Package: occ (via r-universe)

August 23, 2024

Type Package

Title Estimation of PET Neuroreceptor Occupancies

Version 1.2

Date 2024-08-02

Description Estimate the positron emission tomography (PET) neuroreceptor occupancies from the total volumes of distribution of a set of regions of interest. Fitting methods include the simple 'reference region', 'ordinary least squares' (sometimes known as occupancy plot), and 'restricted maximum likelihood estimation'.

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LazyData true

NeedsCompilation no

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Date/Publication 2024-08-22 21:10:02 UTC

Repository https://jrad1.r-universe.dev

RemoteUrl https://github.com/cran/occ

RemoteRef HEAD

RemoteSha 6a39e870fd00546ad0ca9cca8d5a0a0603ca9046

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occ   *Estimates PET neuroreceptor occupancies*

Description

This function estimates positron emission tomography (PET) neuroreceptor occupancies from the
total volumes of distribution (VT) of a set of regions of interest (ROI). Fittings methods include the
simple 'reference region' ("ref"), 'ordinary least squares' ("ols", sometimes known as occupancy
plot), and 'restricted maximum likelihood' estimation ("reml").

Usage

```
occ(VT, method = "reml")
```

Arguments

VT   matrix of total volumes of distribution (VT). Each row must have the VT val-
                    ues of an ROI. The first column must have the baseline VT values, the second
                    column must have the first-postdose VT values, the third column must have the
                    second-postdose VT values, etc. See "occ.example" example below.

method   one of either "ref" (reference region), "ols" (ordinary least squares), or "reml"
                    (restricted maximum likelihood estimation). Please read the assumptions of
                    each method below in Details.

Details

The reference region ("ref") method assumes that: a) neuroreceptor occupancy is different in each
ROI; b) non-displaceable volume of distribution (VND) is different in each scan; c) specific volumes
of distribution (VS) are the same in all scans; d) VS of the first ROI is null; and e) all measurement
errors are negligible. Assumptions d) and e) may be unrealistic in many cases.

The ordinary least squares ("ols") method assumes that: a) neuroreceptor occupancy is the same
in all ROIs; b) VND is different in each postdose scan; c) baseline VND is equal to all postdose
VND; d) VS are different in each postdose scan; e) baseline VS are equal to all postdose VS; f)
measurement errors are different in each scan; and g) measurement error of baseline scan is null.
Assumptions c) and e) may lead to multiple (i.e., mathematically impossible) baseline estimates in
studies with more than one postdose scan. Also, note that assumption g) may be unrealistic in many
cases.

The restricted likelihood estimation ("reml") method assumes that: a) neuroreceptor occupancy is
the same in all ROIs; b) VND is the same in all scans; c) VS are the same in all scans; and d)
measurement error is the same in all scans.

Value

An object of class occ, basically a list including the following elements:

VT   the observed total volumes of distribution

coefficients   the neuroreceptor occupancy coefficients

VND	the non-displaceable volumes of distribution of each scan
VS	the specific volumes of distribution
sigma	the measurement error in each scan
fitted.values	the fitted VT
residuals	the residuals, that is, observed VT minus fitted VT

Author(s)

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References

Radua J, Bullich S, Lopez N and Catafau AM. Restricted maximum likelihood estimation of PET neuroreceptor occupancy in the absence of a reference region. Medical Physics 2011;38:2558.

Doi: 10.1118/1.3578606 (http://dx.doi.org/10.1118/1.3578606)

Examples

```
## Total volumes of distribution (VT) from a simulated PET study
## including a baseline scan, as well as two other scans after
## administration of a drug. Note that each row in the matrix
## represents an ROI, while each column represents a scan.

data(occ.example)
occ.example

#                 Baseline 1st postdose 2nd postdose
# Cerebellum          0.39         0.28         0.30
# Frontal cortex      0.72         0.35         0.47
# Occipital cortex    0.96         0.43         0.62
# Parietal cortex     0.75         0.34         0.50
# Temporal cortex     0.44         0.26         0.31


## Default REML fitting of these simulated data:

m = occ(occ.example)

print(m)      # Prints the neuroreceptor occupancy coefficients

summary(m)    # Also prints the non-displaceable volume of
              # distribution (VND), the specific volumes of
              # distribution (VS) and the measurement error

fitted(m)     # Prints the fitted values

residuals(m)  # Prints the residuals

plot(m)       # Plots the estimated and observed volumes of
              # distribution
```

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occ.example   *Total volumes of distribution (VT) from a simulated PET study*

Description

The data represent the total volumes of distribution (VT) from a simulated PET study, including a baseline scan and two other scans after administering a drug.

Usage

```
occ.example
```

Format

A matrix of total volumes of distribution (VT) with five rows (ROIs) and three columns (scans).

Examples

```
data(occ.example)
occ.example

#                 Baseline 1st postdose 2nd postdose
# Cerebellum          0.39         0.28         0.30
# Frontal cortex      0.72         0.35         0.47
# Occipital cortex    0.96         0.43         0.62
# Parietal cortex     0.75         0.34         0.50
# Temporal cortex     0.44         0.26         0.31


## Find the neuroreceptor occupancy in each scan:

summary(occ(occ.example))


## Plot the estimated and observed volumes of distribution:

plot(occ(occ.example))
```

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