

RanCh

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Title Tools for abstract discrete Random Choice

URL <http://github.com/mccauslw/RanCh>

BugReports <http://github.com/mccauslw/RanCh/issues>

Version 0.0.0.9000

Description This package provides tools for a research project whose purpose is to help us better understand the foundations of stochastic discrete choice. It includes datasets compiled from the literature on context effects and stochastic intransitivity and from some recent experiments. It provides graphical tools to display likelihood function and posterior density contours, as well as regions, in the space of choice probabilities, defined by various stochastic choice axioms, context effects and other conditions.

Imports klaR,
MASS,
bitops,
Smisc,
ggtern

Depends R (>= 3.6.0)

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Encoding UTF-8

LazyData true

RoxygenNote 6.1.1

Suggests knitr,
rmarkdown

VignetteBuilder knitr

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create_P	<i>Random Choice Structure for a three-object universe</i>
----------	--

Description

create_P creates a random choice structure for a three-object universe from

Usage

create_P(p12, p23, p13, P1, P2, names = c("x", "y", "z"))

Arguments

- | | |
|-----|--|
| p12 | Probability of chosing object 1 when presented with objects 1 and 2 |
| p23 | Probability of chosing object 2 when presented with objects 2 and 3 |
| P1 | Probability of chosing object 1 when presented with objects 1, 2 and 3 |
| P2 | Probability of chosing object 2 when presented with objects 1, 2 and 3 |
| P13 | Probability of chosing object 1 when presented with objects 1 and 3 |

Value

A Random Choice Structure

Examples

```
P = create_P(21/40, 37/40, 28/40, 19/40, 15/40, names=c('Red', 'Purple', 'Pink'))
P
```

dDir	<i>Dirichlet density</i>
------	--------------------------

Description

dDir computes the Dirichlet density at a point p in the regular simplex, for a vector α of Dirichlet parameters.

Usage

```
dDir(p, alpha, log = TRUE)
```

Arguments

<code>p</code>	vector of probabilities on the regular simplex
<code>alpha</code>	vector of Dirichlet parameters
<code>log</code>	logical; if TRUE, the log density is returned

Value

density or log density value

dDir3_quantile	<i>Quantile of third order Dirichlet density value</i>
----------------	--

Description

dDir3_quantile computes an approximation of the given quantile of a third order Dirichlet density value, under that Dirichlet distribution.

Usage

```
dDir3_quantile(quantile, alpha, normalized = FALSE)
```

Arguments

<code>quantile</code>	the quantile of the desired density value
<code>alpha</code>	a vector of Dirichlet parameters
<code>normalized</code>	binary; if TRUE, return the quantile as a fraction of the maximum density value; if FALSE, return the unnormalized quantile.

Value

The value of the quantile, normalized or not

dDir_max	<i>Maximum density of a Dirichlet distribution</i>
----------	--

Description

max_dDir computes the maximum density of a Dirichlet distribution as a function of the parameter vector alpha.

Usage

```
dDir_max(alpha, log = TRUE)
```

Arguments

alpha	vector of Dirichlet parameters.
log	logical; if TRUE, the log maximum density is returned.

Value

Density or log density value.

dDir_moments	<i>Moments of Dirichlet density values</i>
--------------	--

Description

moments_dDi computes a vector of the first n raw moments of Dirichlet density values, under that Dirichlet distribution.

Usage

```
dDir_moments(beta, n_mu, log = FALSE)
```

Arguments

n_mu	number of moments to compute.
log	logical; if true return log moments.
alpha	vector of Dirichlet parameters.

Value

vector of moments

Dir3_HD_region	<i>Compute highest density (HD) region for a third order Dirichlet distribution</i>
----------------	---

Description

This function computes a polygon approximating the highest density region of a third order Dirichlet distribution. This can be used to compute highest prior density and highest posterior density (HPD) regions.

Usage

```
Dir3_HD_region(alpha, HD_probability)
```

Arguments

alpha a vector of three (positive) Dirichlet parameters.
HD_probability probability of region to construct

Value

polygon approximation of HD region.

Dir_mult_ML	<i>Marginal likelihood for Dirichlet-multinomial model</i>
-------------	--

Description

Dir_mult_ML computes the marginal likelihood for a Dirichlet prior and multinomial data generating process.

Usage

```
Dir_mult_ML(alpha, N, log = TRUE)
```

Arguments

alpha vector of Dirichlet parameters
N vector of multinomial counts
log logical; if TRUE, return the log Bayes factor.

Value

Marginal likelihood or log marginal likelihood

Ind_Dir_mult_ML	<i>Marginal likelihood for independent Dirichlet-multinomial model</i>
-----------------	--

Description

Ind_Dir_mult_ML computes the marginal likelihood for a model where rows of a count matrix are independent multinomial and the rows of the unknown random choice structure are a priori independent Dirichlet.

Usage

```
Ind_Dir_mult_ML(A, N, log = TRUE)
```

Arguments

A	matrix of Dirichlet parameters, each row giving the Dirichlet distribution of the corresponding row of a random choice structure.
N	count matrix for a universe of objects.
log	logical; if TRUE, return the log Bayes factor

marginalize	<i>Routines for simple manipulations of count matrices and random choice structures.</i>
-------------	--

Description

Marginalize a count matrix or random choice structure

Usage

```
marginalize(input_N, objects)
```

Arguments

input_N	A count matrix
objects	A vector of objects to retain

Details

This function takes as input a count matrix or random choice structure on a universe of objects and returns a marginalization of it to a universe that is a subset of the original universe.

Value

A count matrix

Examples

```
N_bce = marginalize(PC_counts, c(2,3,5))
P_abd = marginalize()
N
```

multiplicative_X3	<i>Compute a cross section of the multiplicative inequality region</i>
-------------------	--

Description

multiplicative_X3 computes the region (a triangle) of ternary probabilities consistent with given binary probabilities and the multiplicative inequality.

Usage

```
multiplicative_X3(P)
```

Arguments

P	A random choice structure
---	---------------------------

Value

A 3x3 matrix where each row gives one of the three vertices, in barycentric coordinates, of the triangular region where the multiplicative inequality holds.

Examples

```
P = create_P(0.7, 0.6, 0.8, 0.6, 0.3, 0.1, names = c('x', 'y', 'z'))
multiplicative_X3(P)
```

PC_counts	<i>Counts</i>
-----------	---------------

Description

A 32x26x5 matrix with count data.

Usage

```
PC_counts
```

Format

An object of class array of dimension 32 x 31 x 5.

PC_demographics	<i>Demographic information for subjects</i>
-----------------	---

Description

Demographic information for subjects

Usage

PC_demographics

Format

A data frame with demographic information on subjects

sex Sex of subject

age Age of subject in years

location Province or territory in Canada

PC_raw	<i>Population Choice experiment data</i>
--------	--

Description

Record of every choice made by every respondent.

Usage

PC_raw

Format

A data frame with 17 variables:

design

gender Sex of respondent: 1 for male, 2 for female

PC_trials	<i>Record of all choice trials</i>
-----------	------------------------------------

Description

Record of all choice trials

Usage

```
PC_trials
```

Format

A data frame with 14 variables

subj Subject identifier

domain Factor indicating choice domain

trial Trial identifier (gives the order in which a subject sees choice sets)

subs Factor indicating the choice subset presented: 'ab', 'cde', etc., objects always in alphabetical order

choice Factor indicating the choice made: 'a', 'b', 'c', 'd' or 'e'

subs_conf Subset configuration, the order objects appear on the screen: 'ba', 'ecd', etc., objects not necessarily in alphabetical order

subs_bin Code for subset where digits of binary representation indicate object membership

choice_int Integer code for chosen object

ab Revealed preference indicator: 1 for a revealed preferred to b, -1 for b revealed preferred to a, 0 otherwise. This is the first of ten revealed preference columns, each pertaining to a particular doubleton set.

plot_HD_Dir3	<i>Plot highest density region for a third order Dirichlet distribution</i>
--------------	---

Description

This function plots the Dirichlet highest density region in barycentric coordinates.

Usage

```
plot_HD_Dir3(A, HD_probability)
```

Arguments

HD_probability probability of highest density region

alpha vector of Dirichlet parameters

Examples

```
plot_HD_Dir3(0.95, c(23, 13, 4))
```

plot_P3	<i>Plot a Random Choice Structure in barycentric coordinates</i>
---------	--

Description

plot_P3 plots four points specifying a Random Choice Structure for a universe of three objects.

Usage

```
plot_P3(P, perm = c(1, 2, 3), binary_pch = 1, ternary_pch = 20)
```

Arguments

P	A random choice structure for a universe of three objects
perm	A permutation of (1, 2, 3) specifying which objects in the universe correspond to the bottom left, top, and bottom right vertex, respectively of the ternary plot.
binary_pch	Plotting character (pch) for binary choice probabilities. Defaults to a hollow circle.
ternary_pch	Plotting character (pch) for ternary choice probability. Defaults to a solid circle. The convention established with the defaults for binary_pch and ternary_pch allow one to distinguish between a binary choice probability and a ternary choice probability that happens to be on the boundary of the triangle.

Examples

```
P = create_P(0.7, 0.6, 0.8, 0.6, 0.3, 0.1, names = c('x', 'y', 'z'))
plot_P3(P)
```

proportions	<i>Random Choice Structure from count proportions</i>
-------------	---

Description

proportions takes a count matrix as input, and returns choice proportions as a random choice structure.

Usage

```
proportions(N)
```

Arguments

N	A count matrix.
---	-----------------

Value

A random choice structure.

Examples

```
PC_P = proportions(PC_counts)
```

RanCh

RanCh: A package for abstract discrete Random Choice

Description

The RanCh package provides data, graphical tools and inference tools for abstract discrete random choice analysis.

Data sets

NA

RCD_prior_1

One-parameter Dirichlet prior for a RCS

Description

RCS_prior_1 computes a matrix of Dirichlet parameters for a one-parameter Dirichlet prior for a random choice structure.

Usage

```
RCD_prior_1(alpha, n_objects)
```

Arguments

alpha	univariate parameter for the one-parameter Dirichlet prior.
n_objects	number of objects in the universe.

Value

a matrix of Dirichlet parameters with the same dimensions as a count matrix for a universe of the same size.

regularity_X3

Compute a cross section of the regularity region

Description

regularity_X3 computes the region (a triangle or the empty set) of ternary probabilities consistent with given binary probabilities and the regularity condition.

Usage

```
regularity_X3(P)
```

Arguments

P A random choice structure.

Value

If the region is empty, the output is NULL. Otherwise, a 3x3 matrix where each row gives one of the three vertices in barycentric coordinates.

Examples

```
P = create_P(0.7, 0.6, 0.8, 0.6, 0.3, 0.1, names = c('x', 'y', 'z'))
reg_region = regularity_X3(P)
```

YG_counts	<i>Counts</i>
-----------	---------------

Description

A 3x16x15x4 matrix with count data.

Usage

YG_counts

Format

An object of class table of dimension 16 x 11 x 4.

YG_demographics	<i>Demographic information for subjects</i>
-----------------	---

Description

Demographic information for subjects

Usage

YG_demographics

Format

- A data frame with demographic information on subjects
- sex Sex of subject
 - educ Educational attainment by subject
 - region Region of subject's residence in US
 - race Race of subject
 - age_range Age range of subject

YG_raw

*YouGov Experiment data***Description**

Record of every choice made by every respondent.

Usage

YG_raw

Format

A data frame with 17 variables:

design

card

domain

combo

perm

choiceset Choice set as a character string

option_1 Object presented in first position: 1, 2, 3 or 4

option_2 Object presented in second position

option_3 Object presented in third position

option_4 Object presented in fourth position

response Object chosen: 1, 2, 3 or 4

order

gender Sex of respondent: 1 for male, 2 for female

educ Education of respondent: 1 for No high school, 2 for High school graduate, 3 for Some college, 4 for 2-year college, 5 for 4-year college, 6 for post-graduate

region Region of respondent: 1 for northeast, 2 for midwest, 3 for south, 4 for west

race Race of respondent: 1 for White, 2 for Black, 3 for Hispanic, 4 for Asian, 5 for Native American, 6 for Mixed, 7 for Other, 8 for Middle Eastern

age_cross Age category of respondent: 1 for 18-34, 2 for 35-54, 3 for 55 and over

YG_trials	<i>Record of all choice trials</i>
-----------	------------------------------------

Description

Record of all choice trials

Usage

YG_trials

Format

A data frame with 14 variables

subj Subject identifier

domain Factor indicating choice domain

trial Trial identifier (gives the order in which a subject sees choice sets)

subs Factor indicating the choice subset presented: 'ab', 'cde', etc.

choice Factor indicating the choice made: 'a', 'b', 'c' or 'd'

subs_conf Subset configuration, the order objects appear on the screen

subs_bin Code for subset where digits of binary representation indicate object membership

choice_int Integer code for chosen object

ab Revealed preference indicator: 1 for a revealed preferred to b, -1 for b revealed preferred to a, 0 otherwise

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