

Package ‘citestR’

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Title Conditional Independence of Missingness Test

Version 0.1.1

Description Tests whether missingness in explanatory variables is conditionally independent of the outcome, given observed data. Uses multiply-imputed datasets and cross-validated classifiers to produce a test statistic and p-value, with a sensitivity parameter (κ) for calibrating interpretation. Wraps the 'citest' Python engine via a local 'FastAPI' server over 'HTTP', so no 'reticulate' dependency is needed at runtime.

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URL <https://github.com/midasverse/citest>

BugReports <https://github.com/midasverse/citest/issues>

Depends R (>= 4.1.0)

Encoding UTF-8

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calibration_pivot	<i>Generate a calibration pivot table</i>
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Description

Rows are R-squared values, columns are gamma_x values, for a fixed beta_yx.

Usage

```
calibration_pivot(
  beta_yx = 0.3,
  r2_grid = NULL,
  beta_grid = NULL,
  gamma_grid = NULL,
  ...
)
```

Arguments

beta_yx	Numeric. Fixed beta_yx value (default 0.3).
r2_grid	Numeric vector, or NULL.
beta_grid	Numeric vector, or NULL.
gamma_grid	Numeric vector, or NULL.
...	Arguments forwarded to ensure_server() .

Value

A data frame (pivot table).

Examples

```
calibration_pivot(beta_yx = 0.3)
```

ci_test

Run the conditional independence test

Description

All-in-one convenience function: creates a dataset on the server, builds a CIMissTest, runs it, and returns the results.

Usage

```
ci_test(  
  data,  
  y,  
  expl_vars = NULL,  
  onehot = TRUE,  
  imputer = "midas",  
  classifier = "rf",  
  m = 10L,  
  n_folds = 10L,  
  classifier_args = list(),  
  imputer_args = list(),  
  random_state = 42L,  
  target_level = "variable",  
  variance_method = "mi_crossfit",  
  subsample_cap = 2000L,  
  ...  
)
```

Arguments

data	A data frame (may contain NA).
y	Character. Name of the outcome variable.
expl_vars	Character vector of explanatory variable names, or NULL.
onehot	Logical. One-hot encode categoricals (default TRUE).
imputer	Character. Imputer backend: "midas" (default), "iterative", "iterative2", "complete", or "null".
classifier	Character. Classifier backend: "rf" (default), "et", or "logistic".

m	Integer. Number of multiply-imputed datasets (default 10).
n_folds	Integer. Number of cross-validation folds (default 10).
classifier_args	Named list of extra classifier arguments.
imputer_args	Named list of extra imputer arguments.
random_state	Integer. Random seed (default 42).
target_level	Character. "variable" or "column".
variance_method	Character. "mi_crossfit" or "legacy_fold".
subsample_cap	Integer or NULL. Maximum rows to subsample.
...	Arguments forwarded to <code>ensure_server()</code> .

Value

A list with elements `model_id`, `dataset_id`, and `results`. The `results` element contains `m`, `B`, `W_bar`, `T`, `t_k`, `p_k`, `p_2s`, and optionally `df`.

Examples

```
df <- data.frame(Y = rnorm(200), X1 = rnorm(200), X2 = rnorm(200))
df$X1[sample(200, 20)] <- NA
result <- ci_test(df, y = "Y")
result$results$p_2s
```

compute_kappa

Compute theoretical imputation bias kappa

Description

Compute theoretical imputation bias kappa

Usage

```
compute_kappa(r2_x_z, beta_yx, gamma_x, ...)
```

Arguments

r2_x_z	Numeric. R-squared of X on observed covariates Z.
beta_yx	Numeric. Coefficient of X in the Y equation.
gamma_x	Numeric. Loading of X in the missingness equation.
...	Arguments forwarded to <code>ensure_server()</code> .

Value

A single numeric value (kappa).

Examples

```
compute_kappa(r2_x_z = 0.5, beta_yx = 0.3, gamma_x = 0.2)
```

ensure_server	<i>Ensure the server is running</i>
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Description

Starts the server if it is not already running. Called internally by every client function so users never have to manage the server manually.

Usage

```
ensure_server(...)
```

Arguments

... Arguments forwarded to [start_server\(\)](#).

Value

Invisibly returns the base URL of the running server.

Examples

```
ensure_server()
```

get_summary	<i>Get a summary of test results</i>
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Description

Retrieves a structured summary for a previously fitted model.

Usage

```
get_summary(model_id, ...)
```

Arguments

model_id Character. UUID returned by [ci_test\(\)](#).
... Arguments forwarded to [ensure_server\(\)](#).

Value

A list with elements `outcome`, `imputer`, `classifier`, `variance_method`, `mean_difference`, `t_statistic`, `df`, `p_value`, and `p_value_two_sided`.

Examples

```
result <- ci_test(df, y = "Y")
get_summary(result$model_id)
```

<code>has_server</code>	<i>Check whether the citest server is running</i>
-------------------------	---

Description

Returns TRUE if the package's background server process is alive. Used as the guard for `@examplesIf` so that examples requiring the Python backend are skipped when no server is available.

Usage

```
has_server()
```

Value

Logical.

<code>imputer_r2</code>	<i>Estimate imputer out-of-sample R-squared</i>
-------------------------	---

Description

Runs a mask-and-impute diagnostic on the server.

Usage

```
imputer_r2(model_id, mask_frac = 0.2, m_eval = 1L, ...)
```

Arguments

<code>model_id</code>	Character. UUID returned by <code>ci_test()</code> .
<code>mask_frac</code>	Numeric. Fraction of observed cells to hold out (default 0.2).
<code>m_eval</code>	Integer. Number of imputations to average over (default 1).
<code>...</code>	Arguments forwarded to <code>ensure_server()</code> .

Value

A list with `mean_r2` and `per_variable` (named numeric vector).

Examples

```
result <- ci_test(df, y = "Y")
imputer_r2(result$model_id)
```

install_backend	<i>Install the citest Python backend</i>
-----------------	--

Description

Creates an isolated Python environment and installs the `midasverse-citest-api` package (which pulls in `midasverse-citest` as a dependency).

Usage

```
install_backend(  
  method = c("pip", "conda", "uv"),  
  envname = "citest_env",  
  package = "midasverse-citest-api"  
)
```

Arguments

<code>method</code>	Character. One of "pip", "conda", or "uv".
<code>envname</code>	Character. Name of the virtual environment to create (default "citest_env").
<code>package</code>	Character. Package specifier to install (default "midasverse-citest-api").

Details

This is the **only** function in the package that uses `reticulate`, and only for environment creation. It is never used at runtime.

Value

No return value, called for side effects.

Examples

```
install_backend()  
install_backend(method = "conda")
```

`kappa_calibration_table`*Generate a kappa calibration table*

Description

Generate a kappa calibration table

Usage

```
kappa_calibration_table(  
  r2_grid = NULL,  
  beta_grid = NULL,  
  gamma_grid = NULL,  
  ...  
)
```

Arguments

<code>r2_grid</code>	Numeric vector of R-squared values, or NULL for defaults.
<code>beta_grid</code>	Numeric vector of beta values, or NULL for defaults.
<code>gamma_grid</code>	Numeric vector of gamma values, or NULL for defaults.
<code>...</code>	Arguments forwarded to ensure_server() .

Value

A data frame with columns `r2_x_z`, `beta_yx`, `gamma_x`, `kappa`, `abs_kappa`.

Examples

```
kappa_calibration_table(r2_grid = c(0.3, 0.5, 0.7))
```

`make_dataset`*Create a dataset on the server*

Description

Sends a data frame to the citest API server and creates a Dataset object.

Usage

```
make_dataset(data, y, expl_vars = NULL, onehot = TRUE, ...)
```

Arguments

data	A data frame (may contain NA for missing values).
y	Character. Name of the outcome variable.
expl_vars	Character vector of explanatory variable names, or NULL for all non-outcome columns.
onehot	Logical. One-hot encode categorical columns (default TRUE).
...	Arguments forwarded to ensure_server() .

Value

A list with elements dataset_id, n, columns, y_name, expl_vars, and pct_missing.

Examples

```
df <- data.frame(Y = rnorm(100), X1 = rnorm(100))
ds <- make_dataset(df, y = "Y")
ds$dataset_id
```

make_dataset_parquet *Create a dataset from a Parquet file*

Description

Uploads a Parquet file to the citest API server.

Usage

```
make_dataset_parquet(file, y, expl_vars = NULL, onehot = TRUE, ...)
```

Arguments

file	Path to a .parquet file.
y	Character. Name of the outcome variable.
expl_vars	Character vector of explanatory variable names, or NULL.
onehot	Logical. One-hot encode categorical columns (default TRUE).
...	Arguments forwarded to ensure_server() .

Value

A list with elements dataset_id, n, columns, y_name, expl_vars, and pct_missing.

Examples

```
ds <- make_dataset_parquet("data.parquet", y = "Y")
```

print.citest_result *Print a citest result*

Description

Displays a concise summary of the conditional independence test result, including the test statistic, degrees of freedom, p-value, and a plain language interpretation.

Usage

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

Arguments

x A citest_result object returned by `ci_test()`.
... Additional arguments (currently ignored).

Value

Invisibly returns x.

Examples

```
result <- structure(list(  
  model_id = "example-id",  
  dataset_id = "example-ds",  
  results = list(m = 0.12, t_k = 2.5, df = 9, p_2s = 0.034)  
) , class = "citest_result")  
print(result)
```

print.citest_summary *Print a citest summary*

Description

Displays a formatted summary of a fitted conditional independence test, including model configuration and key results.

Usage

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

Arguments

x A citest_summary object returned by `get_summary()`.
... Additional arguments (currently ignored).

Value

Invisibly returns x.

Examples

```
smry <- structure(list(
  outcome = "Y",
  imputer = "midas",
  classifier = "rf",
  variance_method = "mi_crossfit",
  mean_difference = 0.12,
  t_statistic = 2.5,
  df = 9,
  p_value_two_sided = 0.034
), class = "citest_summary")
print(smry)
```

simulate_data

Generate a simulated dataset

Description

Calls one of the built-in data-generating processes on the Python server.

Usage

```
simulate_data(
  dgp,
  n = 1000L,
  ci = TRUE,
  missing_mech = "linear",
  beta_y = NULL,
  mcar_prop = NULL,
  k = NULL,
  ...
)
```

Arguments

dgp	Character. Name of the DGP (e.g. "single_mar", "adult").
n	Integer. Number of observations.
ci	Logical. Conditional independence holds (TRUE) or not.
missing_mech	Character. Missingness mechanism ("linear" or "xor").
beta_y	Numeric or NULL. Outcome effect size (for DGPs that use it).
mcar_prop	Numeric or NULL. Proportion of MCAR missingness.
k	Integer or NULL. Number of columns (for the adult DGP).
...	Arguments forwarded to ensure_server() .

Value

A list with dataset_id, n, columns, pct_missing.

Examples

```
sim <- simulate_data("single_mar", n = 500, ci = TRUE)
```

start_server	<i>Start the citest API server</i>
--------------	------------------------------------

Description

Launches `python -m citest_api` as a background process and waits for the `/health` endpoint to respond.

Usage

```
start_server(python = "python3", port = NULL, venv = NULL, max_wait = 120L)
```

Arguments

python	Path to the Python interpreter (default "python3").
port	Port to bind to. If NULL, a free port is chosen automatically.
venv	Path to a Python virtual environment. If supplied, the interpreter is taken from <code><venv>/bin/python</code> (or <code><venv>/Scripts/python.exe</code> on Windows).
max_wait	Maximum number of 0.5-second polling attempts (default 120, i.e. 60 seconds). The first launch may be slower due to Python import caching.

Value

Invisibly returns the port number.

Examples

```
start_server()
start_server(venv = "~/virtualenvs/citest_env")
```

stop_server	<i>Stop the citest API server</i>
-------------	-----------------------------------

Description

Kills the background Python process and clears the internal state.

Usage

```
stop_server()
```

Value

No return value, called for side effects.

Examples

```
stop_server()
```

uninstall_backend	<i>Uninstall the citest Python backend</i>
-------------------	--

Description

Stops the running server (if any), removes the Python environment created by [install_backend\(\)](#), and clears the saved configuration.

Usage

```
uninstall_backend(method = c("pip", "conda", "uv"), envname = "citest_env")
```

Arguments

method	Character. One of "pip", "conda", or "uv". Must match the method used during installation.
envname	Character. Name of the virtual environment to remove (default "citest_env").

Value

No return value, called for side effects.

Examples

```
uninstall_backend()
uninstall_backend(method = "conda")
```

update_backend	<i>Update the citest Python backend</i>
----------------	---

Description

Upgrades the midasverse-citest-api package (and its dependencies) in the existing Python environment. Stops the running server first so that the new version is loaded on next use.

Usage

```
update_backend(
  method = c("pip", "conda", "uv"),
  envname = "citest_env",
  package = "midasverse-citest-api"
)
```

Arguments

method	Character. One of "pip", "conda", or "uv". Must match the method used during installation.
envname	Character. Name of the virtual environment (default "citest_env").
package	Character. Package specifier to upgrade (default "midasverse-citest-api").

Value

No return value, called for side effects.

Examples

```
update_backend()
```

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