Package 'mtscr'

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Type Package

Title Multidimensional Top Scoring for Creativity Research

Version 1.0.2

Description Implementation of Multidimensional Top Scoring method for creativity assessment proposed in Boris Forthmann, Maciej Karwowski, Roger E. Beaty (2023) <doi:10.1037/aca0000571>.

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URL https://github.com/jakub-jedrusiak/mtscr

BugReports https://github.com/jakub-jedrusiak/mtscr/issues

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Depends R (>= 4.1.0)

Imports broom.mixed, cli, dplyr (>= 1.1.0), glmmTMB, glue, lifecycle, methods, purrr, readr, rlang (>= 0.4.11), stringr, tibble

Suggests shiny, covr, datamods, DT, roxygen2, shinyWidgets, testthat (>= 3.0.0), withr, writexl

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Contents

`mtscr_app`	*Shiny GUI for mtscr*

Description

Shiny app used as graphical interface for mtscr. Simply invoke `mtscr_app()` to run.

Usage

```
mtscr_app()
```

Details

To use the GUI you need to have the following packages installed: `DT`, `broom.mixed`, `datamods`, `writexl`.

First thing you see after running the app is `datamods` window for importing your data. You can use the data already loaded in your environment or any other option. Then you'll see four dropdown lists used to choose arguments for `mtscr_model()` and `mtscr_score()` functions. Consult these functions' documentation for more details (execute `?mtscr_score` in the console). When the parameters are chosen, click "Generate model" button. After a while (up to a dozen or so seconds) models' parameters and are shown along with a scored dataframe.

You can download your data as a .csv or an .xlsx file using buttons in the sidebar. You can either download the scores only (i.e. the dataframe you see displayed) or your whole data with `.all_max` and `.all_top2` columns added.

For testing purposes, you may use `mtscr_creativity` dataframe. In the importing window change "Global Environment" to "mtscr" and our dataframe should appear in the upper dropdown list. Use `id` for the ID column, `item` for the item column and `SemDis_MEAN` for the score column.

Value

Runs the app. No explicit return value.

See Also

mtscr_score() for more information on the arguments.

mtscr_creativity for more information about the example dataset.

Forthmann, B., Karwowski, M., & Beaty, R. E. (2023). Don't throw the "bad" ideas away! Multi-dimensional top scoring increases reliability of divergent thinking tasks. Psychology of Aesthetics, Creativity, and the Arts. doi:10.1037/aca0000571

Examples

```
if(interactive()){
mtscr_app()
}
```

| mtscr_creativity | *Creativity assessment through semantic distance dataset* |

Description

A dataset from Forthmann, Karwowski & Beaty (2023) paper. It contains a set of responses in Alternative Uses Task for different items with their semantic distance assessment.

Usage

```
mtscr_creativity
```

Format

mtscr_creativity:

A tibble with 4585 rows and 10 columns:

id patricipant's unique identification number

response response in AUT

item item for which alternative uses were searched for

SemDis_MEAN mean semantic distance

Value

a tibble

Source

https://osf.io/7rgsp/

References

doi:10.1037/aca0000571

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mtscr_model   *Create MTS model*

Description

Create MTS model for creativity analysis.

Usage

```
mtscr_model(
  df,
  id_column,
  item_column = NULL,
  score_column,
  top = 1,
  prepared = FALSE,
  ties_method = c("random", "average"),
  normalise = TRUE,
  self_ranking = NULL
)
```

Arguments

df	Data frame in long format.
id_column	Name of the column containing participants' id.
item_column	Optional, name of the column containing distinct trials (e.g. names of items in AUT).
score_column	Name of the column containing divergent thinking scores (e.g. semantic distance).
top	Integer or vector of integers (see examples), number of top answers to include in the model. Default is 1, i.e. only the top answer.
prepared	Logical, is the data already prepared with mtscr_prepare()?
ties_method	Character string specifying how ties are treated when ordering. Can be "average" (better for continuous scores like semantic distance) or "random" (default, better for ratings). See [rank()](#) for details.
normalise	Logical, should the creativity score be normalised? Default is TRUE and it's recommended to leave it as such.
self_ranking	Name of the column containing answers' self-ranking. Provide if model should be based on top answers self-chosen by the participant. Every item should have its own ranks. The top answers should have a value of 1, and the other answers should have a value of 0. In that case, the top argument doesn't change anything and should be left as top = 1. ties_method is not used if self_ranking was provided. See [mtscr_self_rank](#) for example.

Value

The return value depends on length of the `top` argument. If `top` is a single integer, a `glmmTMB` model is returned. If `top` is a vector of integers, a list of `glmmTMB` models is returned, with names corresponding to the `top` values, e.g. `top1`, `top2`, etc.

Examples

```
data("mtscr_creativity", package = "mtscr")

mtscr_creativity <- mtscr_creativity |>
  dplyr::slice_sample(n = 300) # for performance, ignore

mtscr_model(mtscr_creativity, id, item, SemDis_MEAN) |>
  summary()

# three models for top 1, 2, and 3 answers
mtscr_model(mtscr_creativity, id, item, SemDis_MEAN, top = 1:3) |>
  mtscr_model_summary()

# you can prepare data first
data <- mtscr_prepare(mtscr_creativity, id, item, SemDis_MEAN)
mtscr_model(data, id, item, SemDis_MEAN, prepared = TRUE)

# extract effects for creativity score by hand
model <- mtscr_model(mtscr_creativity, id, item, SemDis_MEAN, top = 1)
creativity_score <- glmmTMB::ranef(model)$cond$id[, 1]
```

---

mtscr_model_summary   *Summarise a model*

Description

Summarise a model generated with mtscr_model with some basic statistics; calculate the empirical reliability and the first difference of the empirical reliability.

Usage

```
mtscr_model_summary(model)
```

Arguments

model   A model generated with mtscr_model. Can be a list of models.

Value

A data frame with the following columns:

model The model number

nobs Number of observations

sigma The square root of the estimated residual variance

logLik The log-likelihood of the model

AIC The Akaike information criterion

BIC The Bayesian information criterion

df.residual The residual degrees of freedom

emp_rel The empirical reliability

FDI The first difference of the empirical reliability

Examples

```
data("mtscr_creativity", package = "mtscr")
mtscr_model(mtscr_creativity, id, item, SemDis_MEAN, top = 1:3) |>
  mtscr_model_summary()
```

---

mtscr_prepare   *Prepare database for MTS*

Description

Prepare database for MTS analysis.

Usage

```
mtscr_prepare(
  df,
  id_column,
  item_column = NULL,
  score_column,
  top = 1,
  minimal = FALSE,
  ties_method = c("random", "average"),
  normalise = TRUE,
  self_ranking = NULL
)
```

Arguments

df	Data frame in long format.
id_column	Name of the column containing participants' id.
item_column	Optional, name of the column containing distinct trials (e.g. names of items in AUT).
score_column	Name of the column containing divergent thinking scores (e.g. semantic distance).
top	Integer or vector of integers (see examples), number of top answers to prepare indicators for. Default is 1, i.e. only the top answer.

minimal	Logical, append columns to df (FALSE) or return only id, item, and the new columns (TRUE).
ties_method	Character string specifying how ties are treated when ordering. Can be "average" (better for continuous scores like semantic distance) or "random" (default, better for ratings). See [rank()](#) for details.
normalise	Logical, should the creativity score be normalised? Default is TRUE and it's recommended to leave it as such.
self_ranking	Name of the column containing answers' self-ranking. Provide if model should be based on top answers self-chosen by the participant. Every item should have its own ranks. The top answers should have a value of 1, and the other answers should have a value of 0. In that case, the top argument doesn't change anything and should be left as top = 1. ties_method is not used if self_ranking was provided. See [mtscr_self_rank](#) for example.

Value

The input data frame with additional columns:

`.z_score` Numerical, z-score of the creativity score

`.ordering` Numerical, ranking of the answer relative to participant and item

`.ordering_topX` Numerical, 0 for *X* top answers, otherwise value of `.ordering`

Number of `.ordering_topX` columns depends on the top argument. If minimal = TRUE, only the new columns and the item and id columns are returned. The values are relative to the participant AND item, so the values for different participants scored for different tasks (e.g. uses for "brick" and "can") are distinct.

Examples

```
data("mtscr_creativity", package = "mtscr")
# Indicators for top 1 and top 2 answers
mtscr_prepare(mtscr_creativity, id, item, SemDis_MEAN, top = 1:2, minimal = TRUE)
```

---

mtscr_score	*Score creativity with MTS*

Description

Score creativity with MTS

Usage

```
mtscr_score(
  df,
  id_column,
  item_column = NULL,
  score_column,
```

```
  top = 1,
  format = c("minimal", "full"),
  ties_method = c("random", "average"),
  normalise = TRUE,
  self_ranking = NULL
)
```

Arguments

df	Data frame in long format.
id_column	Name of the column containing participants' id.
item_column	Optional, name of the column containing distinct trials (e.g. names of items in AUT).
score_column	Name of the column containing divergent thinking scores (e.g. semantic distance).
top	Integer or vector of integers (see examples), number of top answers to prepare indicators for. Default is 1, i.e. only the top answer.
format	Character, controls the format of the output data frame. Accepts:
	"minimal" default, returns only the creativity scores and id columns.
	"full" returns the original data frame with creativity scores columns added.
ties_method	Character string specifying how ties are treated when ordering. Can be "average" (better for continuous scores like semantic distance) or "random" (default, better for ratings). See [rank()](#) for details.
normalise	Logical, should the creativity score be normalised? Default is TRUE and it's recommended to leave it as such.
self_ranking	Name of the column containing answers' self-ranking. Provide if model should be based on top answers self-chosen by the participant. Every item should have its own ranks. The top answers should have a value of 1, and the other answers should have a value of 0. In that case, the top argument doesn't change anything and should be left as top = 1. ties_method is not used if self_ranking was provided. See [mtscr_self_rank](#) for example.

Value

A tibble with creativity scores. If format = "full", the original data frame is returned with scores columns added. Otherwise, only the scores and id columns are returned. number of creativity scores columns (e.g. creativity_score_top2) depends on the top argument.

See Also

[tidyr::pivot_wider()](#) for converting the output to wide format by yourself.

Examples

```
data("mtscr_creativity", package = "mtscr")
mtscr_score(mtscr_creativity, id, item, SemDis_MEAN, top = 1:2)
```

```
# add scores to the original data frame
mtscr_score(mtscr_creativity, id, item, SemDis_MEAN, format = "full")

# use self-chosen best answers
data("mtscr_self_rank", package = "mtscr")
mtscr_score(mtscr_self_rank, subject, task, avr, self_ranking = top_two)
```

---

mtscr_self_rank *Self-chosen best answers*

Description

An example dataset with best answers self-chosen by the participant. Use with `self_ranking` argument in [mtscr_model](#).

Usage

```
mtscr_self_rank
```

Format

mtscr_self_rank:

A tibble with 3225 rows and 4 columns:

subject patricipant's unique identification number

task divergent thinking task number

avr average judges' raiting

top_two indicator of self-chosen two best answer; 1 if chosen, 0 if not

Source

https://osf.io/7rgsp/

References

doi:10.1037/aca0000571

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