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What is needed for using ROP-R?

This summary provides information on how to install and use the ROP-R and the R software required for the proper operation of the ROP-R.

1. General information

The first version of the ROP-R was completed in spring 2022, by András Vargha, a psychologist and mathematician, and Péter Bánsági, a mathematical engineer. Given that ROP-R is a multivariate extension of the ROPstat statistical software, it can be downloaded from www.ropstat.com. Some information on ROPstat and ROP-R can be found in Vargha, Torma, & Bergman (2015) and Vargha & Bánsági (2022). The most important features of ROP-R are as follows.

1. Runs on Windows operating systems.
2. It is a bilingual (English and Hungarian) multivariate statistical software with 10 modules currently offering full statistical analyses in three areas of multivariate statistics: regression analysis, dimensionality reduction (principal component and factor analysis), and cluster analysis.
3. The selected statistical analysis can be parameterised and run in a transparent, simple ROP-R menu window (task window) for each module.
4. After starting the analysis, ROP-R generates an R-readable data file and one or more corresponding R-scripts, which are run and ROP-R converts the resulting R-output into a pleasing format and places it in the ROP-R viewer.
5. These scripts are written by ROP-R into user-accessible text files, which can be useful for those learning R software to understand R-scripts, and for those with previous experience in R to perform more complicated analyses in R than ROP-R-bel.

Importantly, despite its close relationship with ROPstat, ROP-R is standalone software that can be run without ROPstat, and does not even require ROPstat to be installed on the machine. Since ROP-R runs R-scripts from within the program, it requires the R software (specifically its Rcmd.exe program) to be installed. The steps to do this are described below.

2. The installation of R

For ROP-R to work properly, you must first install the R software (latest version: R-4.4.2). Note that ROP-R works correctly with earlier versions R-4.4.0 and R-4.4.1, but with R-4.1.3 you may encounter problems installing some R packages. To install the Windows-based R-4.4.2 with its x64 module, which also allows 64-bit runs, visit this website: https://mirror.metanet.ch/cran/bin/windows/base/. Here you can download the installer (R-4.4.2-win.exe). Use your computer's file manager to find it in the downloaded programs and launch it. By accepting the offered English communication language and the "GNU GENERAL PUBLIC LICENSE" license agreement, the program will offer the folder "C:\Program Files\R\R\R-4.4.2" for the installation of the R software under standard

conditions. If you don't have access to the "C:\Program Files" folder, you can safely specify the "C:_vargha\R\R\R-4.4.2" folder instead, because the "C:_vargha" folder will be created during the installation of ROPstat and/or the ROP-R software anyway, and you will have access to it anyway. Then always accept the option offered by clicking on "Next". Only in the "Select additional tasks" window we will also ask for the "Create a Quick Launch shortcut" option, which will create a shortcut for R on the desktop (named R 4.4.2). In the last window, clicking on "Finish" will complete the installation of R. You may not be able to install the latest version of R for some reason (e.g. because your computer or system is old), in which case you should try installing an earlier version of R[1].

So, after the successful installation of the R software, an R shortcut is created on the desktop (if not, it must be created manually), which can run R packages using the RGui framework. If you have R-4.4.2 previously installed on your computer, you can skip the above steps. The rest of the steps are summarized below.

1. Start the R software using its shortcut.
2. If the RGui for this version of R has already been used on the machine and an R-package has been installed, copy the following instructions in a package into the RGui console (e.g. using Ctrl-C, Ctrl-V) and press Enter.

    install.packages("cluster", dependencies = TRUE)
    install.packages("jmv", dependencies = TRUE)
    install.packages("psych", dependencies = TRUE)
    install.packages("olsrr", dependencies = TRUE)
    install.packages("GPArotation", dependencies = TRUE)
    install.packages("lavaan", dependencies = TRUE)
    install.packages("lavaanPlot", dependencies = TRUE)
    install.packages("factoextra", dependencies = TRUE)
    install.packages("ggplot2", dependencies = TRUE)
    install.packages("ClusterR", dependencies = TRUE)
    install.packages("Gmedian", dependencies = TRUE)
    install.packages("mclust", dependencies = TRUE)
    install.packages("MBESS", dependencies = TRUE)
    install.packages("MASS", dependencies = TRUE)
    install.packages("haven", dependencies = TRUE)

    This causes RGui to install the packages specified in the instructions (it takes several minutes), after which you can exit RGui. If RGui asks for the country in the CRAN mirrors window, let's say Czech Republic, but most other European countries are fine.
3. If no R-package has been previously installed in this RGui on your machine, you should first copy only the first of the install instructions in step 2 above into the RGui console and then run it by pressing Enter. Accept the saving location offered by the program, then after the successful installation copy the other instructions in a bundle and run them. Sometimes in RGui it is problematic to install new packages in a bundle. In such cases, it is a good idea to install the packages one by one (i.e. copy the lines from the list above into RGui and run them by pressing Enter). In the CRAN mirrors window, you should also specify a country (city within a country).
4. Some packages (lavaanPlot, jmv and psych) may fail to install (an Error message is displayed on the RGui console), indicating which package required to install the

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[1] See https://www.filehorse.com/download-r-for-windows/old-versions/

package failed to load. In my experience, it may help to install four special packages (stringi, gtable, fansi and utf8) after the unsuccessful installations using the following instructions (and then repeat the unsuccessful installations):

```
install.packages("stringi", dependencies = TRUE)
install.packages("gtable", dependencies = TRUE)
install.packages("fansi", dependencies = TRUE)
install.packages("utf8", dependencies = TRUE).
```

5. The installations of the packages can only be regarded successful if running the commands below in a bundle you will not get any error message.

```
library("cluster")
library("jmv")
library("psych")
library("olsrr")
library("GPArotation")
library("lavaan")
library("lavaanPlot")
library("factoextra")
library("ggplot2")
library("ClusterR")
library("Gmedian")
library("mclust")
library("MBESS")
library("MASS")
library("haven")
```

3. The installation of ROP-R

General information about the installation of ROP-R is summarized below.

1. The ROP-R software can be downloaded from www.ropstat.com (click on the ROP-R icon there). After successful installation, the program will be located in the "c:_vargha\ropstat" folder (this is also the location of the ropstat.exe program). The ROP-R.exe program can be run from here, but if you use it frequently, it is recommended to place a shortcut for ROP-R on your desktop or on the taskbar. Make sure that the ROP-R.exe file (as well as ropstat.exe) remains in the "c:_vargha\ropstat" folder.

2. The path of the Rcmd.exe program copied during the installation of R must be set in the ROP-R Settings/R-path menu before the first use of the ROP-R multivariable modules. For a standard installation, the path is: c:\Program Files\R\R\R-4.4.2\bin\x64\Rcmd.exe.

3. In ROP-R, data files can be read in the same way as in ROPstat. The default file type when reading is the msw type of ROPstat. In addition, ROP-R accepts Excel files (with xls or xlsx extension), text files formatted in tab or csv format, and SPSS sav and por data files.

4. After all this, if you scan a data file, you can run the multivariate modules of ROP-R using the menu item "Multivariate_analyses_using_R_programs".

5. When a module is started, ROP-R always creates and runs one or more R scripts (with a running indication on the screen). The results can then be viewed in ROP-R's

viewer, arranged in convenient tables, from where they can be sent to Excel or Word, keeping the table formats, or simply copied.

6. An important feature of ROP-R is that the R-scripts created for the analyses are written in *.r format (e.g. EFA.r, CFA.r, PolReg.r, MBCA.r etc.) to text files in a special folder (c:_vargha\ropstat\aktualis), which can be accessed by the user after the analyses and can be run independently in R (e.g. using RGui or RStudio) after exiting ROP-R.

7. If graphical diagrams (plots) are created during the run (e.g. path diagram in mediation analysis or confirmatory factor analysis, or dendrogram in hierarchical cluster analysis), ROP-R will place them in the same folder, in pdf or jpg files.

8. During some analyses (e.g. all regression analyses), the raw R-outputs are also kept in this folder in a text file named oo.txt (or oo1.txt), and ROP-R also collects the run-time feedback from running the R-packages and saves it in a text file named Rreport.txt. If R cannot find an R-package to run, or if it finds a problem with the R-script that ROP-R has created, it can be found in this file.

4. ROP-R menu items

The statistical modules of ROP-R can be run with the menu item "Multivariate_analyses_using_R_programs". The other menu items in ROP-R (File, Edit, Cases, Variables, Transformations, etc.) can be used in the same way as in ROPstat (see Vargha et al., 2016) and most other statistical software.

In the "File" menu, you can import different types of data files (common msw files of ROPstat and ROP-R, Excel xls and xlsx, SPSS sav and por, csv or tabulated text files), open a new msw file, save msw files in SPSS or text file format, etc.

In the "Edit" menu, in addition to the usual options (Cut, Copy, Paste, etc.), the Find, Replace command can be used to list all cases in a data column that contain a given string in this data column (variable) and replace it with another one. For example, this is the easiest way to recode a value of a variable (e.g. to recode all values of 6 to 1 in a column).

The "Cases" menu item can be used, for example, to delete certain selected rows, insert new rows, or reorder the rows in ascending or descending order according to the values of one or more variables.

The "Variables" menu item can be used, for example, to delete certain selected variables or to insert new variables. To delete variables, simply click on „Select" in the top left corner of the screen, then use the mouse to select a cell in the column of variables to be deleted, and finally click on the Delete Variables command in the Variables menu.

The "Transformations" menu offers a rich set of options to transform variables or create new variables using univariate and bivariate operations or statistical functions. Here you can also create new random variables based on 11 different distributions, or recode individual variables by zones or code values.

In the "Settings" menu, you can specify the path of the Rcmd.exe program for ROP-R, which is essential for running the multivariate modules (in a standard installation, this is c:\Program Files\R\R-4.4.2\bin\x64\Rcmd.exe), and you can also specify the font size for the data cells.

5. Statistical modules of the ROP-R

The ten modules of ROP-R can be grouped into three categories:

    I. Regression analyses

        1. Hierarchical regression (HierR)
        2. Polynomial regression (PolR)
        3. Binary logistic regression (BLR)

    II. Dimension reduction analyses

        4. Principal component analysis (PCA)
        5. Exploratory factor analysis (EFA)
        6. Confirmatory factor analysis (CFA)

    III. Cluster analyses

        7. Agglomerative hierarchical cluster analysis (AHCA)
        8. Divisive hierarchical cluster analysis (DHCA)
        9. k-center cluster analysis (KCA)
        10. Model-based cluster analysis (MBCA)

Each module has its own menu template. Vargha & Bánsági (2022) describes these modules in detail, how to use their menu windows, and how to read and interpret the run results. Common to all modules is that after running the analyses assigned in them, a text file called Rreport.txt is always found in the folder "c:_vargha\ropstat\aktualis", which provides feedback on how the R-script or R-scripts created by ROP-R have run. If ROP-R stops at any point or returns an incomplete list of results, you can look in this file for details to find out the cause of the error. Look here for the lines starting with "Warning message" and "Error"!

Finally, note that if ROP-R is properly installed in the c:_vargha\ropstat folder (where the ROPstat software is), the ten multivariate modules of ROP-R are directly available in the ROPstat software under a separate menu item called "Multivariate_analyses_ using_R_programs". In this case it is therefore sufficient to use only ROPstat to access the full statistical arsenal of ROPstat and ROP-R. There is only one feature of ROP-R that is not available from ROPstat, i.e. that does not work in ROPstat: the direct reading of SPSS sav files and their conversion to msw format. For this, ROP-R must be started, but once the conversion is done, further analyses can be done by ROPstat.

References

1. Vargha, A. & Bánsági, P. (2022). ROP-R: a free multivariate statistical software that runs R packages in a ROPstat framework. *Hungarian Statistical Review, 5*(2), 3-29. https://doi.org/10.35618/HSR2022.02.en003 https://www.ksh.hu/hungarian-statistical-review#/year/2022?c=h#02
2. Vargha, A., Torma, B. & Bergman, L. R. (2015). ROPstat: a general statistical package useful for conducting person-oriented analyses. *Journal for Person-Oriented Research*, *1 (1-2)*, 87–98. https://doi.org/10.17505/jpor.2015.09 https://www.person-research.org/journal/files/1_1/filer/44.pdf