Package: int3ract (via r-universe)

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Type Package

Title Plotting Two- and Three-Way Interactions

Version 1.0.7

Description Provides two- and three-way Johnson-Neyman-(Krause) plots for easier interpretation of interactions. It extends the classic framework of Johnson and Neyman (1936) and Johnson and Fay (1950) <doi:10.1007/BF02288864> to Bayesian models and three-way interactions. The functions have dedicated routines for classic lm()/glm() models, as well as 'lme4' models and 'RSiena' results. However, the package can also be used model agnostic and thus extends the availability of JN(K)-plots beyond what is currently available. A detailed introduction can be found in Krause (2026) <doi:10.48550/arXiv.2604.22051>.

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Depends R (>= 4.4.0)

Imports dplyr, tibble, tidyr, ggplot2, ggpattern, scales, lme4

Suggests MCMCpack, RSiena

RoxygenNote 7.3.3

URL https://github.com/RWKrause/int3ract

BugReports https://github.com/RWKrause/int3ract/issues

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`JNK_bayes` *Create Johnson-Neyman plots for Bayesian models*

Description

Accepts either a raw matrix of posterior draws (rows = iterations, columns = parameters) or a `multiSiena` object produced by `sienaBayes()`.

Usage

```
JNK_bayes(
  x,
  theta_1,
  theta_2,
  theta_3 = NULL,
  theta_int_12 = NULL,
  theta_int_13 = NULL,
  theta_int_23 = NULL,
  theta_int_123 = NULL,
  theta_1_vals,
  theta_2_vals,
  theta_3_vals = NULL,
  burn_in = NULL,
  thin = 1,
  thresholds = NULL,
  hyper_only = TRUE,
  round_res = 3,
  noTitle = NULL,
  color_mid = "#EBCC2A",
  color_low = "#3B9AB2",
  color_high = "#F21A00",
  color_values = "grey40",
  color_grid = "black",
  grid_density = 0.01,
  grid_spacing = 0.1,
  save = FALSE,
  folder = NULL
)
```

Arguments

x	matrix or 'multiSiena'; posterior draws or sienaBayes() output. If a matrix, columns should be named or referenced by index. If a 'multiSiena' object, parameters are referenced by their position in the (rate-excluded) effects object.
theta_1	character or numeric; name/index of the first variable involved in the interaction. (For `multiSiena` input, this is the position of the effect in the effects object ignoring rates – `x[x$type != 'rate', ]`).
theta_2	character or numeric; name/index of the second variable.
theta_3	character or numeric; name/index of the third variable. Default NULL (two-way interaction).
theta_int_12	numeric; index of the interaction between theta_1 and theta_2. Not needed when theta_1 etc. are character names (matrix input and `multiSiena` only).
theta_int_13	numeric; index of the theta_1:theta_3 interaction. Default NULL.
theta_int_23	numeric; index of the theta_2:theta_3 interaction. Default NULL.
theta_int_123	numeric; index of the three-way interaction. Default NULL.
theta_1_vals	numeric; range of the statistic theta_1 is multiplied with.
theta_2_vals	numeric; range of the statistic theta_2 is multiplied with.
theta_3_vals	numeric; range of the statistic theta_3 is multiplied with. Default NULL.
burn_in	numeric; burn-in iterations to remove. For `multiSiena` input defaults to `max(x$nwarm, 1)`; for matrix input defaults to 0.
thin	numeric; thinning interval. Default 1.
thresholds	numeric; threshold for significance hashing. Default `c(0.49999999999999999, 0.5)`.
hyper_only	logical; (`multiSiena` only) use only the hyper-parameter, or also produce group-level plots? Default TRUE.
round_res	numeric; rounding digits. Default 3.
noTitle	character; optional plot title.
color_mid	character; mid-point colour. Default '#EBCC2A'.
color_low	character; low-value colour. Default '#3B9AB2'.
color_high	character; high-value colour. Default '#F21A00'.
color_values	character; number colour. Default 'grey40'.
color_grid	character; grid colour. Default 'black'.
grid_density	numeric; hash-grid density. Default 0.01.
grid_spacing	numeric; hash-grid spacing. Default 0.1.
save	logical; save plots with ggsave()? Default FALSE.
folder	character; save folder. Default NULL, which writes into a session-temporary directory (`file.path(tempdir(), 'int3ract JNKplots')`). Set explicitly to write elsewhere.

Value

A list containing tables and plots. For two-way interactions: `param_table` and `plots`. For three-way: `thetas`, `standard_errors`, `p_values`, `significance`, and `plots`. When `hyper_only = FALSE` ('multiSiena'), also returns a list of group-level results under `random_groups_effects`.

Examples

```
# --- two-way: raw posterior matrix (fast, no extra packages) ---
set.seed(1)
n_iter <- 500
post2 <- cbind(x     = rnorm(n_iter,  0.5, 0.2),
               z     = rnorm(n_iter, -0.3, 0.2),
               `x:z` = rnorm(n_iter,  0.4, 0.2))

jnk_bayes2 <- JNK_bayes(post2,
                        theta_1 = 'x', theta_2 = 'z',
                        theta_1_vals = seq(-2, 2, 1),
                        theta_2_vals = seq(-2, 2, 1))

# --- three-way: raw posterior matrix ---
post3 <- cbind(x       = rnorm(n_iter,  0.5, 0.2),
               z       = rnorm(n_iter, -0.3, 0.2),
               w       = rnorm(n_iter,  0.2, 0.2),
               `x:z`   = rnorm(n_iter,  0.4, 0.2),
               `x:w`   = rnorm(n_iter,  0.1, 0.2),
               `z:w`   = rnorm(n_iter, -0.1, 0.2),
               `x:z:w` = rnorm(n_iter,  0.2, 0.2))

jnk_bayes3 <- JNK_bayes(post3,
                        theta_1 = 'x', theta_2 = 'z', theta_3 = 'w',
                        theta_1_vals = seq(-2, 2, 1),
                        theta_2_vals = seq(-2, 2, 1),
                        theta_3_vals = seq(-2, 2, 1))

# --- two-way: integration with MCMCpack (only if installed) ---

if (requireNamespace("MCMCpack", quietly = TRUE)) {
  set.seed(1402)
  dat   <- data.frame(x = rnorm(100), z = rnorm(100))
  dat$y <- dat$x + 0.5 * dat$x * dat$z - 0.5 * dat$z + rnorm(100, sd = 4)
  mod_bayes2 <- MCMCpack::MCMCregress(y ~ x * z, data = dat,
                                      burnin = 1000, mcmc = 10000,
                                      thin = 1, verbose = 0)
  jnk_bayes2_e <- JNK_bayes(mod_bayes2, theta_1 = 'x', theta_2 = 'z',
                            theta_1_vals = seq(-3, 3, 0.5),
                            theta_2_vals = seq(-3, 3, 0.5))
}
```

JNK_freq *Johnson-Neyman(-Krause) plots for frequentist models*

Description

Unified function that accepts `lm`, `glm`, `sienaFit` ('RSiena'), or `lmerMod`/`glmerMod` ('lme4') objects, or raw coefficient vectors and covariance matrices.

Usage

```
JNK_freq(
  x = NULL,
  theta_1,
  theta_2,
  theta_3 = NULL,
  theta_int_12 = NULL,
  theta_int_13 = NULL,
  theta_int_23 = NULL,
  theta_int_123 = NULL,
  theta_1_vals = NULL,
  theta_2_vals = NULL,
  theta_3_vals = NULL,
  covar = NULL,
  coefs = NULL,
  name = NULL,
  group_var = NULL,
  fixed_only = TRUE,
  control_fdr = FALSE,
  alpha = 0.05,
  round_res = 3,
  range_size = NULL,
  sig_color = "seagreen3",
  non_sig_color = "chocolate",
  line_color = "black",
  color_mid = "#EBCC2A",
  color_low = "#3B9AB2",
  color_high = "#F21A00",
  color_values = "grey40",
  color_grid = "black",
  grid_density = 0.01,
  grid_spacing = 0.1,
  crosshatch_non_sig = TRUE,
  save = FALSE,
  folder = NULL
)
```

Arguments

x	model object (lm, glm, sienaFit, lmerMod, glmerMod) or NULL when supplying covar/coefs directly.
theta_1	character or numeric; name (lm/glm/lmerMod/glmerMod) or index (sienaFit) of the first variable.
theta_2	character or numeric; second variable.
theta_3	character or numeric; third variable. Default NULL (two-way).
theta_int_12	numeric; index of the theta_1:theta_2 interaction (sienaFit / generic only). For m/glm/lmerMod/glmerMod inputs the interaction name is resolved automatically.
theta_int_13	numeric; index of the theta_1:theta_3 interaction. Default NULL.
theta_int_23	numeric; index of the theta_2:theta_3 interaction. Default NULL.
theta_int_123	numeric; index of the three-way interaction. Default NULL.
theta_1_vals	numeric; evaluation range for theta_1. Auto-derived from model data for lm/glm/lmerMod/glmerMod if NULL.
theta_2_vals	numeric; evaluation range for theta_2.
theta_3_vals	numeric; evaluation range for theta_3. Default NULL.
covar	matrix; covariance matrix of the relevant parameters. Required only when x is NULL.
coefs	numeric; coefficient vector. Required only when x is NULL.
name	character; variable names. Required only when x is NULL.
group_var	character; ('lme4' only) grouping variable for random effects. Defaults to the first grouping factor.
fixed_only	logical; ('lme4' only) produce only fixed-effects plots? If FALSE, per-group plots are produced for groups with random interaction terms. Default TRUE.
control_fdr	logical; apply Bonferroni-Holm correction? Default FALSE.
alpha	numeric; significance level. Default 0.05.
round_res	integer; rounding precision. Default 3.
range_size	integer; number of moderator values. Default 1000 for two-way, 50 for three-way.
sig_color	character; significant region colour (2-way). Default 'seagreen3'.
non_sig_color	character; non-significant region colour (2-way). Default 'chocolate'.
line_color	character; line colour (2-way). Default 'black'.
color_mid	character; midpoint colour (3-way heatmap). Default '#EBCC2A'.
color_low	character; low-value colour. Default '#3B9AB2'.
color_high	character; high-value colour. Default '#F21A00'.
color_values	character; value label colour. Default 'grey40'.
color_grid	character; crosshatch colour. Default 'black'.
grid_density	numeric; crosshatch density. Default 0.01.

grid_spacing	numeric; crosshatch spacing. Default 0.1.
crosshatch_non_sig	logical; crosshatch non-significant cells? Default TRUE.
save	logical; save plots via ggsave()? Default FALSE.
folder	character; output folder for saved plots. Default NULL, which writes into a session-temporary directory (file.path(tempdir(), 'int3ract JNKplots')). Set explicitly to write elsewhere.

Value

A list containing tables and plots. For two-way interactions: param_table and plots. For three-way: thetas, standard_errors, p_values, significance, and plots. When fixed_only = FALSE ('lme4'), returns a list with fixed and random_groups elements.

Examples

```
# --- two-way lm ---
set.seed(1)
dat <- data.frame(y = rnorm(100), x = rnorm(100),
                  z = rnorm(100), w = rnorm(100))
res <- lm(y ~ x * z * w, dat)

x2 <- JNK_freq(res, theta_1 = 'x', theta_2 = 'z',
               range_size = 50)

# --- three-way lm (small grid for speed) ---
x3 <- JNK_freq(res, theta_1 = 'x', theta_2 = 'z', theta_3 = 'w',
               range_size = 10)

# --- generic (covariance + coefficients) ---
x2_gen <- JNK_freq(covar = vcov(res)[c('x','z','x:z'), c('x','z','x:z')],
                   coefs = coef(res)[c('x','z','x:z')],
                   name  = c('x', 'z'),
                   theta_1 = 'x',
                   theta_2 = 'z',
                   theta_1_vals = c(-3, 3),
                   theta_2_vals = c(-3, 3),
                   range_size = 50)
```

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