvedba v obliki besedne zveze "R software" v obdobju od leta 2000 do 04.10.2013. Bibliografski zadetki so se v nadaljevanju izvozili v .RIS in nato pretvorili v .BIB format. S pomočjo programskega orodja JabRef je bilo možno bibliografske zapise izvoziti v .HTML preglednico z iskalnikom, ki bo v nadaljevanju tega dela vidna.

5.1 Kratko navodilo o uporabi aplikacije

V iskalnik vtipkate le zaželen pojem (**!!!NE SPROŽITE ENTER!!!**), nakar bo na desni strani vidno število zadetkov. Gumb BRISANJE pomeni, da je ob kliku nanj vzpostavljeno prvotno stanje števila zadetkov.

Še nekaj korsitnih napotkov pri iskanju znotraj preglednične bibliografije:

a. uporaba operatorja **OR** (ALI) z znakom |: npr. R SOFTWARE|RSTUDIO

b. če vtipkate zgolj **URL** dobite kot izid samo zadetke s spletnimi povezavami (lahko uporabite tudi zgolj letnice)

c. določitev **časovnega razpona**: npr. 201[0-13] -> zajeti bodo zgolj zapisi od leta 2010 do 2013

d. sopojavljanje **dveh avtorjev**: npr. Abreu.+Ramos

e. v primeru, da želite imeti zgolj **knjige (book)** poizvedujete na naslednji način: book$

Obstajajo še druge možnosti poizvedovanja, vendar predstavljena osnova navadno zadošča.

5.2 Preglednica 1: Svetovna bibliografija o programskem orodju R/Rstudio od leta 2000 do 2013

Hitro iskanje: ☐ **Število ustreznih zadetkov: 141/141.**

Avtor	Naslov	Leto	Revije/Konference	Vrsto vira	DOI/URL
Abreu, N. & Ramos, P.	An integrated application for geostatistical analysis of sea outfall discharges based on R software	2010	OCEANS 2010, pp. -	article	[URL](URL)
Adragni, K. & Raim, A.	LDR: An R Software Package for Likelihood-Based Sufficient Dimension Reduction		math.umbc.edu, pp. -	other	
Agbodza, P.	R SOFTWARE: A STATISTICAL TOOL FOR MODELING PHENOMENA IN GHANA	2013	GHANA MATHEMATICS SOCIETY, pp. -	other	
Aguilera, A., Aguilera-Morillo, M. & ...	CATEGORICAL DATA MODELLING IN A VIRTUAL ENVIRONMENT: SELF-LEARNING VIDEO/TUTORIAL FOR PRACTICES WITH R SOFTWARE	2012	INTED2012 â€¦, pp. -	article	[URL](URL)
Ahmad, R.	Posterior Estimates of Poisson Distribution using R Software		Shlomo S. Sawilowsky, pp. -	other	
Ahmad, S. & Ahmad, K.	Bayesian Analysis of Weibull Distribution Using R Software	2013	Australian Journal of Basic and Applied â€¦, pp. -	other	
Ahmed, S. &	Bayesian Analysis		Shlomo S. Sawilowsky, pp. -	other	

Avtor	Naslov	Leto	Revije/Konference	Vrsto vira	DOI/URL
Khan, A.	of Location-Scale Family of Distributions Using S-PLUS and R Software				
ANDREJIOVĂ, M. & KIMĂKOVĂ, Z.	THE OPEN SOURCE SOFTWARE â€śRâ€ť IN THE STATISTICAL QUALITY CONTROL		annals.fih.upt.ro, pp. -	other	
Bates, D. & Sarkar, D.	lme4: Linear mixed-effects models using S4 classes [R software package]	2011	Retrieved from CRAN, pp. -	other	
Bates, D. & Sarkar, D.	lme4: linear mixed-effects models using S4 classes (version 0.9975-12)[R software package]	2007	, pp. -	other	
Bauer, M., Kozuch, E., Glenn, T. & ...	The electronic assessment of the longitudinal course of bipolar disorder with ChronoRecord (R) software	2008	â€¦, pp. -	other	
Bolker, B.	R] software comparison	2007	R Help Archive, pp. -	other	
Buttrey, S.	Calling the lp_solve linear program software from R, S-PLUS and Excel	2005	Journal of Statistical Software, pp. -	other	
Calenge, C.	The package â€śadehabitatâ€ť for the R software: a tool for the analysis of space and habitat use by animals	2006	Ecological modelling, pp. -	other	URL
Cangea, O., Popovici, D. & Pantea, O.	Studying the eficiency of retaining ammonium on modified natural zeolites using	2008	REVISTA DE CHIMIE, pp. -	other	

Avtor	Naslov	Leto	Revije/Konference	Vrsto vira	DOI/URL
	MATLAB (R) software programs				
Carey, V.	ported to the R software by T	2002	Lumley (versions 3.13 and 4.4) and B. Ripley (version â€¦, pp. -	other	
Center, N.	Nutrition data system for research (NDS-R) software, version 4.06	2003	Minneapolis: University of Minnesota, pp. -	other	
Center, N.	NDS-R software, version 4.03	2001	Minneapolis, MN: NCC, Division of Epidemiology, â€¦, pp. -	other	
Chambers, J.	Software for data analysis: programming with R	2008	, pp. -	book	
Chambers, J.	Programming with R: Software for Data Analysis	2008	, pp. -	other	
Chambers, J. & Chambers, J.	Errata and Notes for â€śSoftware for Data Analysis: Programming with Râ€ť	2008	Software for Data Analysis, pp. -	article	URL
Chandra, H., Sud, U. & Gupta, V.	Small Area Estimation under Area Level Model Using R Software		js.iasri.res.in, pp. -	other	
Chen, C. & Nie, Y.	Algorithm and Implementation Write by R Software for Estimating the Transition Matrix of Homogeneous Markov Chain in Reliability Predictions	2012	Advanced Materials Research, pp. -	article	URL
Close, B. & Zurbenko, I.	KZFT, R-software, package sources	2010	, pp. -	other	
CUI, Y., WEN, Z., CUI, L. & Tian, T.	The Application of R Software in the Calculation of Volatility	2011	Management Science and Engineering, pp. -	article	URL
Dasgupta, A.,	GRASS with R: An		wgbis.ces.iisc.ernet.in, pp. -	other	

Avtor	Naslov	Leto	Revije/Konference	Vrsto vira	DOI/URL
Kumar, U., Mukhopadhyay, C. & ...	Introductory Tutorial to Open Source GIS & Statistical Computing Software for Geospatial Analysis				
Decima, P., Degrugilliers, L., Delanaud, S. & ...	Design of a software for assessing thermoneutrality in closed incubators for preterm neonates (Pretherm (R) project)	2012	â€¦, pp. -	other	
Demmer, R., Pavlidis, P. & Papapanou, P.	Bioinformatics techniques in microarray research: applied microarray data analysis using R and SAS software	2010	Oral Biology, pp. -	article	[URL](URL)
DEURSEN, A.V., KLINT, A. & TOLIDO, P.	R. Software Renovation in Three Steps	2000	, pp. -	other	
Dimitriadou, E., Hornik, K., Leisch, F., Meyer, D. & ...	Miscellaneous Functions of the Department of Statistics for the R Software (e1071), TU Wien	2006	Retrieved September, pp. -	other	
Dobre, A.	Statistical Analysis of International Migration Using R Software	2013	, pp. -	book	[URL](URL)
Drummond, K., Chinen, M., Duncan, T., Miller, H. & ...	Impact of the Thinking Reader [R] Software Program on Grade 6 Reading Vocabulary, Comprehension, Strategies, and Motivation: Final Report. NCEE â€¦	2011	National Center for â€¦, pp. -	other	
Dufour, A. & Lobry, J.	From WS Gosset's pieces of card	2008	BiomÃ©trie Humaine et Anthropologie, pp. -	article	[URL](URL)

Avtor	Naslov	Leto	Revije/Konference	Vrsto vira	DOI/URL
	(1908) to R software: analysing Macdonell's dataset of 3000 criminals.				
Eisenstein, J. & Puerta, A.	R. Software. Adaption in automated user-interface design	2000	Proceedings of the 2000 International Conference on â€¦, pp. -	other	
Fraga, M., Rico, A., Ferrero, C. & ...	Setting-up genomic bisulfite sequencing reactions using Methyl Primer Express (R) Software	2006	Proceedings of the â€¦, pp. -	article	[URL](URL)
Frank, S., Savage, W. & ...	Perioperative Blood Component Utilization and Clinical Outcomes Assessed Using Metavision (R) and Impact OnLine (R) Software	2012	â€¦, pp. -	other	
FRASSON, F. & MOLIN, J.	AnĂˇlise da variabilidade espacial da produtividade de soja utilizando recursos do software r	2006	â€¦ de Agricultura de Precisao. Sao Pedro- â€¦, pp. -	other	
GarcĂa-FernĂˇndez, R., Sanchez, M. & ...	A LEARNING TOOL FOR BUSINESS STUDENTS BASED ON R SOFTWARE	2013	INTED2013 â€¦, pp. -	other	
Garff-Tavernier, M.L. & ...	Use of the Neurosoft ((R)) software for help to the analysis of serum electrophoresis	2008	IMMUNO- â€¦, pp. -	other	
German, D., Adams, B. & ...	The Evolution of the R Software Ecosystem	2013	Software Maintenance and â€¦, pp. -	article	[URL](URL)
Goncalves, G.,	Experience of	201	â€¦ in Education (SIIE), â€¦,	articl	[URL](URL)

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Afonso, L., Ferreira, M. & ...	learning apply to confidence intervals with recourse to the software R for students of higher education of the polytechnic school: Motivation, results and â€¦	2	pp. -	e	
Gowda, N., Panghal, S., Vipul, K. & ...	â€¦ and spectrophotometric methods for simultaneous estimation of nebivolol and hydrochlorothiazide: A novel approach to multivariate calibrations by R-Software â€¦	2009	Journal of AOAC â€¦, pp. -	article	URL
GuĂ rdia-Olmos, J., PerĂł-Cebollero, M. & ...	Using SEM Library of R software to Analyze Exploratory Structural Equation Models		statistics.gov.hk, pp. -	other	
Hampson, L. & Whitehead, J.	R software to accompany" Bayesian methods for the design and interpretation of trials in rare diseases".	2013	, pp. -	book	URL
Helsel, D.	The NADA for R Software		Statistics for Censored Environmental Data Using â€¦, pp. -	article	URL
Ho, D., Imai, K., King, G. & Stuart, E.	MatchIt: Nonparametric preprocessing for parametric causal inference. R software package	2006	, pp. -	other	
Hobiger, T., Amagai, J., Aida, M. &	A real-time GNSS-R system based on software-defined	2012	Advances in Space Research, pp. -	article	URL

Avtor	Naslov	Leto	Revije/Konference	Vrsto vira	DOI/URL
Narita, H.	radio and graphics processing units				
Horvath, S., Shi, T., Shai, R., Chen, C. & Nelson, S.	Statistical Methods Supplement and R software tutorial: Gene Filtering with a Random Forest Predictor	2007	, pp. -	other	
HOZHBAR, K. & MORADI, A.	R SOFTWARE: PROGRAMMING ENVIRONMENT FOR ECONOMETRICS AND TIME SERIES ANALYSIS	2009	ECONOMIC MODELLING, pp. -	article	URL
Iacobucci, A. & Robert, C.	The Art of R Programming: A Tour of Statistical Software Design by Norman Matloff	2012	CHANCE, pp. -	article	URL
Intel, R.	OpenCL SDK-Intel R Software Network	2010	URL http://software. intel. com/en-us/articles/vcsource-â€¦, pp. -	other	
Jank, W.	Appendix: Introduction to the Statistical Software R	2011	Business Analytics for Managers, pp. -	article	URL
Jember, T.	Multivariate Data Analysis Using R Software: Practical Excercises for Multivariate Analysis	2012	, pp. -	book	URL
JOMBART, T.	Performing a spatial Principal Component Analysis using the R software	2006	, pp. -	other	
Jr, P.R. & Diggle, P.	geoR: A Package for Geostatistical Data Analysis Using the R Software	2003	Available September, pp. -	other	
Kasprzyk, I.	Latent class models	201	, pp. -	book	URL

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	in the R software	0			
Kasprzyk, I.	Graphical Presentation of a Multi-Way Contingency Table in the R Software	2009	Acta Universitatis Lodziensis. Folia Oeconomica, pp. -	article	[URL](URL)
Khan, A.	R-software: A newer tool in epidemiological data analysis	2013	Indian journal of community medicine: official â€¦, pp. -	other	
Khan, A., Ahmed, A. & Ahmad, S.	MONTE CARLO SIMULATION OF DISTRIBUTIONS USING R-SOFTWARE	2008	â€¦, pp. -	other	
Knezevic, S., Streibig, J. & Ritz, C.	Utilizing R software package for dose-response studies: the concept and data analysis	2009	, pp. -	book	[URL](URL)
Kostadinova, K.	Multiple Regression Analysis in Teaching Statistics by R Software		conf.uni-ruse.bg, pp. -	other	
Kuhnert, P. & Venables, B.	An introduction to R: Software for statistical modelling & computing. Course exercise	2005	, pp. -	other	
Kuhnert, P., Venables, B. & Zocchi, S.	An introduction to R: software for statistical modelling & computing	2005	, pp. -	book	
Kumar, D.	A Study Applied Bayesian Statistics Using R-Software	2012	, pp. -	other	
Lalehzari, R., Lalehzari, N. & Kafash, B.	Introduction to Numerical Simulation of Stochastic Differential Equations by Using R Software and its Finantial		conf.semnan.ac.ir, pp. -	other	

Avtor	Naslov	Leto	Revije/Konference	Vrsto vira	DOI/URL
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