

Package ‘EMMLi’

July 21, 2025

Type Package

Title A Maximum Likelihood Approach to the Analysis of Modularity

Version 0.0.3

Date 2017-02-17

Author Anjali Goswami, Tim Lucas, Prabu Sivasubramaniam, John Finarelli

Maintainer Tim Lucas <timcdlucas@gmail.com>

Description Fit models of modularity to morphological landmarks. Perform model selection on results. Fit models with a single within-module correlation or with separate within-module correlations fitted to each module.

License MIT + file LICENSE

Imports stats, utils

Suggests testthat

LazyData true

URL <https://github.com/timcdlucas/EMMLi>

RoxygenNote 5.0.1

NeedsCompilation no

Repository CRAN

Date/Publication 2017-02-17 14:37:57

Contents

EMMLi	2
macacaCorrel	3
macacaModels	4
Index	5

Description

Calculates the AICc values, model likelihoods, and posterior probabilities of different models of modularity, as described in Goswami and Finarelli (2016).

Usage

```
EMMLi(corr, N_sample, mod, saveAs = NULL, abs = TRUE, pprob = 0.05)
```

Arguments

corr	Lower triangle or full correlation matrix. n x n square matrix for n landmarks.
N_sample	The number of specimens
mod	A data frame defining the models. The first column should contain the landmark names. Subsequent columns should define which landmarks are contained within each module with integers, factors or characters. If a landmark should be ignored for a specific model (i.e., it is unintegrated in any module), the element should be NA.
saveAs	A character string defining the filename and path for where to save output. If NULL, the output is not saved to file
abs	Logical denoting whether absolute values should be used. Default is TRUE, as in Goswami and Finarelli (2016)
pprob	posterior probability cutoff for reporting of models. Default is 0.05, as suggested in Goswami and Finarelli (2016)

Details

The publication describing this analysis is A. Goswami and J. Finarelli (2016) EMMLi: A maximum likelihood approach to the analysis of modularity. *Evolution* <http://onlinelibrary.wiley.com/doi/10.1111/evo.12956/abstract>.

Value

A list containing two elements. The first (results) gives the AIC results for each model. The second (rho) gives the within and between module correlations. Optionally, the output is saved to the file defined by the saveAs argument with only models with a posterior probability > 0.01 being saved.

Examples

```
set.seed(1)

# Chose a filename and directory for output
dir <- tempdir()
```

```
file <- paste0(dir, 'EMMLiTest.csv')

# Examine a correlation matrix and model dataframe
dim(macacaCorrel)
head(macacaModels)

# run EMMLi
output <- EMMLi(macacaCorrel, 20, macacaModels, file)

unlink(file)

# run EMMLi without writing output
output <- EMMLi(macacaCorrel, 20, macacaModels)

# Raw data example to illustrate pitfalls
corrPath <- system.file("extdata", "M11mcorrel.csv", package = "EMMLi")
corr <- read.csv(corrPath, header = FALSE)

modelPath <- system.file("extdata", "macaca_landmarklist.csv", package = "EMMLi")
mod <- read.csv(modelPath, header = TRUE, row.names = 1)

# First column should be character or factor. Subsequent columns integer
sapply(mod, class)

out <- EMMLi(corr, 42, mod)
```

macacaCorrel	<i>Correlation matrix for 61 landmarks from Japanese macaque (<i>Macaca fuscata</i>) craniums.</i>
--------------	--

Description

3D coordinates for 61 landmarks on the crania of 42 juvenile Japanese macaque (*Macaca fuscata*) from the Primate Research Institute at Inuyama, Japan, was aligned and scaled with Generalized Procrustes superimposition. The vector congruence coefficient correlation was then calculated for each pair of landmarks

Usage

```
macacaCorrel
```

Format

A 61 x 61 matrix

Details

```
#' @seealso macacaModels
```

Source

Goswami, A. and P. D. Polly. 2010. Methods for studying morphological integration and modularity. Pp. 213-243 in J. Alroy, and E. G. Hunt, eds. Quantitative Methods in Paleobiology. Paleontological Society Special Publications.

macacaModels

Models of (Macaca fuscata) cranial modularity.

Description

Seven models of cranial landmark modularity. These models group the 61 landmarks in [macacaCorrel](#) into modules. See Goswami and Finarelli (2016) for more details.

Usage

macacaModels

Format

A data frame with 61 rows (one for each landmark) and 8 columns.

- X.1Landmark names (character or factor)
- Other columnsModel specification. Integers determine which module each landmark is in. NAs indicate that a landmark is not in any module.

Source

A. Goswami and J. Finarelli (2016) EMLLi: A maximum likelihood approach to the analysis of modularity. *Evolution* <http://onlinelibrary.wiley.com/doi/10.1111/evo.12956/abstract>.

See Also

[macacaCorrel](#)

Index

* **datasets**

macacaCorrel, 3

macacaModels, 4

EMMLi, 2

macacaCorrel, 3, 4

macacaModels, 3, 4