

Package ‘RVIpkg’

September 25, 2020

Title Regional Vulnerability Index

Version 0.1.1

Description The Regional Vulnerability Index (RVI), a statistical measure of brain structural abnormality, quantifies an individual’s similarity to the expected pattern of deficits in schizophrenia (Kochunov P, Fan F, Ryan MC, et al. (2020) <doi:10.1002/hbm.25045>).

License GPL (>= 2)

Encoding UTF-8

LazyData true

RoxygenNote 7.1.1

Depends R (>= 2.10)

Imports stats

NeedsCompilation no

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RVI_func

*Regional Vulnerability Index***Description**

The Regional Vulnerability Index (RVI), a statistical measure of brain structural abnormality, quantifies an individual's similarity to the expected pattern of deficits seen in schizophrenia derived from large-scale meta-analyses by the ENIGMA consortium. This package outputs the inverse-normal transformed residuals, z-normalized INT residuals, and the final RVI coefficients.

Usage

```
RVI_func(ID, DXcontrol, covariates, resp.range, EP, data)
```

Arguments

ID	a column name of subject IDs in data.
DXcontrol	an character string specifying control subset(i.e. DXcontrol='DX==0'). Mean and standard deviation for z-normalization should be calculated in healthy controls.
covariates	an optional character vector specifying column names of covariates (i.e. Age, Sex). If covariates=NULL, residuals will not be adjusted for covariates. If covariates are specified(i.e. covariates=c('Age','Sex')), residuals will be adjusted for covariates.
resp.range	a numeric vector specifying column range of responses
EP	a numeric vector specifying an expected pattern of measurements.
data	a data frame contains a column of subject IDs, a column of controls, columns of covariates, columns of responses.

Details

The RVI is developed as a simple measure of agreement between an individual's pattern of regional neuroimaging traits and the expected pattern of schizophrenia. First, residuals are extracted from simple linear regression by regressing out effects of optional covariates (age, sex) and intracranial brain volume using the full sample (patients and controls). The residuals are inverse-normal transformed (INT) based on residuals' ranks, and then the transformed residuals are z-normalized using mean and standard deviation calculated in healthy controls. The RVI is then calculated as a Pearson correlation coefficient between z-normalized values of subjects and their expected pattern. These expected patterns include cortical, subcortical, and white matter intracranial brain volumes for Schizophrenia Spectrum Disorders (SSD).

Value

A list with the following elements:

i.norm.resid	inverse-normal transformed(INT) residuals
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<code>z.norm.resid</code>	z-normalized INT residuals
<code>RVI</code>	pearson correlation coefficient between the z-normalized INT residuals of subjects and their expected pattern

Note

The `RVI_func()` function is developed at the Maryland Psychiatric Research Center, Department of Psychiatry, University of Maryland School of Medicine. This project is supported by NIH R01 EB015611 grant. Please cite our funding if you use this software.

References

Kochunov P, Fan F, Ryan MC, et al. Translating ENIGMA schizophrenia findings using the regional vulnerability index: Association with cognition, symptoms, and disease trajectory (2020). *Hum Brain Mapp.* 2020;10.1002/hbm.25045. doi: [10.1002/hbm.25045](https://doi.org/10.1002/hbm.25045)

R Core Team (2020). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL <https://www.R-project.org/>.

Examples

```
E.P <- c(-0.37,0.31,-0.02,-0.08,-0.21,0.46,0.31,0.25)
RVI1 <- RVI_func(ID='ID', DXcontrol='DX==0', covariates=c('Age','Sex'), resp.range=c(5:12),
EP=E.P, data=RVIpkg::test)
RVI2 <- RVI_func(ID='ID', DXcontrol='DX==0', covariates=NULL, resp.range=c(5:12),
EP=E.P, data=RVIpkg::test)
```

test

test

Description

Simulated volumes of subcortical structures of Schizophrenia spectrum disorder are used as an example for this function. You can calculate RVI for this dataset"

Usage

```
test
```

Format

A data frame with 196 rows and 12 variables:

ID subjects' ID

DX indicators of control group

Age subjects' age

Sex subjects' gender

Lateral.Ventricle simulated volumes of lateral Ventricle

Thalamus simulated volumes of Thalamus

Caudate simulated volumes of Caudate

Putamen simulated volumes of Putamen

Pallidum simulated volumes of Pallidum

Hippocampus simulated volumes of Hippocampus

Amygdala simulated volumes of Amygdala

Left.Accumbens.area simulated volumes of left Accumbens

Source

The 'test' dataset is from Maryland Psychiatric Research Center, Department of Psychiatry, University of Maryland School of Medicine.

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