Package 'ncmR'

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Type Package

Title Fit Neutral Community Model to Microbiome or Ecological Data

Version 0.2.0

Description Provides tools for fitting the neutral community model (NCM) to assess the role of stochastic processes in community assembly. The package implements the framework of Sloan et al. (2006) <doi:10.1111/j.1462-2920.2005.00956.x>, enabling users to evaluate neutral dynamics in ecological and microbial communities.

License GPL (>= 3)

Encoding UTF-8

LazyData true

Depends R (>= 3.5)

Imports dplyr, ggplot2 (>= 4.0.0), ggtext, Hmisc, minpack.lm, showtext

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URL https://github.com/h-xuanjiu/ncmR

NeedsCompilation no

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Repository CRAN

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Contents

`example_data` *Example OTU table and grouping information for NCM demonstration*

Description

A simulated dataset containing an OTU table (ASV counts) and corresponding group labels. The data are intended to illustrate the usage of the `fit_ncm` function.

Usage

```
example_data
```

Format

A list with two components:

otu A data frame with 15 rows (samples) and 2000 columns (ASVs). Row names are sample identifiers, column names are ASV identifiers. Values represent counts of each ASV in each sample.

grp A data frame with 15 rows and 1 column named `group`. Row names correspond to the samples in `otu`. The `group` column contains character labels ("A", "A", ..., etc.) indicating group membership for each sample.

Source

Simulated data for package examples.

`fit_ncm` *Fit Neutral Community Model (NCM) with optional grouping and total pooling*

Description

Fit Neutral Community Model (NCM) with optional grouping and total pooling

Usage

```
fit_ncm(
  otu,
  grp = NULL,
  group_col = "group",
  groups = NULL,
  simplify = TRUE,
  return_model = FALSE,
  ...
)
```

Arguments

otu	OTU table, rows = samples, columns = species (data.frame or matrix)
grp	Optional data.frame with rownames = sample IDs, and one column specifying group membership. If NULL, all samples in otu are used as one group.
group_col	Column name in grp that contains group labels (default "group").
groups	Character vector of group names to analyze. If NULL and grp is provided, the function fits models for each group AND for all samples combined (total). If non-NULL, only those groups are analyzed (no total model).
simplify	If TRUE and only one model is fitted, return the model list directly (not nested).
return_model	Whether to return the nlsLM model object (default FALSE to save space).
...	Additional arguments passed to nlsLM (e.g., lower, upper, control).

Value

A list containing model results. If multiple models, a named list with keys: - "all" (if total model fitted) and group names. Each value is a list with: m, N, Nm, ci, rsqr, predictions, (model optional).

Examples

```
# Load example data
data(example_data)
otu <- example_data$otu
grp <- example_data$grp

# 1. No grouping: fit the total model using all samples
res_total <- fit_ncm(otu)
print(paste("m =", round(res_total$m, 4)))
print(paste("R^2 =", round(res_total$rsqr, 4)))
head(res_total$predictions)

# 2. With grouping: fit models for all groups + total
res_all <- fit_ncm(otu, grp)

# 3. Only specific groups (no total model), returns a single model object
res_sub <- fit_ncm(otu, grp, groups = "A")
res_sub$status_summary
```

---

ggsave_unicode *Save a ggplot with Unicode support using showtext*

Description

This function is a wrapper around `ggplot2::ggsave()` that temporarily activates the **showtext** graphics engine before saving. It ensures that Unicode characters (e.g., Chinese, special symbols) are rendered correctly in the saved file, regardless of the output format (vector or raster).

Usage

```
ggsave_unicode(plot, filename, ...)
```

Arguments

plot	The ggplot object to save (should be a unicode_ggplot or any ggplot object).
filename	File name to save the plot. Extension determines the format (e.g., .png, .pdf, .svg).
...	Additional arguments passed to ggplot2::ggsave(), such as width, height, dpi, units, etc.

Details

The function calls showtext::showtext_begin() before saving and ensures showtext::showtext_end() is called afterwards, even if an error occurs. It then passes all arguments to ggplot2::ggsave().

Value

Invisibly returns the filename (as ggsave does).

See Also

scatter_plot for creating plots that display correctly, print.unicode_ggplot for automatic display support.

Examples

```
## Not run:
p <- scatter_plot(...)
ggsave_unicode(p, "myplot.png", width = 6, height = 4, dpi = 300)

## End(Not run)
```

---

print.summary_ncm *Print summary of NCM model*

Description

Print summary of NCM model

Usage

```
## S3 method for class 'summary_ncm'
print(x, ...)
```

Arguments

x	An object of class "summary_ncm".
...	Additional arguments (not used).

Value

No return value, called for side effects. Prints a formatted table of NCM results to the console.

---

print.summary_ncm_group *Print summary of NCM group results*

Description

Print summary of NCM group results

Usage

```
## S3 method for class 'summary_ncm_group'
print(x, ...)
```

Arguments

x	An object of class "summary_ncm_group".
...	Additional arguments (not used).

Value

No return value, called for side effects. Prints a formatted table of NCM group results to the console.

---

print.unicode_ggplot *Print a unicode_ggplot object with automatic showtext support*

Description

This method temporarily activates the **showtext** graphics engine to ensure that Unicode characters (e.g., Chinese, special symbols) are rendered correctly when the plot is displayed. After printing, the original graphics device state is restored.

Usage

```
## S3 method for class 'unicode_ggplot'
print(x, ...)
```

Arguments

x	A unicode_ggplot object (a ggplot with an extra class).
...	Additional arguments passed to the next print method (e.g., to print.ggplot).

Details

The method calls showtext::showtext_begin(), then uses NextMethod() to invoke the original print.ggplot method, which actually draws the plot. Finally, showtext::showtext_end() is called to restore the device. This all happens automatically when a unicode_ggplot object is printed (e.g., when its name is typed at the console or when print() is explicitly called).

Value

The input object x, returned invisibly.

See Also

scatter_plot for creating such objects, ggsave_unicode for saving them with Unicode support.

Examples

```
## Not run:
p <- scatter_plot(...)   # returns a unicode_ggplot object
p                            # automatically uses this print method

## End(Not run)
```

---

scatter_plot *Scatter plot for NCM results and data frames*

Description

Generic function for creating scatter plots. Methods available for NCM result objects and data frames.

Usage

```
scatter_plot(object, ...)

## S3 method for class 'NCM'
scatter_plot(
  object,
  point_alpha = 0.8,
  point_size = 3,
  point_colors = c(Above = "#ED7D70", Below = "#2B889B", Neutral = "#B57FAF"),
  fit_line_color = "#335399",
```

```
  fit_line_type = "solid",
  fit_line_size = 1,
  ci_line_color = "#335399",
  ci_line_type = "dashed",
  ci_line_size = 1,
  axis_title_x_text = "Mean relative abundance (log10)",
  axis_title_y_text = "Frequency of occupancy",
  axis_title_x_size = 25,
  axis_title_y_size = 25,
  axis_text_x_size = 20,
  axis_text_y_size = 20,
  legend_title_text = NA,
  legend_size = 6,
  legend_position = c(0.8, 0.4),
  legend_hjust = 0,
  legend_vjust = 1,
  fit_para_size = 6,
  fit_para_position = c(0.02, 0.98),
  fit_para_hjust = 0,
  fit_para_vjust = 1,
  font_family = "sans",
  ...
)

## S3 method for class 'data.frame'
scatter_plot(
  object,
  rsqr,
  Nm,
  m,
  map,
  point_alpha = 0.8,
  point_size = 3,
  point_colors = c(Above = "#ED7D70", Below = "#2B889B", Neutral = "#B57FAF"),
  fit_line_color = "#335399",
  fit_line_type = "solid",
  fit_line_size = 1,
  ci_line_color = "#335399",
  ci_line_type = "dashed",
  ci_line_size = 1,
  axis_title_x_text = "Mean relative abundance (log10)",
  axis_title_y_text = "Frequency of occupancy",
  axis_title_x_size = 25,
  axis_title_y_size = 25,
  axis_text_x_size = 20,
  axis_text_y_size = 20,
  legend_title_text = NA,
  legend_size = 6,
```

```
  legend_position = c(0.8, 0.4),
  legend_hjust = 0,
  legend_vjust = 1,
  fit_para_size = 6,
  fit_para_position = c(0.02, 0.98),
  fit_para_hjust = 0,
  fit_para_vjust = 1,
  font_family = "sans",
  ...
)

## Default S3 method:
scatter_plot(object, ...)
```

Arguments

object	An object to plot: NCM result or data.frame
...	Additional arguments passed to methods
point_alpha	Alpha transparency for points (default: 0.8)
point_size	Point size (default: 3)
point_colors	Named vector of colors for Above/Below/Neutral status
fit_line_color	Fitted line color (default: "#335399")
fit_line_type	Line type for fitted curve (default: "solid")
fit_line_size	Line width for fitted curve (default: 1)
ci_line_color	Confidence interval line color (default: "#335399")
ci_line_type	Confidence interval line type (default: "dashed")
ci_line_size	Confidence interval line width (default: 1)
axis_title_x_text	X-axis title text
axis_title_y_text	Y-axis title text
axis_title_x_size	X-axis title font size (default: 25)
axis_title_y_size	Y-axis title font size (default: 25)
axis_text_x_size	X-axis tick label font size (default: 20)
axis_text_y_size	Y-axis tick label font size (default: 20)
legend_title_text	Legend title text (default: NA)
legend_size	Legend text size (default: 6)
legend_position	Legend position as NPC coordinates c(x, y) (default: c(0.80, 0.40))

legend_hjust	Legend horizontal justification (default: 0)
legend_vjust	Legend vertical justification (default: 1)
fit_para_size	Fitting parameter text size (default: 6)
fit_para_position	Parameter annotation position as NPC coordinates c(x, y) (default: c(0.02, 0.98))
fit_para_hjust	Parameter horizontal justification (default: 0)
fit_para_vjust	Parameter vertical justification (default: 1)
font_family	Font family (default: "sans")
rsqr	R-squared value from NCM fit
Nm	Nm parameter from NCM fit
m	m parameter from NCM fit
map	Named vector for column name mapping (e.g., c(p = "abundance"))

Value

A ggplot object

Methods (by class)

- `scatter_plot(NCM)`: Plot NCM result with fitted curve, confidence intervals, and parameter annotations. Supports full customization of visual elements.
- `scatter_plot(data.frame)`: Plot data.frame by converting to NCM object. Requires manual specification of model parameters (rsqr, Nm, m) and optional column name mapping.
- `scatter_plot(default)`: Default method for unsupported types.

Examples

```
# Load example data
data(example_data)
otu <- example_data$otu

# fit the total model using all samples
res_total <- fit_ncm(otu)

# plot
scatter_plot(res_total)

# Load example data
data(example_data)
otu <- example_data$otu

# fit the total model using all samples
res_total <- fit_ncm(otu)

df <- res_total$predictions

# Plot with manual parameters
scatter_plot(df, rsqr = 0.95, Nm = 500, m = 0.5678)
```

summary.NCM *Summary method for NCM objects*

Description

Summary method for NCM objects

Usage

```
## S3 method for class 'NCM'
summary(object, ...)
```

Arguments

object	An object of class "NCM" (single model).
...	Additional arguments (not used).

Value

An object of class "summary_ncm" containing key model statistics.

summary.NCM_group *Summary method for NCM group results*

Description

Summary method for NCM group results

Usage

```
## S3 method for class 'NCM_group'
summary(object, ...)
```

Arguments

object	An object of class "NCM_group" (list of NCM objects).
...	Additional arguments (not used).

Value

An object of class "summary_ncm_group" containing summary for each group.

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