

Package ‘raveio’

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Type Package

Title File-System Toolbox for RAVE Project

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Language en-US

Description Includes multiple cross-platform read/write interfaces for 'RAVE' project. 'RAVE' stands for ``R analysis and visualization of human intracranial electroencephalography data". The whole project aims at providing powerful free-source package that analyze brain recordings from patients with electrodes placed on the cortical surface or inserted into the brain. 'raveio' as part of this project provides tools to read/write neurophysiology data from/to 'RAVE' file structure, as well as several popular formats including 'EDF(+)', 'Matlab', 'BIDS-iEEG', and 'HDF5', etc. Documentation and examples about 'RAVE' project are provided at <https://openwetware.org/wiki/RAVE>, and the paper by John F. Magnotti, Zhengjia Wang, Michael S. Beauchamp (2020) [doi:10.1016/j.neuroimage.2020.117341](https://doi.org/10.1016/j.neuroimage.2020.117341); see 'citation(`raveio")' for details.

BugReports <https://github.com/beauchamplab/raveio/issues>

URL <https://beauchamplab.github.io/raveio/>

License GPL-3

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ants_coreg	<i>Register 'CT' or 'MR' images via 'ANTs'</i>
------------	--

Description

ants_coreg aligns 'CT' to 'MR' images; ants_mri_to_template aligns native 'MR' images to group templates

Usage

```
ants_coreg(
  ct_path,
  mri_path,
  coreg_path = NULL,
  reg_type = c("DenseRigid", "Rigid", "SyN", "Affine", "TRSAA", "SyNCC", "SyNOnly"),
  aff_metric = c("mattes", "meansquares", "GC"),
  syn_metric = c("mattes", "meansquares", "demons", "CC"),
  verbose = TRUE,
  ...
)

cmd_run_ants_coreg(
  subject,
  ct_path,
  mri_path,
  reg_type = c("DenseRigid", "Rigid", "SyN", "Affine", "TRSAA", "SyNCC", "SyNOnly"),
  aff_metric = c("mattes", "meansquares", "GC"),
  syn_metric = c("mattes", "meansquares", "demons", "CC"),
  verbose = TRUE,
  dry_run = FALSE
)

ants_mri_to_template(
  subject,
  template_subject = getOption("threeBrain.template_subject", "N27"),
  preview = FALSE,
  verbose = TRUE,
```

```

    ...
)

cmd_run_ants_mri_to_template(
  subject,
  template_subject = getOption("threeBrain.template_subject", "N27"),
  verbose = TRUE,
  dry_run = FALSE
)

ants_morph_electrode(subject, preview = FALSE, dry_run = FALSE)

```

Arguments

ct_path, mri_path	absolute paths to 'CT' and 'MR' image files
coreg_path	registration path, where to save results; default is the parent folder of ct_path
reg_type	registration type, choices are 'DenseRigid', 'Rigid', 'Affine', 'SyN', 'TRSAA', 'SyNCC', 'SyNOnly', or other types; see ants_registration
aff_metric	cost function to use for linear or 'affine' transform
syn_metric	cost function to use for 'SyN' transform
verbose	whether to verbose command; default is true
...	other arguments passed to ants_registration
subject	'RAVE' subject
dry_run	whether to dry-run the script and to print out the command instead of executing the code; default is false
template_subject	template to map 'MR' images
preview	whether to preview results; default is false

Value

Aligned 'CT' will be generated at the coreg_path path:

- 'ct_in_t1.nii.gz' aligned 'CT' image; the image is also re-sampled into 'MRI' space
- 'transform.yaml' transform settings and outputs
- 'CT_IJK_to_MR_RAS.txt' transform matrix from volume 'IJK' space in the original 'CT' to the 'RAS' anatomical coordinate in 'MR' scanner; 'affine' transforms only
- 'CT_RAS_to_MR_RAS.txt' transform matrix from scanner 'RAS' space in the original 'CT' to 'RAS' in 'MR' scanner space; 'affine' transforms only

as_rave_project *Convert character to [RAVEProject](#) instance*

Description

Convert character to [RAVEProject](#) instance

Usage

```
as_rave_project(project, ...)
```

Arguments

project	character project name
...	passed to other methods

Value

A [RAVEProject](#) instance

See Also

[RAVEProject](#)

as_rave_subject *Get [RAVESubject](#) instance from character*

Description

Get [RAVESubject](#) instance from character

Usage

```
as_rave_subject(subject_id, strict = TRUE, reload = TRUE)
```

Arguments

subject_id	character in format "project/subject"
strict	whether to check if subject directories exist or not
reload	whether to reload (update) subject information, default is true

Value

[RAVESubject](#) instance

See Also

[RAVESubject](#)

as_rave_unit	<i>Convert numeric number into print-friendly format</i>
--------------	--

Description

Convert numeric number into print-friendly format

Usage

```
as_rave_unit(x, unit, label = "")
```

Arguments

x	numeric or numeric vector
unit	the unit of x
label	prefix when printing x

Value

Still numeric, but print-friendly class

Examples

```
sp <- as_rave_unit(1024, 'GB', 'Hard-disk space is ')
print(sp, digits = 0)

sp - 12

as.character(sp)

as.numeric(sp)

# Vectorize
sp <- as_rave_unit(c(500,200), 'MB/s', c('Writing: ', 'Reading: '))
print(sp, digits = 0, collapse = '\n')
```

auto_process_blackrock

Monitors 'BlackRock' output folder and automatically import data into 'RAVE'

Description

Automatically import 'BlackRock' files from designated folder and perform 'Notch' filters, 'Wavelet' transform; also generate epoch, reference files.

Usage

```

auto_process_blackrock(
  watch_path,
  project_name = "automated",
  task_name = "RAVEWatchDog",
  scan_interval = 10,
  time_threshold = Sys.time(),
  max_jobs = 1L,
  as_job = NA,
  dry_run = FALSE,
  config_open = dry_run
)

```

Arguments

watch_path	the folder to watch
project_name	the project name to generate
task_name	the watcher's name
scan_interval	scan the directory every scan_interval seconds, cannot be lower than 1
time_threshold	time-threshold of files: all files with modified time prior to this threshold will be ignored; default is current time
max_jobs	maximum concurrent imports, default is 1
as_job	whether to run in 'RStudio' background job or to block the session when monitoring; default is auto-detected
dry_run	whether to dry-run the code (instead of executing the scripts, return the watcher's instance and open the settings file); default is false
config_open	whether to open the pipeline configuration file; default is equal to dry_run

Value

When `dry_run` is true, then the watcher's instance will be returned; otherwise nothing will be returned.

backup_file	<i>Back up and rename the file or directory</i>
-------------	---

Description

Back up and rename the file or directory

Usage

```

backup_file(path, remove = FALSE, quiet = FALSE)

```


Arguments

path path to a file or a directory
 remove whether to remove the original path; default is false
 quiet whether not to verbose the messages; default is false

Value

FALSE if nothing to back up, or the back-up path if path exists

Examples

```
path <- tempfile()
file.create(path)

path2 <- backup_file(path, remove = TRUE)

file.exists(c(path, path2))
unlink(path2)
```

 BlackrockFile

Class definition to load data from 'BlackRock' 'Micro-systems' files

Description

Currently only supports minimum file specification version 2.3. Please contact the package maintainer or 'RAVE' team if older specifications are needed

Public fields

block character, session block ID

Active bindings

base_path absolute base path to the file
 version 'NEV' specification version
 electrode_table electrode table
 sample_rate_nev_timestamp sample rate of 'NEV' data packet time-stamps
 has_nsx named vector of 'NSx' availability
 recording_duration recording duration of each 'NSx'
 sample_rates sampling frequencies of each 'NSx' file

Methods

Public methods:

- `BlackrockFile#print()`
- `BlackrockFile$new()`
- `BlackrockFile$nev_path()`
- `BlackrockFile$nsx_paths()`
- `BlackrockFile$refresh_data()`
- `BlackrockFile$get_epoch()`
- `BlackrockFile$get_waveform()`
- `BlackrockFile$get_electrode()`
- `BlackrockFile$clone()`

Method `print()`: print user-friendly messages

Usage:

```
BlackrockFile#print()
```

Method `new()`: constructor

Usage:

```
BlackrockFile$new(path, block, nev_data = TRUE)
```

Arguments:

`path` the path to 'BlackRock' file, can be with or without file extensions

`block` session block ID; default is the file name

`nev_data` whether to load comments and 'waveforms'

Method `nev_path()`: get 'NEV' file path

Usage:

```
BlackrockFile$nev_path()
```

Returns: absolute file path

Method `nsx_paths()`: get 'NSx' file paths

Usage:

```
BlackrockFile$nsx_paths(which = NULL)
```

Arguments:

`which` which signal file to get, or NULL to return all available paths, default is NULL; must be integers

Returns: absolute file paths

Method `refresh_data()`: refresh and load 'NSx' data

Usage:

```
BlackrockFile$refresh_data(force = FALSE, verbose = TRUE, nev_data = FALSE)
```

Arguments:

`force` whether to force reload data even if the data has been loaded and cached before

verbose whether to print out messages when loading
 nev_data whether to refresh 'NEV' extended data; default is false
Returns: nothing

Method get_epoch(): get epoch table from the 'NEV' comment data packet

Usage:
 BlackrockFile\$get_epoch()
Returns: a data frame

Method get_waveform(): get 'waveform' of the spike data

Usage:
 BlackrockFile\$get_waveform()
Returns: a list of spike 'waveform' (without normalization)

Method get_electrode(): get electrode data

Usage:
 BlackrockFile\$get_electrode(electrode, nstype = NULL)
Arguments:
 electrode integer, must be a length of one
 nstype which signal bank, for example, 'ns3', 'ns5'
Returns: a normalized numeric vector (analog signals with 'uV' as the unit)

Method clone(): The objects of this class are cloneable with this method.

Usage:
 BlackrockFile\$clone(deep = FALSE)
Arguments:
 deep Whether to make a deep clone.

 cache_path

Manipulate cached data on the file systems

Description

Manipulate cached data on the file systems

Usage

```
cache_root(check = FALSE)

clear_cached_files(subject_code, quiet = FALSE)
```

Arguments

check	whether to ensure the cache root path
subject_code	subject code to remove; default is missing. If subject_code is provided, then only this subject-related cache files will be removed.
quiet	whether to suppress the message

Details

'RAVE' intensively uses cache files. If running on personal computers, the disk space might be filled up very quickly. These cache files are safe to remove if there is no 'RAVE' instance running. Function `clear_cached_files` is designed to remove these cache files. To run this function, please make sure that all 'RAVE' instances are shutdown.

Value

`cache_root` returns the root path that stores the 'RAVE' cache data; `clear_cached_files` returns nothing

Examples

```
cache_root()
```

```
catgl Print colored messages
```

Description

Print colored messages

Usage

```
catgl(..., .envir = parent.frame(), level = "DEBUG", .pal, .capture = FALSE)
```

Arguments

..., .envir	passed to glue
level	passed to cat2
.pal	see pal in cat2
.capture	logical, whether to capture message and return it without printing

Details

The level has order that sorted from low to high: "DEBUG", "DEFAULT", "INFO", "WARNING", "ERROR", "FATAL". Each different level will display different colors and icons before the message. You can suppress messages with certain levels by setting 'raveio' options via `raveio_setopt('verbose_level', <level>)`. Messages with levels lower than the threshold will be muffled. See examples.

Value

The message as characters

Examples

```
# ----- Basic Styles -----

# Temporarily change verbose level for example
raveio_setopt('verbose_level', 'DEBUG', FALSE)

# debug
catgl('Debug message', level = 'DEBUG')

# default
catgl('Default message', level = 'DEFAULT')

# info
catgl('Info message', level = 'INFO')

# warning
catgl('Warning message', level = 'WARNING')

# error
catgl('Error message', level = 'ERROR')

try({
  # fatal, will call stop and raise error
  catgl('Error message', level = 'FATAL')
}, silent = TRUE)

# ----- Muffle messages -----

# Temporarily change verbose level to 'WARNING'
raveio_setopt('verbose_level', 'WARNING', FALSE)

# default, muffled
catgl('Default message')

# message printed for level >= Warning
catgl('Default message', level = 'WARNING')
catgl('Default message', level = 'ERROR')
```

Description

These shell commands are for importing 'DICOM' images to 'Nifti' format, reconstructing cortical surfaces, and align' the CT' to 'MRI'. The commands are only tested on 'MacOS' and 'Linux'. On 'Windows' machines, please use the 'WSL2' system.

Usage

```
cmd_run_3dAllineate(
  subject,
  mri_path,
  ct_path,
  overwrite = FALSE,
  command_path = NULL,
  dry_run = FALSE,
  verbose = dry_run
)

cmd_execute(
  script,
  script_path,
  command = "bash",
  dry_run = FALSE,
  backup = TRUE,
  args = NULL,
  ...
)

cmd_run_dcm2niix(
  subject,
  src_path,
  type = c("MRI", "CT"),
  merge = c("Auto", "No", "Yes"),
  float = c("Yes", "No"),
  crop = c("No", "Yes", "Ignore"),
  overwrite = FALSE,
  command_path = NULL,
  dry_run = FALSE,
  verbose = dry_run
)

cmd_run_flirt(
  subject,
  mri_path,
  ct_path,
  dof = 6,
  cost = c("mutualinfo", "leastsq", "normcorr", "corratio", "normmi", "labeldiff", "bbr"),
  search = 90,
  searchcost = c("mutualinfo", "leastsq", "normcorr", "corratio", "normmi", "labeldiff",
```

```

    "bbr"),
    overwrite = FALSE,
    command_path = NULL,
    dry_run = FALSE,
    verbose = dry_run
)

cmd_run_recon_all(
  subject,
  mri_path,
  args = c("-all", "-autorecon1", "-autorecon2", "-autorecon3", "-autorecon2-cp",
    "-autorecon2-wm", "-autorecon2-pial"),
  work_path = NULL,
  overwrite = FALSE,
  command_path = NULL,
  dry_run = FALSE,
  verbose = dry_run
)

```

Arguments

subject	characters or a RAVESubject instance
mri_path	the absolute to 'MRI' volume; must in 'Nifti' format
ct_path	the absolute to 'CT' volume; must in 'Nifti' format
overwrite	whether to overwrite existing files; default is false
command_path	command line path if 'RAVE' cannot find the command binary files
dry_run	whether to run in dry-run mode; under such mode, the shell command will not execute. This is useful for debugging scripts; default is false
verbose	whether to print out the command script; default is true under dry-run mode, and false otherwise
script	the shell script
script_path	path to run the script
command	which command to invoke; default is 'bash'
backup	whether to back up the script file immediately; default is true
args	further arguments in the shell command, especially the 'FreeSurfer' reconstruction command
...	passed to system2
src_path	source of the 'DICOM' or 'Nifti' image (absolute path)
type	type of the 'DICOM' or 'Nifti' image; choices are 'MRI' and 'CT'
merge, float, crop	'dcm2niix' conversion arguments; ignored when the source is in 'Nifti' format
dof, cost, search, searchcost	parameters used by 'FSL' 'flirt' command; see their documentation for details
work_path	work path for 'FreeSurfer' command;

Value

A list of data containing the script details:

```
script script details
script_path where the script should/will be saved
dry_run whether dry-run mode is turned on
log_file path to the log file
execute a function to execute the script
```

collapse2

Collapse high-dimensional tensor array

Description

Collapse high-dimensional tensor array

Usage

```
collapse2(x, keep, method = c("mean", "sum"), ...)

## S3 method for class 'FileArray'
collapse2(x, keep, method = c("mean", "sum"), ...)

## S3 method for class 'Tensor'
collapse2(x, keep, method = c("mean", "sum"), ...)

## S3 method for class 'array'
collapse2(x, keep, method = c("mean", "sum"), ...)
```

Arguments

x	R array, FileArray-class , or Tensor object
keep	integer vector, the margins to keep
method	character, calculates mean or sum of the array when collapsing
...	passed to other methods

Value

A collapsed array (or a vector or matrix), depending on keep

See Also

[collapse](#)

Examples

```
x <- array(1:16, rep(2, 4))

collapse2(x, c(3, 2))

# Alternative method, but slower when `x` is a large array
apply(x, c(3, 2), mean)
```

collapse_power	<i>Collapse power array with given analysis cubes</i>
----------------	---

Description

Collapse power array with given analysis cubes

Usage

```
collapse_power(x, analysis_index_cubes)

## S3 method for class 'array'
collapse_power(x, analysis_index_cubes)

## S3 method for class 'FileArray'
collapse_power(x, analysis_index_cubes)
```

Arguments

`x` a [FileArray-class](#) array, must have 4 modes in the following sequence Frequency, Time, Trial, and Electrode

`analysis_index_cubes` a list of analysis indices for each mode

Value

a list of collapsed (mean) results

`freq_trial_elec` collapsed over time-points

`freq_time_elec` collapsed over trials

`time_trial_elec` collapsed over frequencies

`freq_time` collapsed over trials and electrodes

`freq_elec` collapsed over trials and time-points

`freq_trial` collapsed over time-points and electrodes

`time_trial` collapsed over frequencies and electrodes

`time_elec` collapsed over frequencies and trials

trial_elec collapsed over frequencies and time-points
 freq power per frequency, averaged over other modes
 time power per time-point, averaged over other modes
 trial power per trial, averaged over other modes

Examples

```
# Generate a 4-mode tensor array
x <- filearray::filearray_create(
  tempfile(), dimension = c(16, 100, 20, 5),
  partition_size = 1
)
x[] <- rnorm(160000)
dnames <- list(
  Frequency = 1:16,
  Time = seq(0, 1, length.out = 100),
  Trial = 1:20,
  Electrode = 1:5
)
dimnames(x) <- dnames

# Collapse array
results <- collapse_power(x, list(
  overall = list(),
  A = list(Trial = 1:5, Frequency = 1:6),
  B = list(Trial = 6:10, Time = 1:50)
))

# Plot power over frequency and time
groupB_result <- results$B
image(t(groupB_result$freq_time),
      x = dnames$Time[groupB_result$cube_index$Time],
      y = dnames$Frequency[groupB_result$cube_index$Frequency],
      xlab = "Time (s)",
      ylab = "Frequency (Hz)",
      xlim = range(dnames$Time))
```

Description

'HDF5', 'csv' are common file formats that can be easily read into 'Matlab' or 'Python'

Usage

```
convert_fst_to_hdf5(fst_path, hdf5_path, exclude_names = NULL)
```

```
convert_fst_to_csv(fst_path, csv_path, exclude_names = NULL)
```

Arguments

fst_path	path to 'fst' file
hdf5_path	path to 'HDF5' file; if file exists before the conversion, the file will be erased first. Please make sure the files are backed up.
exclude_names	table names to exclude
csv_path	path to 'csv' file; if file exists before the conversion, the file will be erased first. Please make sure the files are backed up.

Value

convert_fst_to_hdf5 will return a list of data saved to 'HDF5'; convert_fst_to_csv returns the normalized 'csv' path.

convert_blackrock	<i>Convert 'BlackRock' 'NEV/NSx' files</i>
-------------------	--

Description

Convert 'BlackRock' 'NEV/NSx' files

Usage

```
convert_blackrock(
  file,
  block = NULL,
  subject = NULL,
  to = NULL,
  comments = TRUE,
  format = c("mat", "hdf5")
)
```

Arguments

file	path to any 'NEV/NSx' file
block	the block name, default is file name
subject	subject code to save the files; default is NULL
to	save to path, must be a directory; default is under the file path. If subject is provided, then the default is subject raw directory path
comments	whether to extract comment section as epoch; default is true
format	output format, choices are 'mat' or 'hdf5'

Value

The results will be stored in directory specified by `to`. Please read the output message carefully.

<code>dir_create2</code>	<i>Force creating directory with checks</i>
--------------------------	---

Description

Force creating directory with checks

Usage

```
dir_create2(x, showWarnings = FALSE, recursive = TRUE, check = TRUE, ...)
```

Arguments

<code>x</code>	path to create
<code>showWarnings</code> , <code>recursive</code> , ...	passed to dir.create
<code>check</code>	whether to check the directory after creation

Value

Normalized path

Examples

```
path <- file.path(tempfile(), 'a', 'b', 'c')

# The following are equivalent
dir.create(path, showWarnings = FALSE, recursive = TRUE)

dir_create2(path)
```

ECoGTensor *'iEEG/ECoG' Tensor class inherit from Tensor*

Description

Four-mode tensor (array) especially designed for 'iEEG/ECoG' data. The Dimension names are: Trial, Frequency, Time, and Electrode.

Super class

`raveio::Tensor` -> ECoGTensor

Methods

Public methods:

- `ECoGTensor$flatten()`
- `ECoGTensor$new()`

Method `flatten()`: converts tensor (array) to a table (data frame)

Usage:

```
ECoGTensor$flatten(include_index = TRUE, value_name = "value")
```

Arguments:

`include_index` logical, whether to include dimension names
`value_name` character, column name of the value

Returns: a data frame with the dimension names as index columns and `value_name` as value column

Method `new()`: constructor

Usage:

```
ECoGTensor$new(
  data,
  dim,
  dimnames,
  varnames,
  hybrid = FALSE,
  swap_file = temp_tensor_file(),
  temporary = TRUE,
  multi_files = FALSE,
  use_index = TRUE,
  ...
)
```

Arguments:

`data` array or vector
`dim` dimension of data, must match with data

dimnames list of dimension names, equal length as dim
 varnames names of dimnames, recommended names are: Trial, Frequency, Time, and Electrode
 hybrid whether to enable hybrid mode to reduce RAM usage
 swap_file if hybrid mode, where to store the data; default stores in `raveio_getopt('tensor_temp_path')`
 temporary whether to clean up the space when exiting R session
 multi_files logical, whether to use multiple files instead of one giant file to store data
 use_index logical, when `multi_files` is true, whether use index dimension as partition number
 ... further passed to `Tensor` constructor

Returns: an `ECoGTensor` instance

Author(s)

Zhengjia Wang

find_path	<i>Try to find path along the root directory</i>
-----------	--

Description

Try to find path under root directory even if the original path is missing; see examples.

Usage

```
find_path(path, root_dir, all = FALSE)
```

Arguments

path	file path
root_dir	top directory of the search path
all	return all possible paths, default is false

Details

When file is missing, `find_path` concatenates the root directory and path combined to find the file. For example, if path is "a/b/c/d", the function first seek for existence of "a/b/c/d". If failed, then "b/c/d", and then "~/c/d" until reaching root directory. If `all=TRUE`, then all files/directories found along the search path will be returned

Value

The absolute path of file if exists, or NULL if missing/failed.

Examples

```

root <- tempdir()

# ----- Case 1: basic use case -----

# Create a path in root
dir_create2(file.path(root, 'a'))

# find path even it's missing. The search path will be
# root/ins/cd/a - missing
# root/cd/a     - missing
# root/a       - exists!
find_path('ins/cd/a', root)

# ----- Case 2: priority -----
# Create two paths in root
dir_create2(file.path(root, 'cc/a'))
dir_create2(file.path(root, 'a'))

# If two paths exist, return the first path found
# root/ins/cd/a - missing
# root/cd/a     - exists - returned
# root/a       - exists, but ignored
find_path('ins/cc/a', root)

# ----- Case 3: find all -----
# Create two paths in root
dir_create2(file.path(root, 'cc/a'))
dir_create2(file.path(root, 'a'))

# If two paths exist, return the first path found
# root/ins/cd/a - missing
# root/cd/a     - exists - returned
# root/a       - exists - returned
find_path('ins/cc/a', root, all = TRUE)

```

generate_reference *Generate common average reference signal for 'RAVE' subjects*

Description

To properly run this function, please install ravetools package.

Usage

```
generate_reference(subject, electrodes)
```

Arguments

subject	subject ID or RAVESubject instance
electrodes	electrodes to calculate the common average; these electrodes must run through 'Wavelet' first

Details

The goal of generating common average signals is to capture the common movement from all the channels and remove them out from electrode signals.

The common average signals will be stored at subject reference directories. Two exact same copies will be stored: one in 'HDF5' format such that the data can be read universally by other programming languages; one in [filearray](#) format that can be read in R with super fast speed.

Value

A reference instance returned by [new_reference](#) with signal type determined automatically.

get_projects	<i>Get all possible projects in 'RAVE' directory</i>
--------------	--

Description

Get all possible projects in 'RAVE' directory

Usage

```
get_projects(refresh = TRUE)
```

Arguments

refresh	whether to refresh the cache; default is true
---------	---

Value

characters of project names

get_val2	<i>Get value or return default if invalid</i>
----------	---

Description

Get value or return default if invalid

Usage

```
get_val2(x, key = NA, default = NULL, na = FALSE, min_len = 1L, ...)
```

Arguments

x	a list, or environment, or just any R object
key	the name to obtain from x. If NA, then return x. Default is NA
default	default value if
na, min_len, ...	passed to is_valid-ish

Value

values of the keys or default is invalid

Examples

```
x <- list(a=1, b = NA, c = character(0))

# ----- Basic usage -----

# no key, returns x if x is valid
get_val2(x)

get_val2(x, 'a', default = 'invalid')

# get 'b', NA is not filtered out
get_val2(x, 'b', default = 'invalid')

# get 'b', NA is considered invalid
get_val2(x, 'b', default = 'invalid', na = TRUE)

# get 'c', length 0 is allowed
get_val2(x, 'c', default = 'invalid', min_len = 0)

# length 0 is forbidden
```

```
get_val2(x, 'c', default = 'invalid', min_len = 1)
```

h5_names	<i>Returns all names contained in 'HDF5' file</i>
----------	---

Description

Returns all names contained in 'HDF5' file

Usage

```
h5_names(file)
```

Arguments

file, 'HDF5' file path

Value

characters, data set names

h5_valid	<i>Check whether a 'HDF5' file can be opened for read/write</i>
----------	---

Description

Check whether a 'HDF5' file can be opened for read/write

Usage

```
h5_valid(file, mode = c("r", "w"), close_all = FALSE)
```

Arguments

file path to file
mode 'r' for read access and 'w' for write access
close_all whether to close all connections or just close current connection; default is false.
 Set this to TRUE if you want to close all other connections to the file

Value

logical whether the file can be opened.

Examples

```

x <- array(1:27, c(3,3,3))
f <- tempfile()

# No data written to the file, hence invalid
h5_valid(f, 'r')

save_h5(x, f, 'dset')
h5_valid(f, 'w')

# Open the file and hold a connection
ptr <- hdf5r::H5File$new(filename = f, mode = 'w')

# Can read, but cannot write
h5_valid(f, 'r') # TRUE
h5_valid(f, 'w') # FALSE

# However, this can be reset via `close_all=TRUE`
h5_valid(f, 'r', close_all = TRUE)
h5_valid(f, 'w') # TRUE

# Now the connection is no longer valid
ptr

```

import_electrode_table

Import electrode table into subject meta folder

Description

Import electrode table into subject meta folder

Usage

```
import_electrode_table(path, subject, use_fs = NA, dry_run = FALSE, ...)
```

Arguments

path	path of table file, must be a 'csv' file
subject	'RAVE' subject ID or instance
use_fs	whether to use 'FreeSurfer' files to calculate other coordinates
dry_run	whether to dry-run the process; if true, then the table will be generated but not saved to subject's meta folder
...	passed to read.csv

Value

Nothing, the electrode information will be written directly to the subject's meta directory

<code>install_modules</code>	<i>Install 'RAVE' modules</i>
------------------------------	-------------------------------

Description

Install 'RAVE' modules

Usage

```
install_modules(modules, dependencies = FALSE)
```

Arguments

<code>modules</code>	a vector of characters, repository names; default is to automatically determined from a public registry
<code>dependencies</code>	whether to update dependent packages; default is false

Value

nothing

<code>is.blank</code>	<i>Check If Input Has Blank String</i>
-----------------------	--

Description

Check If Input Has Blank String

Usage

```
is.blank(x)
```

Arguments

<code>x</code>	input data: a vector or an array
----------------	----------------------------------

Value

`x == ""`

is.zerolenth	<i>Check If Input Has Zero Length</i>
--------------	---------------------------------------

Description

Check If Input Has Zero Length

Usage

```
is.zerolenth(x)
```

Arguments

x input data: a vector, list, or array

Value

whether x has zero length

is_valid-ish	<i>Check if data is close to "valid"</i>
--------------	--

Description

Check if data is close to "valid"

Usage

```
is_valid-ish(  
  x,  
  min_len = 1,  
  max_len = Inf,  
  mode = NA,  
  na = TRUE,  
  blank = FALSE,  
  all = FALSE  
)
```

Arguments

x data to check
min_len, max_len minimal and maximum length
mode which storage mode (see [mode](#)) should x be considered valid. Default is NA:
 disabled.

na	whether NA values considered invalid?
blank	whether blank string considered invalid?
all	if na or blank is true, whether all element of x being invalid will result in failure?

Value

logicals whether input x is valid

Examples

```
# length checks
is_valid_ish(NULL) # FALSE
is_valid_ish(integer(0)) # FALSE
is_valid_ish(integer(0), min_len = 0) # TRUE
is_valid_ish(1:10, max_len = 9) # FALSE

# mode check
is_valid_ish(1:10) # TRUE
is_valid_ish(1:10, mode = 'numeric') # TRUE
is_valid_ish(1:10, mode = 'character') # FALSE

# NA or blank checks
is_valid_ish(NA) # FALSE
is_valid_ish(c(1,2,NA), all = FALSE) # FALSE
is_valid_ish(c(1,2,NA), all = TRUE) # TRUE as not all elements are NA

is_valid_ish(c('1',''), all = FALSE) # TRUE
is_valid_ish(1:3, all = FALSE) # TRUE as 1:3 are not characters
```

join_tensors

Join Multiple Tensors into One Tensor

Description

Join Multiple Tensors into One Tensor

Usage

```
join_tensors(tensors, temporary = TRUE)
```

Arguments

tensors	list of Tensor instances
temporary	whether to garbage collect space when exiting R session

Details

Merges multiple tensors. Each tensor must share the same dimension with the last one dimension as 1, for example, $100 \times 100 \times 1$. Join 3 tensors like this will result in a $100 \times 100 \times 3$ tensor. This function is handy when each sub-tensors are generated separately. However, it does no validation test. Use with cautions.

Value

A new [Tensor](#) instance with the last dimension

Author(s)

Zhengjia Wang

Examples

```
tensor1 <- Tensor$new(data = 1:9, c(3,3,1), dimnames = list(
  A = 1:3, B = 1:3, C = 1
), varnames = c('A', 'B', 'C'))
tensor2 <- Tensor$new(data = 10:18, c(3,3,1), dimnames = list(
  A = 1:3, B = 1:3, C = 2
), varnames = c('A', 'B', 'C'))
merged <- join_tensors(list(tensor1, tensor2))
merged$get_data()
```

LazyFST

R6 Class to Load 'fst' Files

Description

provides hybrid data structure for 'fst' file

Methods

Public methods:

- [LazyFST\\$open\(\)](#)
- [LazyFST\\$close\(\)](#)
- [LazyFST\\$save\(\)](#)
- [LazyFST\\$new\(\)](#)
- [LazyFST\\$get_dims\(\)](#)
- [LazyFST\\$subset\(\)](#)

Method `open()`: to be compatible with [LazyH5](#)

Usage:

`LazyFST$open(...)`

Arguments:

... ignored

Returns: none

Method `close()`: close the connection

Usage:

```
LazyFST$close(..., .remove_file = FALSE)
```

Arguments:

... ignored

`.remove_file` whether to remove the file when garbage collected

Returns: none

Method `save()`: to be compatible with [LazyH5](#)

Usage:

```
LazyFST$save(...)
```

Arguments:

... ignored

Returns: none

Method `new()`: constructor

Usage:

```
LazyFST$new(file_path, transpose = FALSE, dims = NULL, ...)
```

Arguments:

`file_path` where the data is stored

`transpose` whether to load data transposed

`dims` data dimension, only support 1 or 2 dimensions

... ignored

Method `get_dims()`: get data dimension

Usage:

```
LazyFST$get_dims(...)
```

Arguments:

... ignored

Returns: vector, dimensions

Method `subset()`: subset data

Usage:

```
LazyFST$subset(i = NULL, j = NULL, ..., drop = TRUE)
```

Arguments:

`i`, `j`, ... index along each dimension

`drop` whether to apply [drop](#) the subset

Returns: subset of data

Author(s)

Zhengjia Wang

Examples

```
if(interactive()){  
  
  # Data to save, total 8 MB  
  x <- matrix(rnorm(1000000), ncol = 100)  
  
  # Save to local disk  
  f <- tempfile()  
  fst::write_fst(as.data.frame(x), path = f)  
  
  # Load via LazyFST  
  dat <- LazyFST$new(file_path = f, dims = c(10000, 100))  
  
  # dat < 1 MB  
  
  # Check whether the data is identical  
  range(dat[] - x)  
  
  # The reading of column is very fast  
  system.time(dat[,100])  
  
  # Reading rows might be slow  
  system.time(dat[1,])  
  
}
```

LazyH5

Lazy 'HDF5' file loader

Description

provides hybrid data structure for 'HDF5' file

Public fields

quiet whether to suppress messages

Methods**Public methods:**

- [LazyH5\\$finalize\(\)](#)
- [LazyH5\\$print\(\)](#)

- `LazyH5$new()`
- `LazyH5$save()`
- `LazyH5$open()`
- `LazyH5$close()`
- `LazyH5$subset()`
- `LazyH5$get_dims()`
- `LazyH5$get_type()`

Method `finalize()`: garbage collection method

Usage:

```
LazyH5$finalize()
```

Returns: none

Method `print()`: overrides print method

Usage:

```
LazyH5$print()
```

Returns: self instance

Method `new()`: constructor

Usage:

```
LazyH5$new(file_path, data_name, read_only = FALSE, quiet = FALSE)
```

Arguments:

`file_path` where data is stored in 'HDF5' format

`data_name` the data stored in the file

`read_only` whether to open the file in read-only mode. It's highly recommended to set this to be true, otherwise the file connection is exclusive.

`quiet` whether to suppress messages, default is false

Returns: self instance

Method `save()`: save data to a 'HDF5' file

Usage:

```
LazyH5$save(  
  x,  
  chunk = "auto",  
  level = 7,  
  replace = TRUE,  
  new_file = FALSE,  
  force = TRUE,  
  ctype = NULL,  
  size = NULL,  
  ...  
)
```

Arguments:

`x` vector, matrix, or array

chunk chunk size, length should matches with data dimension
 level compress level, from 1 to 9
 replace if the data exists in the file, replace the file or not
 new_file remove the whole file if exists before writing?
 force if you open the file in read-only mode, then saving objects to the file will raise error. Use force=TRUE to force write data
 ctype data type, see [mode](#), usually the data type of x. Try mode(x) or storage.mode(x) as hints.
 size deprecated, for compatibility issues
 ... passed to self open() method

Method open(): open connection

Usage:

```
LazyH5$open(new_dataset = FALSE, robj, ...)
```

Arguments:

new_dataset only used when the internal pointer is closed, or to write the data
 robj data array to save
 ... passed to createDataSet in hdf5r package

Method close(): close connection

Usage:

```
LazyH5$close(all = TRUE)
```

Arguments:

all whether to close all connections associated to the data file. If true, then all connections, including access from other programs, will be closed

Method subset(): subset data

Usage:

```
LazyH5$subset(..., drop = FALSE, stream = FALSE, envir = parent.frame())
```

Arguments:

drop whether to apply [drop](#) the subset
 stream whether to read partial data at a time
 envir if i, j, ... are expressions, where should the expression be evaluated
 i, j, ... index along each dimension

Returns: subset of data

Method get_dims(): get data dimension

Usage:

```
LazyH5$get_dims(stay_open = TRUE)
```

Arguments:

stay_open whether to leave the connection opened

Returns: dimension of the array

Method `get_type()`: get data type

Usage:

```
LazyH5$get_type(stay_open = TRUE)
```

Arguments:

`stay_open` whether to leave the connection opened

Returns: data type, currently only character, integer, raw, double, and complex are available, all other types will yield "unknown"

Author(s)

Zhengjia Wang

Examples

```
# Data to save
x <- array(rnorm(1000), c(10,10,10))

# Save to local disk
f <- tempfile()
save_h5(x, file = f, name = 'x', chunk = c(10,10,10), level = 0)

# Load via LazyFST
dat <- LazyH5$new(file_path = f, data_name = 'x', read_only = TRUE)

dat

# Check whether the data is identical
range(dat - x)

# Read a slice of the data
system.time(dat[,10,])
```

LFP_electrode

Definitions of reference with 'LFP' signal type

Description

Please use a safer [new_electrode](#) function to create instances. This documentation is to describe the member methods of the electrode class `LFP_electrode`

Super class

[raveio::RAVEAbstarctElectrode](#) -> `LFP_electrode`

Active bindings

h5_fname 'HDF5' file name
 valid whether current electrode is valid: subject exists and contains current electrode or reference;
 subject electrode type matches with current electrode type
 raw_sample_rate voltage sample rate
 power_sample_rate power/phase sample rate
 preprocess_info preprocess information
 power_file path to power 'HDF5' file
 phase_file path to phase 'HDF5' file
 voltage_file path to voltage 'HDF5' file

Methods**Public methods:**

- `LFP_electrode#print()`
- `LFP_electrode$set_reference()`
- `LFP_electrode$new()`
- `LFP_electrode$.load_noref_wavelet()`
- `LFP_electrode$.load_noref_voltage()`
- `LFP_electrode$.load_wavelet()`
- `LFP_electrode$.load_voltage()`
- `LFP_electrode$.load_raw_voltage()`
- `LFP_electrode$load_data()`
- `LFP_electrode$load_blocks()`
- `LFP_electrode$clear_cache()`
- `LFP_electrode$clear_memory()`
- `LFP_electrode$clone()`

Method `print()`: print electrode summary

Usage:

`LFP_electrode#print()`

Method `set_reference()`: set reference for current electrode

Usage:

`LFP_electrode$set_reference(reference)`

Arguments:

reference either NULL or LFP_electrode instance

Method `new()`: constructor

Usage:

`LFP_electrode$new(subject, number, quiet = FALSE)`

Arguments:

subject, number, quiet see constructor in [RAVEAbstarctElectrode](#)

Method `.load_noref_wavelet()`: load non-referenced wavelet coefficients (internally used)

Usage:

```
LFP_electrode$.load_noref_wavelet(reload = FALSE)
```

Arguments:

reload whether to reload cache

Returns: if the reference number is NULL or 'noref', then returns 0, otherwise returns a [FileArray-class](#)

Method `.load_noref_voltage()`: load non-referenced voltage (internally used)

Usage:

```
LFP_electrode$.load_noref_voltage(reload = FALSE)
```

Arguments:

reload whether to reload cache

srate voltage signal sample rate

Method `.load_wavelet()`: load referenced wavelet coefficients (internally used)

Usage:

```
LFP_electrode$.load_wavelet(
  type = c("power", "phase", "wavelet-coefficient"),
  reload = FALSE
)
```

Arguments:

type type of data to load

reload whether to reload cache

Method `.load_voltage()`: load referenced voltage (internally used)

Usage:

```
LFP_electrode$.load_voltage(reload = FALSE)
```

Arguments:

reload whether to reload cache

Method `.load_raw_voltage()`: load raw voltage (no process)

Usage:

```
LFP_electrode$.load_raw_voltage(reload = FALSE)
```

Arguments:

reload whether to reload cache

Method `load_data()`: method to load electrode data

Usage:

```
LFP_electrode$load_data(
  type = c("power", "phase", "voltage", "wavelet-coefficient", "raw-voltage")
)
```

Arguments:

type data type such as "power", "phase", "voltage", "wavelet-coefficient", and "raw-voltage".
 For "power", "phase", and "wavelet-coefficient", 'Wavelet' transforms are required.
 For "voltage", 'Notch' filters must be applied. All these types except for "raw-voltage" will be referenced. For "raw-voltage", no reference will be performed since the data will be the "raw" signal (no processing).

Method load_blocks(): load electrode block-wise data (with no reference), useful when epoch is absent

Usage:

```
LFP_electrode$load_blocks(
  blocks,
  type = c("power", "phase", "voltage", "wavelet-coefficient", "raw-voltage"),
  simplify = TRUE
)
```

Arguments:

blocks session blocks

type data type such as "power", "phase", "voltage", "raw-voltage" (with no filters applied, as-is from imported), "wavelet-coefficient". Note that if type is "raw-voltage", then the data only needs to be imported; for "voltage" data, 'Notch' filters must be applied; for all other types, 'Wavelet' transforms are required.

simplify whether to simplify the result

Returns: If simplify is enabled, and only one block is loaded, then the result will be a vector (type="voltage") or a matrix (others), otherwise the result will be a named list where the names are the blocks.

Method clear_cache(): method to clear cache on hard drive

Usage:

```
LFP_electrode$clear_cache(...)
```

Arguments:

... ignored

Method clear_memory(): method to clear memory

Usage:

```
LFP_electrode$clear_memory(...)
```

Arguments:

... ignored

Method clone(): The objects of this class are cloneable with this method.

Usage:

```
LFP_electrode$clone(deep = FALSE)
```

Arguments:

deep Whether to make a deep clone.

Examples

```

# Download subject demo/DemoSubject

subject <- as_rave_subject("demo/DemoSubject", strict = FALSE)

if(dir.exists(subject$path)) {

# Electrode 14 in demo/DemoSubject
e <- new_electrode(subject = subject, number = 14, signal_type = "LFP")

# Load CAR reference "ref_13-16,24"
ref <- new_reference(subject = subject, number = "ref_13-16,24",
                    signal_type = "LFP")
e$set_reference(ref)

# Set epoch
e$set_epoch(epoch = 'auditory_onset')

# Set loading window
e$trial_intervals <- list(c(-1, 2))

# Preview
print(e)

# Now epoch power
power <- e$load_data("power")
names(dimnames(power))

# Subset power
subset(power, Time ~ Time < 0, Electrode ~ Electrode == 14)

# Draw baseline
tempfile <- tempfile()
bl <- power_baseline(power, baseline_windows = c(-1, 0),
                    method = "decibel", filebase = tempfile)
collapsed_power <- collapse2(bl, keep = c(2,1))
# Visualize
dname <- dimnames(bl)
image(collapsed_power, x = dname$Time, y = dname$Frequency,
      xlab = "Time (s)", ylab = "Frequency (Hz)",
      main = "Mean power over trial (Baseline: -1~0 seconds)",
      sub = glue('Electrode {e$number} (Reference: {ref$number}'))))
abline(v = 0, lty = 2, col = 'blue')
text(x = 0, y = 20, "Audio onset", col = "blue", cex = 0.6)

# clear cache on hard disk
e$clear_cache()
ref$clear_cache()

}

```


LFP_reference

*Definitions of reference with 'LFP' signal type***Description**

Please use a safer [new_reference](#) function to create instances. This documentation is to describe the member methods of the electrode class LFP_reference

Super class

[raveio::RAVEAbstarctElectrode](#) -> LFP_reference

Active bindings

`exists` whether electrode exists in subject

`h5_fname` 'HDF5' file name

`valid` whether current electrode is valid: subject exists and contains current electrode or reference;
subject electrode type matches with current electrode type

`raw_sample_rate` voltage sample rate

`power_sample_rate` power/phase sample rate

`preprocess_info` preprocess information

`power_file` path to power 'HDF5' file

`phase_file` path to phase 'HDF5' file

`voltage_file` path to voltage 'HDF5' file

Methods**Public methods:**

- [LFP_reference#print\(\)](#)
- [LFP_reference\\$set_reference\(\)](#)
- [LFP_reference\\$new\(\)](#)
- [LFP_reference\\$.load_noref_wavelet\(\)](#)
- [LFP_reference\\$.load_noref_voltage\(\)](#)
- [LFP_reference\\$.load_wavelet\(\)](#)
- [LFP_reference\\$.load_voltage\(\)](#)
- [LFP_reference\\$load_data\(\)](#)
- [LFP_reference\\$load_blocks\(\)](#)
- [LFP_reference\\$clear_cache\(\)](#)
- [LFP_reference\\$clear_memory\(\)](#)
- [LFP_reference\\$clone\(\)](#)

Method `print()`: print reference summary

Usage:

```
LFP_reference$print()
```

Method `set_reference()`: set reference for current electrode

Usage:

```
LFP_reference$set_reference(reference)
```

Arguments:

reference either NULL or LFP_electrode instance

Method `new()`: constructor

Usage:

```
LFP_reference$new(subject, number, quiet = FALSE)
```

Arguments:

subject, number, quiet see constructor in [RAVEAbstarctElectrode](#)

Method `.load_noref_wavelet()`: load non-referenced wavelet coefficients (internally used)

Usage:

```
LFP_reference$.load_noref_wavelet(reload = FALSE)
```

Arguments:

reload whether to reload cache

Returns: if the reference number is NULL or 'noref', then returns 0, otherwise returns a [FileArray-class](#)

Method `.load_noref_voltage()`: load non-referenced voltage (internally used)

Usage:

```
LFP_reference$.load_noref_voltage(reload = FALSE)
```

Arguments:

reload whether to reload cache

srate voltage signal sample rate

Method `.load_wavelet()`: load referenced wavelet coefficients (internally used)

Usage:

```
LFP_reference$.load_wavelet(
  type = c("power", "phase", "wavelet-coefficient"),
  reload = FALSE
)
```

Arguments:

type type of data to load

reload whether to reload cache

Method `.load_voltage()`: load referenced voltage (internally used)

Usage:

```
LFP_reference$.load_voltage(reload = FALSE)
```

Arguments:

reload whether to reload cache

Method load_data(): method to load electrode data

Usage:

```
LFP_reference$load_data(
  type = c("power", "phase", "voltage", "wavelet-coefficient")
)
```

Arguments:

type data type such as "power", "phase", "voltage", "wavelet-coefficient".

Method load_blocks(): load electrode block-wise data (with reference), useful when epoch is absent

Usage:

```
LFP_reference$load_blocks(
  blocks,
  type = c("power", "phase", "voltage", "wavelet-coefficient"),
  simplify = TRUE
)
```

Arguments:

blocks session blocks

type data type such as "power", "phase", "voltage", "wavelet-coefficient". Note that if type is voltage, then 'Notch' filters must be applied; otherwise 'Wavelet' transforms are required.

simplify whether to simplify the result

Returns: If simplify is enabled, and only one block is loaded, then the result will be a vector (type="voltage") or a matrix (others), otherwise the result will be a named list where the names are the blocks.

Method clear_cache(): method to clear cache on hard drive

Usage:

```
LFP_reference$clear_cache(...)
```

Arguments:

... ignored

Method clear_memory(): method to clear memory

Usage:

```
LFP_reference$clear_memory(...)
```

Arguments:

... ignored

Method clone(): The objects of this class are cloneable with this method.

Usage:

```
LFP_reference$clone(deep = FALSE)
```

Arguments:

deep Whether to make a deep clone.

Examples

```

## Not run:

# Download subject demo/DemoSubject

subject <- as_rave_subject("demo/DemoSubject")

# Electrode 14 as reference electrode (Bipolar referencing)
e <- new_reference(subject = subject, number = "ref_14",
                  signal_type = "LFP")

# Reference "ref_13-16,24" (CAR or white-matter reference)
ref <- new_reference(subject = subject, number = "ref_13-16,24",
                   signal_type = "LFP")
ref

# Set epoch
e$set_epoch(epoch = 'auditory_onset')

# Set loading window
e$trial_intervals <- list(c(-1, 2))

# Preview
print(e)

# Now epoch power
power <- e$load_data("power")
names(dimnames(power))

# Subset power
subset(power, Time ~ Time < 0, Electrode ~ Electrode == 14)

# clear cache on hard disk
e$clear_cache()

## End(Not run)

```

load_bids_ieeg_header *Read in description files from 'BIDS-iEEG' format*

Description

Analyze file structures and import all json and tsv files. File specification can be found at <https://bids-specification.readthedocs.io/en/stable/>, chapter "Modality specific files", section "Intracranial Electroencephalography" ([doi:10.1038/s4159701901057](https://doi.org/10.1038/s4159701901057)). Please note that this function has very limited support on BIDS format.

Usage

```
load_bids_ieeg_header(bids_root, project_name, subject_code, folder = "ieeg")
```

Arguments

bids_root	'BIDS' root directory
project_name	project folder name
subject_code	subject code, do not include "sub-" prefix
folder	folder name corresponding to 'ieeg' data. It's possible to analyze other folders. However, by default, the function is designed for 'ieeg' folder.

Value

A list containing the information below:

subject_code	character, removed leading "sub-"
project_name	character, project name
has_session	whether session/block names are indicated by the file structure
session_names	session/block names indicated by file structure. If missing, then session name will be "default"
paths	a list containing path information
stimuli_path	stimuli path, not used for now
sessions	A named list containing meta information for each session/block. The names of the list is task name, and the items corresponding to the task contains events and channel information. Miscellaneous files are stored in "others" variable.

Examples

```
# Download https://github.com/bids-standard/bids-examples/
# extract to directory ~/rave_data/bids_dir/

bids_root <- '~/rave_data/bids_dir/'
project_name <- 'ieeg_visual'

if(dir.exists(bids_root) &&
  dir.exists(file.path(bids_root, project_name, 'sub-01'))){

  header <- load_bids_ieeg_header(bids_root, project_name, '01')

  print(header)

  # sessions
  names(header$sessions)

  # electrodes
  head(header$sessions$`01`$spaces$unknown_space$stable)
```

```

# visual task channel settings
head(header$sessions$`01`$tasks$`01-visual-01`$channels)

# event table
head(header$sessions$`01`$tasks$`01-visual-01`$channels)
}

```

load_fst_or_h5 *Function try to load 'fst' arrays, if not found, read 'HDF5' arrays*

Description

Function try to load 'fst' arrays, if not found, read 'HDF5' arrays

Usage

```

load_fst_or_h5(
  fst_path,
  h5_path,
  h5_name,
  fst_need_transpose = FALSE,
  fst_need_drop = FALSE,
  ram = FALSE
)

```

Arguments

fst_path	'fst' file cache path
h5_path	alternative 'HDF5' file path
h5_name	'HDF5' data name
fst_need_transpose	does 'fst' data need transpose?
fst_need_drop	drop dimensions
ram	whether to load to memory directly or perform lazy loading

Details

RAVE stores data with redundancy. One electrode data is usually saved with two copies in different formats: 'HDF5' and 'fst', where 'HDF5' is cross-platform and supported by multiple languages such as MatLab, Python, etc, while 'fst' format is supported by R only, with super high read/write speed. load_fst_or_h5 checks whether the presence of 'fst' file, if failed, then it reads data from persistent 'HDF5' file.

Value

If 'fst' cache file exists, returns [LazyFST](#) object, otherwise returns [LazyH5](#) instance

`load_h5`*Lazy Load 'HDF5' File via [hdf5r-package](#)*

Description

Wrapper for class [LazyH5](#), which load data with "lazy" mode - only read part of dataset when needed.

Usage

```
load_h5(file, name, read_only = TRUE, ram = FALSE, quiet = FALSE)
```

Arguments

<code>file</code>	'HDF5' file
<code>name</code>	group/data_name path to dataset (H5D data)
<code>read_only</code>	only used if ram=FALSE, whether the returned LazyH5 instance should be read only
<code>ram</code>	load data to memory immediately, default is false
<code>quiet</code>	whether to suppress messages

Value

If ram is true, then return data as arrays, otherwise return a [LazyH5](#) instance.

See Also

[save_h5](#)

Examples

```
file <- tempfile()
x <- array(1:120, dim = c(4,5,6))

# save x to file with name /group/dataset/1
save_h5(x, file, '/group/dataset/1', quiet = TRUE)

# read data
y <- load_h5(file, '/group/dataset/1', ram = TRUE)
class(y) # array

z <- load_h5(file, '/group/dataset/1', ram = FALSE)
class(z) # LazyH5

dim(z)
```

load_meta2	<i>Load 'RAVE' subject meta data</i>
------------	--------------------------------------

Description

Load 'RAVE' subject meta data

Usage

```
load_meta2(meta_type, project_name, subject_code, subject_id, meta_name)
```

Arguments

meta_type	electrodes, epochs, time_points, frequencies, references ...
project_name	project name
subject_code	subject code
subject_id	"project_name/subject_code"
meta_name	only used if meta_type is epochs or references

Value

A data frame of the specified meta type or NULL is no meta data is found.

load_yaml	<i>A port to read_yaml</i>
-----------	--

Description

For more examples, see [save_yaml](#).

Usage

```
load_yaml(file, ..., map = NULL)
```

Arguments

file, ...	passed to read_yaml
map	fastmap2 instance or NULL

Value

A [fastmap2](#). If map is provided then return map, otherwise return newly created one

See Also

[fastmap2](#), [save_yaml](#), [read_yaml](#), [write_yaml](#)

mgh_to_nii	<i>Convert 'FreeSurfer' 'mgh' to 'Nifti'</i>
------------	--

Description

Convert 'FreeSurfer' 'mgh' to 'Nifti'

Usage

```
mgh_to_nii(from, to)
```

Arguments

from	path to 'FreeSurfer' 'mgh' or 'mgz' file
to	path to 'Nifti' file, must ends with 'nii' or 'nii.gz'

Value

Nothing; the file will be created to path specified by to

module_add	<i>Add new 'RAVE' (2.0) module to current project</i>
------------	---

Description

Add new 'RAVE' (2.0) module to current project

Usage

```
module_add(  
  module_id,  
  module_label,  
  path = ".",  
  type = c("default", "bare"),  
  ...,  
  pipeline_name = module_id,  
  overwrite = FALSE  
)
```

Arguments

module_id	module ID to create, must be unique
module_label	a friendly label to display in the dashboard
path	project root path; default is current directory
type	template to choose, options are 'default' and 'bare'
...	additional configurations to the module such as 'order', 'group', 'badge'
pipeline_name	the pipeline name to create along with the module; default is identical to module_id
overwrite	whether to overwrite existing module if module with same ID exists; default is false

Value

Nothing.

module_registry	<i>'RAVE' module registry</i>
-----------------	-------------------------------

Description

Create, view, or reserve the module registry

Usage

```

module_registry(
  title,
  repo,
  modules,
  authors,
  url = sprintf("https://github.com/%s", repo)
)

module_registry2(repo, description)

get_modules_registries(update = NA)

add_module_registry(title, repo, modules, authors, url, dry_run = FALSE)

```

Arguments

title	title of the registry, usually identical to the description title in 'DESCRIPTION' or RAVE-CONFIG file
repo	'Github' repository
modules	characters of module ID, must only contain letters, digits, underscore, dash; must not be duplicated with existing registered modules

authors	a list of module authors; there must be one and only one author with 'cre' role (see person). This author will be considered maintainer, who will be in charge if editing the registry
url	the web address of the repository
description	path to 'DESCRIPTION' or RAVE-CONFIG file
update	whether to force updating the registry
dry_run	whether to generate and preview message content instead of opening an email link

Details

A 'RAVE' registry contains the following data entries: repository title, name, 'URL', authors, and a list of module IDs. 'RAVE' requires that each module must use a unique module ID. It will cause an issue if two modules share the same ID. Therefore 'RAVE' maintains a public registry list such that the module maintainers can register their own module ID and prevent other people from using it.

To register your own module ID, please use `add_module_registry` to validate and send an email to the 'RAVE' development team.

Value

a registry object, or a list of registries

Examples

```
library(raveio)

# get current registries
get_modules_registries(FALSE)

# create your own registry
module_registry(
  repo = "dipterix/rave-pipelines",
  title = "A Collection of 'RAVE' Builtin Pipelines",
  authors = list(
    list("Zhengjia", "Wang", role = c("cre", "aut"),
        email = "dipterix@rave.wiki")
  ),
  modules = "brain_viewer"
)

# If your repository is on Github and RAVE-CONFIG file exists
module_registry2("dipterix/rave-pipelines")

# send a request to add your registry
if(interactive()) {
  reg <- module_registry2("dipterix/rave-pipelines")
  add_module_registry(reg)
}
```

```
}

```

new_electrode	<i>Create new electrode channel instance or a reference signal instance</i>
---------------	---

Description

Create new electrode channel instance or a reference signal instance

Usage

```
new_electrode(subject, number, signal_type, ...)
```

```
new_reference(subject, number, signal_type, ...)
```

Arguments

subject	characters, or a RAVESubject instance
number	integer in new_electrode, or characters in new_reference; see 'Details' and 'Examples'
signal_type	signal type of the electrode or reference; can be automatically inferred, but it is highly recommended to specify a value; see SIGNAL_TYPES
...	other parameters passed to class constructors, respectively

Details

In new_electrode, number should be a positive valid integer indicating the electrode number. In new_reference, number can be one of the followings:

'noref', **or** NULL no reference is needed

'ref_X' where 'X' is a single number, then the reference is another existing electrode; this could occur in bipolar-reference cases

'ref_XXX' 'XXX' is a combination of multiple electrodes that can be parsed by [parse_svec](#). This could occur in common average reference, or white matter reference. One example is 'ref_13-16,24', meaning the reference signal is an average of electrode 13, 14, 15, 16, and 24.

Value

Electrode or reference instances that inherit [RAVEAbstarctElectrode](#) class

Examples

```

## Not run:

# Download subject demo/DemoSubject (~500 MB)

# Electrode 14 in demo/DemoSubject
subject <- as_rave_subject("demo/DemoSubject")
e <- new_electrode(subject = subject, number = 14, signal_type = "LFP")

# Load CAR reference "ref_13-16,24"
ref <- new_reference(subject = subject, number = "ref_13-16,24",
                    signal_type = "LFP")
e$set_reference(ref)

# Set epoch
e$set_epoch(epoch = 'auditory_onset')

# Set loading window
e$trial_intervals <- list(c(-1, 2))

# Preview
print(e)

# Now epoch power
power <- e$load_data("power")
names(dimnames(power))

# Subset power
subset(power, Time ~ Time < 0, Electrode ~ Electrode == 14)

# Draw baseline
tempfile <- tempfile()
bl <- power_baseline(power, baseline_windows = c(-1, 0),
                    method = "decibel", filebase = tempfile)
collapsed_power <- collapse2(bl, keep = c(2,1))
# Visualize
dname <- dimnames(bl)
image(collapsed_power, x = dname$Time, y = dname$Frequency,
      xlab = "Time (s)", ylab = "Frequency (Hz)",
      main = "Mean power over trial (Baseline: -1~0 seconds)",
      sub = glue('Electrode {e$number} (Reference: {ref$number})'))
abline(v = 0, lty = 2, col = 'blue')
text(x = 0, y = 20, "Audio onset", col = "blue", cex = 0.6)

# clear cache on hard disk
e$clear_cache()
ref$clear_cache()

## End(Not run)

```

niftyreg_coreg	<i>Register 'CT' to 'MR' images via 'NiftyReg'</i>
----------------	--

Description

Supports 'Rigid', 'affine', or 'non-linear' transformation

Usage

```
niftyreg_coreg(
  ct_path,
  mri_path,
  coreg_path = NULL,
  reg_type = c("rigid", "affine", "nonlinear"),
  interp = c("trilinear", "cubic", "nearest"),
  verbose = TRUE,
  ...
)
```

```
cmd_run_niftyreg_coreg(
  subject,
  ct_path,
  mri_path,
  reg_type = c("rigid", "affine", "nonlinear"),
  interp = c("trilinear", "cubic", "nearest"),
  verbose = TRUE,
  dry_run = FALSE,
  ...
)
```

Arguments

ct_path, mri_path	absolute paths to 'CT' and 'MR' image files
coreg_path	registration path, where to save results; default is the parent folder of ct_path
reg_type	registration type, choices are 'rigid', 'affine', or 'nonlinear'
interp	how to interpolate when sampling volumes, choices are 'trilinear', 'cubic', or 'nearest'
verbose	whether to verbose command; default is true
...	other arguments passed to register_volume
subject	'RAVE' subject
dry_run	whether to dry-run the script and to print out the command instead of executing the code; default is false

Value

Nothing is returned from the function. However, several files will be generated at the 'CT' path:

'ct_in_t1.nii' aligned 'CT' image; the image is also re-sampled into 'MRI' space

'CT_IJK_to_MR_RAS.txt' transform matrix from volume 'IJK' space in the original 'CT' to the 'RAS' anatomical coordinate in 'MR' scanner

'CT_RAS_to_MR_RAS.txt' transform matrix from scanner 'RAS' space in the original 'CT' to 'RAS' in 'MR' scanner space

pipeline	<i>Creates 'RAVE' pipeline instance</i>
----------	---

Description

Set pipeline inputs, execute, and read pipeline outputs

Usage

```
pipeline(
  pipeline_name,
  settings_file = "settings.yaml",
  paths = pipeline_root()
)
```

Arguments

pipeline_name the name of the pipeline, usually title field in the 'DESCRIPTION' file, or the pipeline folder name (if description file is missing)

settings_file the name of the settings file, usually stores user inputs

paths the paths to search for the pipeline, usually the parent directory of the pipeline; default is `pipeline_root`, which only search for pipelines that are installed or in current working directory.

Value

A `PipelineTools` instance

Examples

```
if(interactive()) {
  library(raveio)

  # ----- Set up a bare minimal example pipeline -----
  pipeline_path <- pipeline_create_template(
    root_path = tempdir(), pipeline_name = "raveio_demo",
```

```

  overwrite = TRUE, activate = FALSE, template_type = "rmd-bare")

save_yaml(list(
  n = 100, pch = 16, col = "steelblue"
), file = file.path(pipeline_path, "settings.yaml"))

pipeline_build(pipeline_path)

rmarkdown::render(input = file.path(pipeline_path, "main.Rmd"),
  output_dir = pipeline_path,
  knit_root_dir = pipeline_path,
  intermediates_dir = pipeline_path, quiet = TRUE)

utils::browseURL(file.path(pipeline_path, "main.html"))

# ----- Example starts -----

pipeline <- pipeline("raveio_demo", paths = tempdir())

pipeline$run("plot_data")

# Run again and you will see some targets are skipped
pipeline$set_settings(pch = 2)
pipeline$run("plot_data")

head(pipeline$read("input_data"))

# or use
pipeline[c("n", "pch", "col")]
pipeline[-c("input_data")]

pipeline$target_table

pipeline$result_table

pipeline$progress("details")

# ----- Clean up -----
unlink(pipeline_path, recursive = TRUE)

}

```

pipeline-knitr-markdown

Configure 'rmarkdown' files to build 'RAVE' pipelines

Description

Allows building 'RAVE' pipelines from 'rmarkdown' files. Please use it in 'rmarkdown' scripts only. Use [pipeline_create_template](#) to create an example.

Usage

```
configure_knitr(languages = c("R", "python"))

pipeline_setup_rmd(
  module_id,
  env = parent.frame(),
  collapse = TRUE,
  comment = "#>",
  languages = c("R", "python"),
  project_path = dipsaus::rs_active_project(child_ok = TRUE, shiny_ok = TRUE)
)
```

Arguments

languages	one or more programming languages to support; options are 'R' and 'python'
module_id	the module ID, usually the name of direct parent folder containing the pipeline file
env	environment to set up the pipeline translator
collapse, comment	passed to set method of opts_chunk
project_path	the project path containing all the pipeline folders, usually the active project folder

Value

A function that is supposed to be called later that builds the pipeline scripts

PipelineResult	<i>Pipeline result object</i>
----------------	-------------------------------

Description

Pipeline result object
 Pipeline result object

Public fields

progressor progress bar object, usually generated from [progress2](#)
 promise a [promise](#) instance that monitors the pipeline progress
 verbose whether to print warning messages
 names names of the pipeline to build
 async_callback function callback to call in each check loop; only used when the pipeline is running in `async=TRUE` mode
 check_interval used when `async=TRUE` in [pipeline_run](#), interval in seconds to check the progress

Active bindings

`variables` target variables of the pipeline

`variable_descriptions` readable descriptions of the target variables

`valid` logical true or false whether the result instance hasn't been invalidated

`status` result status, possible status are 'initialize', 'running', 'finished', 'canceled', and 'errored'. Note that 'finished' only means the pipeline process has been finished.

`process` (read-only) process object if the pipeline is running in 'async' mode, or NULL; see `r_bg`.

Methods**Public methods:**

- `PipelineResult$validate()`
- `PipelineResult$invalidate()`
- `PipelineResult$get_progress()`
- `PipelineResult$new()`
- `PipelineResult$run()`
- `PipelineResult$await()`
- `PipelineResult$print()`
- `PipelineResult$get_values()`
- `PipelineResult$clone()`

Method `validate()`: check if result is valid, raises errors when invalidated

Usage:

```
PipelineResult$validate()
```

Method `invalidate()`: invalidate the pipeline result

Usage:

```
PipelineResult$invalidate()
```

Method `get_progress()`: get pipeline progress

Usage:

```
PipelineResult$get_progress()
```

Method `new()`: constructor (internal)

Usage:

```
PipelineResult$new(path = character(0L), verbose = FALSE)
```

Arguments:

`path` pipeline path

`verbose` whether to print warnings

Method `run()`: run pipeline (internal)

Usage:

```
PipelineResult$run(  
  expr,  
  env = parent.frame(),  
  quoted = FALSE,  
  async = FALSE,  
  process = NULL  
)
```

Arguments:

expr expression to evaluate

env environment of expr

quoted whether expr has been quoted

async whether the process runs in other sessions

process the process object inherits `process`, will be inferred from expr if process=NULL, and will raise errors if cannot be found

Method `await()`: wait until some targets get finished

Usage:

```
PipelineResult$await(names = NULL, timeout = Inf)
```

Arguments:

names target names to wait, default is NULL, i.e. to wait for all targets that have been scheduled

timeout maximum waiting time in seconds

Returns: TRUE if the target is finished, or FALSE if timeout is reached

Method `print()`: print method

Usage:

```
PipelineResult$print()
```

Method `get_values()`: get results

Usage:

```
PipelineResult$get_values(names = NULL, ...)
```

Arguments:

names the target names to read

... passed to `codelinkpipeline_read`

Method `clone()`: The objects of this class are cloneable with this method.

Usage:

```
PipelineResult$clone(deep = FALSE)
```

Arguments:

deep Whether to make a deep clone.

PipelineTools *Class definition for pipeline tools*

Description

Class definition for pipeline tools

Class definition for pipeline tools

Active bindings

settings_path absolute path to the settings file

target_table table of target names and their descriptions

result_table summary of the results, including signatures of data and commands

pipeline_path the absolute path of the pipeline

pipeline_name the code name of the pipeline

Methods

Public methods:

- PipelineTools\$new()
- PipelineTools\$set_settings()
- PipelineTools\$get_settings()
- PipelineTools\$read()
- PipelineTools\$run()
- PipelineTools\$eval()
- PipelineTools\$progress()
- PipelineTools\$attach()
- PipelineTools\$with_activated()
- PipelineTools\$clean()
- PipelineTools\$save_data()
- PipelineTools\$load_data()
- PipelineTools\$clone()

Method new(): construction function

Usage:

```
PipelineTools$new(
  pipeline_name,
  settings_file = "settings.yaml",
  paths = pipeline_root()
)
```

Arguments:

pipeline_name name of the pipeline, usually in the pipeline 'DESCRIPTION' file, or pipeline folder name

`settings_file` the file name of the settings file, where the user inputs are stored
`paths` the paths to find the pipeline, usually the parent folder of the pipeline; default is `pipeline_root()`

Method `set_settings()`: set inputs

Usage:

```
PipelineTools$set_settings(..., .list = NULL)
```

Arguments:

`...`, `.list` named list of inputs; all inputs should be named, otherwise errors will be raised

Method `get_settings()`: get current inputs

Usage:

```
PipelineTools$get_settings(key, default = NULL, constraint)
```

Arguments:

`key` the input name; default is missing, i.e., to get all the settings

`default` default value if not found

`constraint` the constraint of the results; if input value is not from constraint, then only the first element of constraint will be returned.

Returns: The value of the inputs, or a list if key is missing

Method `read()`: read intermediate variables

Usage:

```
PipelineTools$read(var_names, ifnotfound = NULL, ...)
```

Arguments:

`var_names` the target names, can be obtained via `x$target_table` member; default is missing, i.e., to read all the intermediate variables

`ifnotfound` variable default value if not found

`...` other parameters passing to [pipeline_read](#)

Returns: The values of the targets

Method `run()`: run the pipeline

Usage:

```
PipelineTools$run(
  names = NULL,
  async = FALSE,
  as_promise = async,
  scheduler = c("none", "future", "clustermq"),
  type = c("smart", "callr", "vanilla"),
  envir = new.env(parent = globalenv()),
  callr_function = NULL,
  ...
)
```

Arguments:

`names` pipeline variable names to calculate; default is to calculate all the targets

async whether to run asynchronous in another process
 as_promise whether to return a `PipelineResult` instance
 scheduler, type, envir, callr_function, ... passed to `pipeline_run` if `as_promise` is true, otherwise these arguments will be passed to `pipeline_run_bare`

Returns: A `PipelineResult` instance if `as_promise` or `async` is true; otherwise a list of values for input names

Method `eval()`: run the pipeline in order; unlike `$run()`, this method does not use the targets infrastructure, hence the pipeline results will not be stored, and the order of names will be respected.

Usage:

```
PipelineTools$eval(names, env = parent.frame(), clean = TRUE)
```

Arguments:

names pipeline variable names to calculate; must be specified
 env environment to evaluate and store the results
 clean whether to evaluate without polluting env

Method `progress()`: get progress of the pipeline

Usage:

```
PipelineTools$progress(method = c("summary", "details"))
```

Arguments:

method either 'summary' or 'details'

Returns: A table of the progress

Method `attach()`: attach pipeline tool to environment (internally used)

Usage:

```
PipelineTools$attach(env)
```

Arguments:

env an environment

Method `with_activated()`: run code with pipeline activated, some environment variables and function behaviors might change under such condition (for example, targets package functions)

Usage:

```
PipelineTools$with_activated(expr, quoted = FALSE, env = parent.frame())
```

Arguments:

expr expression to evaluate
 quoted whether expr is quoted; default is false
 env environment to run expr

Method `clean()`: clean all or part of the data store

Usage:

```
PipelineTools$clean(
  destroy = c("all", "cloud", "local", "meta", "process", "progress", "objects",
    "scratch", "workspaces"),
  ask = FALSE
)
```

Arguments:

destroy, ask see [tar_destroy](#)

Method `save_data()`: save data to pipeline data folder

Usage:

```
PipelineTools$save_data(
  data,
  name,
  format = c("json", "yaml", "csv", "fst", "rds"),
  overwrite = FALSE,
  ...
)
```

Arguments:

data R object

name the name of the data to save, must start with letters

format serialize format, choices are 'json', 'yaml', 'csv', 'fst', 'rds'; default is 'json'.

To save arbitrary objects such as functions or environments, use 'rds'

overwrite whether to overwrite existing files; default is no

... passed to saver functions

Returns: the saved file path

Method `load_data()`: load data from pipeline data folder

Usage:

```
PipelineTools$load_data(
  name,
  error_if_missing = TRUE,
  default_if_missing = NULL,
  format = c("auto", "json", "yaml", "csv", "fst", "rds"),
  ...
)
```

Arguments:

name the name of the data

error_if_missing whether to raise errors if the name is missing

default_if_missing default values to return if the name is missing

format the format of the data, default is automatically obtained from the file extension

... passed to loader functions

Returns: the data if file is found or a default value

Method `clone()`: The objects of this class are cloneable with this method.

Usage:

```
PipelineTools$clone(deep = FALSE)
```

Arguments:

deep Whether to make a deep clone.

See Also

[pipeline](#)

pipeline_install *Install 'RAVE' pipelines*

Description

Install 'RAVE' pipelines

Usage

```
pipeline_install_local(
  src,
  to = c("default", "custom", "workdir", "tempdir"),
  upgrade = FALSE,
  force = FALSE,
  ...
)

pipeline_install_github(
  repo,
  to = c("default", "custom", "workdir", "tempdir"),
  upgrade = FALSE,
  force = FALSE,
  ...
)
```

Arguments

src	pipeline directory
to	installation path; choices are 'default', 'custom', 'workdir', and 'tempdir'. Please specify pipeline root path via pipeline_root when 'custom' is used.
upgrade	whether to upgrade the dependence; default is FALSE for stability, however, it is highly recommended to upgrade your dependencies
force	whether to force installing the pipelines
...	other parameters not used
repo	'Github' repository in user-repository combination, for example, 'dipterix/rave-pipeline'

Value

nothing

pipeline_settings_get_set

Get or change pipeline input parameter settings

Description

Get or change pipeline input parameter settings

Usage

```
pipeline_settings_set(
    ...,
    pipeline_path = Sys.getenv("RAVE_PIPELINE", "."),
    pipeline_settings_path = file.path(pipeline_path, "settings.yaml")
)
```

```
pipeline_settings_get(
    key,
    default = NULL,
    constraint = NULL,
    pipeline_path = Sys.getenv("RAVE_PIPELINE", "."),
    pipeline_settings_path = file.path(pipeline_path, "settings.yaml")
)
```

Arguments

pipeline_path	the root directory of the pipeline
pipeline_settings_path	the settings file of the pipeline, must be a 'yaml' file; default is 'settings.yaml' in the current pipeline
key, ...	the character key(s) to get or set
default	the default value is key is missing
constraint	the constraint of the resulting value; if not NULL, then result must be within the constraint values, otherwise the first element of constraint will be returned. This is useful to make sure the results stay within given options

Value

pipeline_settings_set returns a list of all the settings. pipeline_settings_get returns the value of given key.

power_baseline	<i>Calculate power baseline</i>
----------------	---------------------------------

Description

Calculate power baseline

Usage

```
power_baseline(
  x,
  baseline_windows,
  method = c("percentage", "sqrt_percentage", "decibel", "zscore", "sqrt_zscore"),
  units = c("Trial", "Frequency", "Electrode"),
  ...
)

## S3 method for class 'rave_prepare_power'
power_baseline(
  x,
  baseline_windows,
  method = c("percentage", "sqrt_percentage", "decibel", "zscore", "sqrt_zscore"),
  units = c("Frequency", "Trial", "Electrode"),
  electrodes,
  ...
)

## S3 method for class 'FileArray'
power_baseline(
  x,
  baseline_windows,
  method = c("percentage", "sqrt_percentage", "decibel", "zscore", "sqrt_zscore"),
  units = c("Frequency", "Trial", "Electrode"),
  filebase = NULL,
  ...
)

## S3 method for class 'array'
power_baseline(
  x,
  baseline_windows,
  method = c("percentage", "sqrt_percentage", "decibel", "zscore", "sqrt_zscore"),
  units = c("Trial", "Frequency", "Electrode"),
  ...
)

## S3 method for class 'ECoGTensor'
```

```

power_baseline(
  x,
  baseline_windows,
  method = c("percentage", "sqrt_percentage", "decibel", "zscore", "sqrt_zscore"),
  units = c("Trial", "Frequency", "Electrode"),
  filebase = NULL,
  hybrid = TRUE,
  ...
)

```

Arguments

x	R array, filearray , ECoGTensor , or 'rave_prepare_power' object created by prepare_subject_power .
baseline_windows	list of baseline window (intervals)
method	baseline method; choices are 'percentage', 'sqrt_percentage', 'decibel', 'zscore', 'sqrt_zscore'; see 'Details' in baseline_array
units	the unit of the baseline; see 'Details'
...	passed to other methods
electrodes	the electrodes to be included in baseline calculation; for power repository object produced by prepare_subject_power only; default is all available electrodes in each of signal_types
filebase	where to store the output; default is NULL and is automatically determined
hybrid	whether the array will be

Details

The arrays must be four-mode tensor and must have valid named [dimnames](#). The dimension names must be 'Trial', 'Frequency', 'Time', 'Electrode', case sensitive.

The `baseline_windows` determines the baseline windows that are used to calculate time-points of baseline to be included. This can be one or more intervals and must pass the validation function [validate_time_window](#).

The `units` determines the unit of the baseline. It can be one or more of 'Trial', 'Frequency', 'Electrode'. The default value is all of them, i.e., baseline for each combination of trial, frequency, and electrode. To share the baseline across trials, please remove 'Trial' from units. To calculate baseline that should be shared across electrodes (e.g. in some mini-electrodes), remove 'Electrode' from the units.

Value

Usually the same type as the input: for arrays, [filearray](#), or [ECoGTensor](#), the outputs are also the same type with the same dimensions; for 'rave_prepare_power' repositories, the results will be stored in its 'baselined' element; see 'Examples'.

Examples

```
## Not run:
# The following code need to download additional demo data
# Please see https://rave.wiki/ for more details

library(raveio)
repo <- prepare_subject_power(
  subject = "demo/DemoSubject",
  time_windows = c(-1, 3),
  electrodes = c(14, 15))

##### Direct baseline on the repository
power_baseline(x = repo, method = "decibel",
              baseline_windows = list(c(-1, 0), c(2, 3)))
power_mean <- repo$power$baselined$collapse(
  keep = c(2,1), method = "mean")
image(power_mean, x = repo$time_points, y = repo$frequency,
      xlab = "Time (s)", ylab = "Frequency (Hz)",
      main = "Mean power over trial (Baseline: -1~0 & 2~3)")
abline(v = 0, lty = 2, col = 'blue')
text(x = 0, y = 20, "Aud-Onset", col = "blue", cex = 0.6)

##### Alternatively, baseline on electrode instances
baselined <- lapply(repo$power$data_list, function(inst) {
  re <- power_baseline(inst, method = "decibel",
                      baseline_windows = list(c(-1, 0), c(2, 3)))
  collapse2(re, keep = c(2,1), method = "mean")
})
power_mean2 <- (baselined[[1]] + baselined[[2]]) / 2

# Same with precision difference
max(abs(power_mean2 - power_mean)) < 1e-6

## End(Not run)
```

prepare_subject_bare0 *Prepare 'RAVE' single-subject data*

Description

Prepare 'RAVE' single-subject data

Usage

```
prepare_subject_bare0(
```

```
    subject,  
    electrodes,  
    reference_name,  
    ...,  
    quiet = TRUE,  
    repository_id = NULL  
  )  
  
prepare_subject_bare(  
  subject,  
  electrodes,  
  reference_name,  
  ...,  
  repository_id = NULL  
)  
  
prepare_subject_with_epoch(  
  subject,  
  electrodes,  
  reference_name,  
  epoch_name,  
  time_windows,  
  env = parent.frame(),  
  ...  
)  
  
prepare_subject_power(  
  subject,  
  electrodes,  
  reference_name,  
  epoch_name,  
  time_windows,  
  signal_type = c("LFP"),  
  env = parent.frame(),  
  verbose = TRUE,  
  ...  
)  
  
prepare_subject_with_blocks(  
  subject,  
  electrodes,  
  reference_name,  
  blocks,  
  signal_type = "LFP",  
  time_frequency = signal_type == "LFP",  
  env = parent.frame(),  
  repository_id = NULL,  
  ...  
)
```

```

)

prepare_subject_raw_voltage_with_epoch(
  subject,
  electrodes,
  epoch_name,
  time_windows,
  ...,
  quiet = TRUE,
  repository_id = NULL
)

prepare_subject_voltage_with_epoch(
  subject,
  electrodes,
  epoch_name,
  time_windows,
  reference_name,
  ...,
  quiet = TRUE,
  repository_id = NULL
)

```

Arguments

subject	character of project and subject, such as "demo/YAB", or RAVESubject instance
electrodes	integer vector of electrodes, or a character that can be parsed by parse_svec
reference_name	reference name to be loaded
...	ignored
quiet	whether to quietly load the data
repository_id	used internally
epoch_name	epoch name to be loaded, or a RAVEEpoch instance
time_windows	a list of time windows that are relative to epoch onset time; need to pass the validation validate_time_window
env	environment to evaluate
signal_type	electrode signal type (length of one) to be considered; default is 'LFP'. This option rarely needs to change unless you really want to check the power data from other types. For other signal types, check SIGNAL_TYPES
verbose	whether to show progress
blocks	one or more session blocks to load
time_frequency	whether to load time-frequency data when preparing block data

Value

A [fastmap2](#) (basically a list) of objects. Depending on the functions called, the following items may exist in the list:

subject A [RAVESubject](#) instance
 epoch_name Same as input epoch_name
 epoch A [RAVEEpoch](#) instance
 reference_name Same as input reference_name
 reference_table A data frame of reference
 electrode_table A data frame of electrode information
 frequency A vector of frequencies
 time_points A vector of time-points
 power_list A list of power data of the electrodes
 power_dimnames A list of trial indices, frequencies, time points, and electrodes that are loaded

progress_with_logger *Enhanced progress with logger message*

Description

For best performance, please install 'ravedash'. This function can replace [progress2](#).

Usage

```

progress_with_logger(
  title,
  max = 1,
  ...,
  quiet = FALSE,
  session = shiny::getDefaultReactiveDomain(),
  shiny_auto_close = FALSE,
  outputId = NULL,
  log
)

```

Arguments

title, max, ..., quiet, session, shiny_auto_close
 see [progress2](#)

outputId will be used if package 'shidashi' is installed, otherwise will be ignored

log function, NULL, or missing; default is missing, which will use logger function in the package 'ravedash', or [cat2](#) if 'ravedash' is not installed. If log=NULL, then the message will be suppressed in 'shiny' applications. If a function provided, then the function will be called.

Value

A list, see [progress2](#)

 py_nipy_coreg

 Register 'CT' to 'MR' images via 'nipy' script

Description

Align 'CT' using `nipy.algorithms.registration.histogram_registration`.

Usage

```

py_nipy_coreg(
    ct_path,
    mri_path,
    clean_source = TRUE,
    inverse_target = TRUE,
    precenter_source = TRUE,
    smooth = 0,
    reg_type = c("rigid", "affine"),
    interp = c("pv", "tri"),
    similarity = c("cr11", "cc", "cr", "mi", "nmi", "slr"),
    optimizer = c("powell", "steepest", "cg", "bfgs", "simplex"),
    tol = 1e-04,
    dry_run = FALSE
)

cmd_run_nipy_coreg(
    subject,
    ct_path,
    mri_path,
    clean_source = TRUE,
    inverse_target = TRUE,
    precenter_source = TRUE,
    reg_type = c("rigid", "affine"),
    interp = c("pv", "tri"),
    similarity = c("cr11", "cc", "cr", "mi", "nmi", "slr"),
    optimizer = c("powell", "steepest", "cg", "bfgs", "simplex"),
    dry_run = FALSE,
    verbose = FALSE
)

```

Arguments

`ct_path`, `mri_path` absolute paths to 'CT' and 'MR' image files

`clean_source` whether to replace negative 'CT' values with zeros; default is true

`inverse_target` whether to inverse 'MRI' color intensity; default is true

precenter_source	whether to adjust the 'CT' transform matrix before alignment, such that the origin of 'CT' is at the center of the volume; default is true. This option may avoid the case that 'CT' is too far-away from the 'MR' volume at the beginning of the optimization
smooth, interp, optimizer, tol	optimization parameters, see 'nipy' documentation for details.
reg_type	registration type, choices are 'rigid' or 'affine'
similarity	the cost function of the alignment; choices are 'cr11' ('L1' regularized correlation), 'cc' (correlation coefficient), 'cr' (correlation), 'mi' (mutual information), 'nmi' (normalized mutual information), 'slr' (likelihood ratio). In reality I personally find 'cr11' works best in most cases, though many tutorials suggest 'nmi'.
dry_run	whether to dry-run the script and to print out the command instead of executing the code; default is false
subject	'RAVE' subject
verbose	whether to verbose command; default is false

Value

Nothing is returned from the function. However, several files will be generated at the 'CT' path:

'ct_in_t1.nii' aligned 'CT' image; the image is also re-sampled into 'MRI' space

'CT_IJK_to_MR_RAS.txt' transform matrix from volume 'IJK' space in the original 'CT' to the 'RAS' anatomical coordinate in 'MR' scanner

'CT_RAS_to_MR_RAS.txt' transform matrix from scanner 'RAS' space in the original 'CT' to 'RAS' in 'MR' scanner space

rave-pipeline	<i>'RAVE' pipeline functions</i>
---------------	----------------------------------

Description

Utility functions for 'RAVE' pipelines, currently designed for internal development use. The infrastructure will be deployed to 'RAVE' in the future to facilitate the "self-expanding" aim. Please check the official 'RAVE' website.

Usage

```
pipeline_root(root_path)
```

```
pipeline_list(root_path = pipeline_root())
```

```
pipeline_find(name, root_path = pipeline_root())
```

```
pipeline_attach(name, root_path = pipeline_root())

pipeline_run(
  pipe_dir = Sys.getenv("RAVE_PIPELINE", "."),
  scheduler = c("none", "future", "clustermq"),
  type = c("smart", "callr", "vanilla"),
  envir = new.env(parent = globalenv()),
  callr_function = NULL,
  names = NULL,
  async = FALSE,
  check_interval = 0.5,
  progress_quiet = !async,
  progress_max = NA,
  progress_title = "Running pipeline",
  ...
)

pipeline_clean(
  pipe_dir = Sys.getenv("RAVE_PIPELINE", "."),
  destroy = c("all", "cloud", "local", "meta", "process", "progress", "objects",
    "scratch", "workspaces"),
  ask = FALSE
)

pipeline_run_bare(
  pipe_dir = Sys.getenv("RAVE_PIPELINE", "."),
  scheduler = c("none", "future", "clustermq"),
  type = c("smart", "callr", "vanilla"),
  envir = new.env(parent = globalenv()),
  callr_function = NULL,
  names = NULL,
  ...
)

load_targets(...)

pipeline_target_names(pipe_dir = Sys.getenv("RAVE_PIPELINE", "."))

pipeline_debug(
  quick = TRUE,
  env = parent.frame(),
  pipe_dir = Sys.getenv("RAVE_PIPELINE", "."),
  skip_names
)

pipeline_eval(
  names,
  env = new.env(parent = parent.frame()),
```

```
    pipe_dir = Sys.getenv("RAVE_PIPELINE", "."),
    settings_path = file.path(pipe_dir, "settings.yaml")
  )

  pipeline_visualize(
    pipe_dir = Sys.getenv("RAVE_PIPELINE", "."),
    glimpse = FALSE,
    targets_only = TRUE,
    shortcut = FALSE,
    zoom_speed = 0.1,
    ...
  )

  pipeline_progress(
    pipe_dir = Sys.getenv("RAVE_PIPELINE", "."),
    method = c("summary", "details", "custom"),
    func = targets::tar_progress_summary
  )

  pipeline_fork(
    src = Sys.getenv("RAVE_PIPELINE", "."),
    dest = tempfile(pattern = "rave_pipeline_"),
    filter_pattern =
      "(^data|R|\\.R|\\.yaml|\\.txt|\\.csv|\\.fst|\\.conf|\\.json|\\.rds)$",
    activate = FALSE
  )

  pipeline_build(pipe_dir = Sys.getenv("RAVE_PIPELINE", "."))

  pipeline_read(
    var_names,
    pipe_dir = Sys.getenv("RAVE_PIPELINE", "."),
    branches = NULL,
    ifnotfound = NULL
  )

  pipeline_vartable(
    pipe_dir = Sys.getenv("RAVE_PIPELINE", "."),
    targets_only = TRUE,
    complete_only = FALSE,
    ...
  )

  pipeline_hasname(var_names, pipe_dir = Sys.getenv("RAVE_PIPELINE", "."))

  pipeline_watch(
    pipe_dir = Sys.getenv("RAVE_PIPELINE", "."),
    targets_only = TRUE,
```

```

    ...
)

pipeline_create_template(
  root_path,
  pipeline_name,
  overwrite = FALSE,
  activate = TRUE,
  template_type = c("rmd", "r", "rmd-bare")
)

pipeline_create_subject_pipeline(
  subject,
  pipeline_name,
  overwrite = FALSE,
  activate = TRUE,
  template_type = c("rmd", "r")
)

pipeline_description(file)

pipeline_load_extdata(
  name,
  format = c("auto", "json", "yaml", "csv", "fst", "rds"),
  error_if_missing = TRUE,
  default_if_missing = NULL,
  pipe_dir = Sys.getenv("RAVE_PIPELINE", "."),
  ...
)

pipeline_save_extdata(
  data,
  name,
  format = c("json", "yaml", "csv", "fst", "rds"),
  overwrite = FALSE,
  pipe_dir = Sys.getenv("RAVE_PIPELINE", "."),
  ...
)

```

Arguments

<code>root_path</code>	the root directory for pipeline templates
<code>name, pipeline_name</code>	the pipeline name to create; usually also the folder
<code>pipe_dir</code>	where the pipeline directory is; can be set via system environment <code>Sys.setenv("RAVE_PIPELINE"=...)</code>
<code>scheduler</code>	how to schedule the target jobs: default is 'none', which is sequential. If you have multiple heavy-weighted jobs that can be scheduled at the same time, you can choose 'future' or 'clustermq'

type	how the pipeline should be executed; current choices are "smart" to enable 'future' package if possible, 'callr' to use <code>r</code> , or 'vanilla' to run everything sequentially in the main session.
callr_function	function that will be passed to <code>tar_make</code> ; will be forced to be NULL if type='vanilla', or <code>r</code> if type='callr'
names	the names of pipeline targets that are to be executed; default is NULL, which runs all targets; use <code>pipeline_target_names</code> to check all your available target names.
async	whether to run pipeline without blocking the main session
check_interval	when running in background (non-blocking mode), how often to check the pipeline
progress_title, progress_max, progress_quiet	control the progress, see progress2 .
...	other parameters, targets, etc.
destroy	what part of data repository needs to be cleaned
ask	whether to ask
quick	whether to skip finished targets to save time
env, envir	environment to execute the pipeline
skip_names	hint of target names to fast skip provided they are up-to-date; only used when quick=TRUE. If missing, then skip_names will be automatically determined
settings_path	path to settings file name within subject's pipeline path
glimpse	whether to hide network status when visualizing the pipelines
targets_only	whether to return the variable table for targets only; default is true
shortcut	whether to display shortcut targets
zoom_speed	zoom speed when visualizing the pipeline dependence
method	how the progress should be presented; choices are "summary", "details", "custom". If custom method is chosen, then func will be called
func	function to call when reading customized pipeline progress; default is tar_progress_summary
src, dest	pipeline folder to copy the pipeline script from and to
filter_pattern	file name patterns used to filter the scripts to avoid copying data files; default is " <code>\\.(R yaml txt csv fst conf)\$</code> "
activate	whether to activate the new pipeline folder from dest; default is false
var_names	variable name to fetch or to check
branches	branch to read from; see tar_read
ifnotfound	default values to return if variable is not found
complete_only	whether only to show completed and up-to-date target variables; default is false
overwrite	whether to overwrite existing pipeline; default is false so users can double-check; if true, then existing pipeline, including the data will be erased
template_type	which template type to create; choices are 'r' or 'rmd'
subject	character indicating valid 'RAVE' subject ID, or RAVESubject instance

file	path to the 'DESCRIPTION' file under the pipeline folder, or pipeline collection folder that contains the pipeline information, structures, dependencies, etc.
format	format of the extended data, default is 'json', other choices are 'yaml', 'fst', 'csv', 'rds'
error_if_missing, default_if_missing	what to do if the extended data is not found
data	extended data to be saved

Value

pipeline_root	the root directories of the pipelines
pipeline_list	the available pipeline names under pipeline_root
pipeline_find	the path to the pipeline
pipeline_run	a PipelineResult instance
load_targets	a list of targets to build
pipeline_target_names	a vector of characters indicating the pipeline target names
pipeline_visualize	a widget visualizing the target dependence structure
pipeline_progress	a table of building progress
pipeline_fork	a normalized path of the forked pipeline directory
pipeline_read	the value of corresponding var_names, or a named list if var_names has more than one element
pipeline_varstable	a table of summaries of the variables; can raise errors if pipeline has never been executed
pipeline_hasname	logical, whether the pipeline has variable built
pipeline_watch	a basic shiny application to monitor the progress
pipeline_description	the list of descriptions of the pipeline or pipeline collection

rave-raw-validation *Validate raw files in 'rave' directory*

Description

Validate subjects and returns whether the subject can be imported into 'rave'

Usage

```
validate_raw_file(
  subject_code,
  blocks,
  electrodes,
  format,
  data_type = c("continuous"),
  ...
)

IMPORT_FORMATS
```

Arguments

subject_code	subject code, direct folder under 'rave' raw data path
blocks	block character, direct folder under subject folder. For raw files following 'BIDS' convention, see details
electrodes	electrodes to verify
format	integer or character. For characters, run names(IMPORT_FORMATS)
data_type	currently only support continuous type of signals
...	other parameters used if validating 'BIDS' format; see details.

Format

An object of class list of length 7.

Details

Six types of raw file structures are supported. They can be basically classified into two categories: 'rave' native raw structure and 'BIDS-iEEG' structure.

In 'rave' native structure, subject folders are stored within the root directory, which can be obtained via `raveio_getopt('raw_data_dir')`. Subject directory is the subject code. Inside of subject folder are block files. In 'rave', term 'block' is the combination of session, task, and run. Within each block, there should be 'iEEG' data files.

In 'BIDS-iEEG' format, the root directory can be obtained via `raveio_getopt('bids_data_dir')`. 'BIDS' root folder contains project folders. This is unlike 'rave' native raw data format. Subject folders are stored within the project directories. The subject folders start with 'sub-'. Within subject folder, there are session folders with prefix 'ses-'. Session folders are optional. 'iEEG' data is stored in 'ieeg' folder under the session/subject folder. 'ieeg' folder should contain at least

electrodes.tsv sub-<label>*_{electrodes}.tsv

'iEEG' description sub-<label>*_{task}-<label>_{run}-<index>_{ieeg}.json

'iEEG' data file sub-<label>*_{task}-<label>_{run}-<index>_{ieeg}.<ext>, in current 'rave', only extensions '.vhdr+.eeg/.dat' ('BrainVision') or 'EDF' (or plus) are supported.

When format is 'BIDS', project_name must be specified.

The following formats are supported:

'`.mat/.h5` file per electrode per block' 'rave' native raw format, each block folder contains multiple 'Matlab' or 'HDF5' files. Each file corresponds to a channel/electrode. File names should follow '`xxx001.mat`' or '`xxx001.h5`'. The numbers before the extension are channel numbers.

'Single `.mat/.h5` file per block' 'rave' native raw format, each block folder contains **only** one 'Matlab' or 'HDF5' file. The file name can be arbitrary, but extension must be either '`.mat`' or '`.h5`'. Within the file there should be a matrix containing all the data. The short dimension of the matrix will be channels, and larger side of the dimension corresponds to the time points.

'Single EDF(+) file per block' 'rave' native raw format, each block folder contains **only** one '`.edf`' file.

'Single BrainVision file (.vhdr+.eeg, .vhdr+.dat) per block' 'rave' native raw format, each block folder contains **only** two files. The first file is header '.vhdr' file. It contains all meta information. The second is either '.eeg' or '.dat' file containing the body, i.e. signal entries.

'BIDS & EDF(+)' 'BIDS' format. The data file should have '.edf' extension

'BIDS & BrainVision (.vhdr+.eeg, .vhdr+.dat)' 'BIDS' format. The data file should have '.vhdr'+'.eeg/.dat' extensions

Value

logical true or false whether the directory is valid. Attributes containing error reasons or snapshot of the data. The attributes might be:

snapshot	description of data found if passing the validation
valid_run_names	For 'BIDS' format, valid session+task+run name if passing the validation
reason	named list where the names are the reason why validation fails and values are corresponding sessions or electrodes or both.

rave-server	<i>Install and configure 'RAVE' server as background service using shiny-server</i>
-------------	---

Description

Works on 'Linux' and 'Mac' only.

Usage

```
rave_server_install(
  url = "https://github.com/rstudio/shiny-server/archive/refs/tags/v1.5.18.987.zip"
)

rave_server_configure(
  ports = 17283,
  user = Sys.info()[["user"]],
  rave_version = c("1", "2")
)
```

Arguments

url	'URL' to shiny-server 'ZIP' file to download
ports	integer vectors or character, indicating the port numbers to host 'RAVE' instances a valid port must be within the range from 1024 to 65535.
user	user to run the service as; default is the login user
rave_version	internally used; might be deprecated in the future

Value

nothing

Examples

```
## Not run:  
  
# OS-specific. Please install R package `rpy2` first  
  
# Install rave-server  
rave_server_install()  
  
# Let port 17283-17290 to host RAVE instance  
rave_server_configure(ports = "17283-17290")  
  
## End(Not run)
```

rave-snippet	<i>'RAVE' code snippets</i>
--------------	-----------------------------

Description

Run snippet code

Usage

```
update_local_snippet(force = TRUE)  
  
load_snippet(topic, local = TRUE)
```

Arguments

force	whether to force updating the snippets; default is true
topic	snippet topic
local	whether to use local snippets first before requesting online repository

Value

'load_snippet' returns snippet as a function, others return nothing

Examples

```

if(interactive()) {
  update_local_snippet()
  snippet <- load_snippet("dummy-snippet")
  snippet
}

```

RAVEAbstarctElectrode *Abstract definition of electrode class in RAVE*

Description

This class is not intended for direct use. Please create new child classes and implement some key methods.

Public fields

subject subject instance ([RAVESubject](#))

number integer stands for electrode number or reference ID

reference reference electrode, either NULL for no reference or an electrode instance inherits RAVEAbstarctElectrode

epoch a [RAVEEpoch](#) instance

Active bindings

type signal type of the electrode, such as 'LFP', 'Spike', and 'EKG'; default is 'Unknown'

power_enabled whether the electrode can be used in power analyses such as frequency, or frequency-time analyses; this usually requires transforming the electrode raw voltage signals using signal processing methods such as 'Fourier', 'wavelet', 'Hilbert', 'multi-taper', etc. If an electrode has power data, then it's power data can be loaded via [prepare_subject_power](#) method.

is_reference whether this instance is a reference electrode

location location type of the electrode, see [LOCATION_TYPES](#) for details

exists whether electrode exists in subject

preprocess_file path to preprocess 'HDF5' file

power_file path to power 'HDF5' file

phase_file path to phase 'HDF5' file

voltage_file path to voltage 'HDF5' file

reference_name reference electrode name

epoch_name current epoch name

cache_root run-time cache path; NA if epoch or trial intervals are missing

trial_intervals trial intervals relative to epoch onset

Methods**Public methods:**

- [RAVEAbstarctElectrode\\$new\(\)](#)
- [RAVEAbstarctElectrode\\$set_reference\(\)](#)
- [RAVEAbstarctElectrode\\$set_epoch\(\)](#)
- [RAVEAbstarctElectrode\\$clear_cache\(\)](#)
- [RAVEAbstarctElectrode\\$clear_memory\(\)](#)
- [RAVEAbstarctElectrode\\$load_data\(\)](#)
- [RAVEAbstarctElectrode\\$load_blocks\(\)](#)
- [RAVEAbstarctElectrode\\$clone\(\)](#)

Method `new()`: constructor*Usage:*

```
RAVEAbstarctElectrode$new(subject, number, quiet = FALSE)
```

Arguments:

subject character or [RAVESubject](#) instance
 number current electrode number or reference ID
 quiet reserved, whether to suppress warning messages

Method `set_reference()`: set reference for instance*Usage:*

```
RAVEAbstarctElectrode$set_reference(reference)
```

Arguments:

reference NULL or [RAVEAbstarctElectrode](#) instance instance

Method `set_epoch()`: set epoch instance for the electrode*Usage:*

```
RAVEAbstarctElectrode$set_epoch(epoch)
```

Arguments:

epoch characters or [RAVEEpoch](#) instance. For characters, make sure "epoch_<name>.csv" is in meta folder.

Method `clear_cache()`: method to clear cache on hard drive*Usage:*

```
RAVEAbstarctElectrode$clear_cache(...)
```

Arguments:

... implemented by child instances

Method `clear_memory()`: method to clear memory*Usage:*

```
RAVEAbstarctElectrode$clear_memory(...)
```

Arguments:

... implemented by child instances

Method `load_data()`: method to load electrode data

Usage:

```
RAVEAbstarctElectrode$load_data(type)
```

Arguments:

type data type such as "power", "phase", "voltage", "wavelet-coefficient", or others depending on child class implementations

Method `load_blocks()`: load electrode block-wise data (with reference), useful when epoch is absent

Usage:

```
RAVEAbstarctElectrode$load_blocks(blocks, type, simplify = TRUE)
```

Arguments:

blocks session blocks

type data type such as "power", "phase", "voltage", "wavelet-coefficient".

simplify whether to simplify the result

Returns: If simplify is enabled, and only one block is loaded, then the result will be a vector (type="voltage") or a matrix (others), otherwise the result will be a named list where the names are the blocks.

Method `clone()`: The objects of this class are cloneable with this method.

Usage:

```
RAVEAbstarctElectrode$clone(deep = FALSE)
```

Arguments:

deep Whether to make a deep clone.

Examples

```
## Not run:

# To run this example, please download demo subject (~700 MB) from
# https://github.com/beauchamplab/rave/releases/tag/v0.1.9-beta

generator <- RAVEAbstarctElectrode

# load demo subject electrode 14
e <- generator$new("demo/DemoSubject", number = 14)

# set epoch
e$subject$epoch_names
e$set_epoch("auditory_onset")
head(e$epoch$table)

# set epoch range (-1 to 2 seconds relative to onset)
e$trial_intervals <- c(-1,2)
# or to set multiple ranges
```

```

e$trial_intervals <- list(c(-2,-1), c(0, 2))

# set reference
e$subject$reference_names
reference_table <- e$subject$meta_data(
  meta_type = "reference",
  meta_name = "default")
ref_name <- subset(reference_table, Electrode == 14)[["Reference"]]

# the reference is CAR type, mean of electrode 13-16,24
ref_name

# load & set reference
ref <- generator$new(e$subject, ref_name)
e$set_reference(ref)

## End(Not run)

```

RAVEEpoch

Definition for epoch class

Description

Trial epoch, contains the following information: Block experiment block/session string; Time trial onset within that block; Trial trial number; Condition trial condition. Other optional columns are Event_xxx (starts with "Event"). See <https://openwetware.org/wiki/RAVE:Epoching> or more details.

Public fields

name epoch name, character
subject RAVESubject instance
data a list of trial information, internally used
table trial epoch table
.columns epoch column names, internally used

Active bindings

columns columns of trial table
n_trials total number of trials
trials trial numbers

Methods**Public methods:**

- [RAVEEpoch\\$new\(\)](#)
- [RAVEEpoch\\$trial_at\(\)](#)
- [RAVEEpoch\\$update_table\(\)](#)
- [RAVEEpoch\\$set_trial\(\)](#)
- [RAVEEpoch\\$clone\(\)](#)

Method new(): constructor*Usage:*

RAVEEpoch\$new(subject, name)

Arguments:

subject RAVESubject instance or character

name character, make sure "epoch_<name>.csv" is in meta folder

Method trial_at(): get ith trial*Usage:*

RAVEEpoch\$trial_at(i, df = TRUE)

Arguments:

i trial number

df whether to return as data frame or a list

Method update_table(): manually update table field*Usage:*

RAVEEpoch\$update_table()

Returns: self\$table**Method set_trial():** set one trial*Usage:*

RAVEEpoch\$set_trial(Block, Time, Trial, Condition, ...)

Arguments:

Block block string

Time time in second

Trial positive integer, trial number

Condition character, trial condition

... other key-value pairs corresponding to other optional columns

Method clone(): The objects of this class are cloneable with this method.*Usage:*

RAVEEpoch\$clone(deep = FALSE)

Arguments:

deep Whether to make a deep clone.

Examples

```

# Please download DemoSubject ~700MB from
# https://github.com/beauchamplab/rave/releases/tag/v0.1.9-beta

## Not run:

# Load meta/epoch_auditory_onset.csv from subject demo/DemoSubject
epoch <-RAVEEpoch$new(subject = 'demo/DemoSubject',
                      name = 'auditory_onset')

# first several trials
head(epoch$table)

# query specific trial
old_trial1 <- epoch$trial_at(1)

# Create new trial or change existing trial
epoch$set_trial(Block = '008', Time = 10,
               Trial = 1, Condition = 'AkknownVmeant')
new_trial1 <- epoch$trial_at(1)

# Compare new and old trial 1
rbind(old_trial1, new_trial1)

# To get updated trial table, must update first
epoch$update_table()
head(epoch$table)

## End(Not run)

```

raveio-constants

The constant variables

Description

The constant variables

Usage

SIGNAL_TYPES

LOCATION_TYPES

MNI305_to_MNI152

Format

An object of class character of length 6.

An object of class character of length 5.

An object of class matrix (inherits from array) with 4 rows and 4 columns.

Details

SIGNAL_TYPES has the following options: 'LFP', 'Spike', 'EKG', 'Audio', 'Photodiode', or 'Unknown'. As of 'raveio' 0.0.6, only 'LFP' (see [LFP_electrode](#)) signal type is supported.

LOCATION_TYPES is a list of the electrode location types: 'iEEG' (this includes the next two), 'sEEG' (stereo), 'ECoG' (surface), 'EEG' (scalp), 'Others'. See field 'location' in [RAVEAbstarctElectrode](#)

MNI305_to_MNI152 is a 4-by-4 matrix converting 'MNI305' coordinates to 'MNI152' space. The difference of these two spaces is: 'MNI305' is an average of 305 human subjects, while 'MNI152' is the average of 152 people. These two coordinates differs slightly. While most of the 'MNI' coordinates reported by 'RAVE' and 'FreeSurfer' are in the 'MNI305' space, many other programs are expecting 'MNI152' coordinates.

raveio-option

Set/Get 'raveio' option

Description

Persist settings on local configuration file

Usage

```
raveio_setopt(key, value, .save = TRUE)
```

```
raveio_resetopt(all = FALSE)
```

```
raveio_getopt(key, default = NA, temp = TRUE)
```

```
raveio_confpath(cfile = "settings.yaml")
```

Arguments

key	character, option name
value	character or logical of length 1, option value
.save	whether to save to local drive, internally used to temporary change option. Not recommended to use it directly.
all	whether to reset all non-default keys
default	is key not found, return default value
temp	when saving, whether the key-value pair should be considered temporary, a temporary settings will be ignored when saving; when getting options, setting temp to false will reveal the actual settings.
cfile	file name in configuration path

Details

`raveio_setopt` stores key-value pair in local path. The values are persistent and shared across multiple sessions. There are some read-only keys such as `"session_string"`. Trying to set those keys will result in error.

`raveio_getopt` returns value corresponding to the keys. If key is missing, the whole option will be returned.

If set `all=TRUE`, `raveio_resetopt` resets all keys including non-standard ones. However `"session_string"` will never reset.

Value

`raveio_setopt` returns modified value; `raveio_resetopt` returns current settings as a list; `raveio_confpath` returns absolute path for the settings file; `raveio_getopt` returns the settings value to the given key, or default if not found.

See Also

`R_user_dir`

RAVEPreprocessSettings

Defines preprocess configurations

Description

R6 class definition

Public fields

`current_version` current configuration setting version

`path` settings file path

`backup_path` alternative back up path for redundancy checks

`data` list of raw configurations, internally used only

`subject` [RAVESubject](#) instance

`read_only` whether the configuration should be read-only, not yet implemented

Active bindings

`version` configure version of currently stored files

`old_version` whether settings file is old format

`blocks` experiment blocks

`electrodes` electrode numbers

`sample_rates` voltage data sample rate

notch_filtered whether electrodes are notch filtered
 has_wavelet whether each electrode has wavelet transforms
 data_imported whether electrodes are imported
 data_locked whether electrode, blocks and sample rate are locked? usually when an electrode is imported into 'rave', that electrode is locked
 electrode_locked whether electrode is imported and locked
 wavelet_params wavelet parameters
 notch_params Notch filter parameters
 electrode_types electrode signal types
 @freeze_blocks whether to free block, internally used
 @freeze_lfp_ecog whether to freeze electrodes that record 'LFP' signals, internally used
 @lfp_ecog_sample_rate 'LFP' sample rates, internally used
 all_blocks characters, all possible blocks even not included in some projects
 raw_path raw data path
 raw_path_type raw data path type, 'native' or 'bids'

Methods

Public methods:

- [RAVEPreprocessSettings\\$new\(\)](#)
- [RAVEPreprocessSettings\\$valid\(\)](#)
- [RAVEPreprocessSettings\\$has_raw\(\)](#)
- [RAVEPreprocessSettings\\$set_blocks\(\)](#)
- [RAVEPreprocessSettings\\$set_electrodes\(\)](#)
- [RAVEPreprocessSettings\\$set_sample_rates\(\)](#)
- [RAVEPreprocessSettings\\$migrate\(\)](#)
- [RAVEPreprocessSettings\\$electrode_info\(\)](#)
- [RAVEPreprocessSettings\\$save\(\)](#)

Method `new()`: constructor

Usage:

```
RAVEPreprocessSettings$new(subject, read_only = TRUE)
```

Arguments:

subject character or [RAVESubject](#) instance

read_only whether subject should be read-only (not yet implemented)

Method `valid()`: whether configuration is valid or not

Usage:

```
RAVEPreprocessSettings$valid()
```

Method `has_raw()`: whether raw data folder exists

Usage:

RAVEPreprocessSettings\$has_raw()

Method set_blocks(): set blocks

Usage:

```
RAVEPreprocessSettings$set_blocks(blocks, force = FALSE)
```

Arguments:

blocks character, combination of session task and run

force whether to ignore checking. Only used when data structure is not native, for example, 'BIDS' format

Method set_electrodes(): set electrodes

Usage:

```
RAVEPreprocessSettings$set_electrodes(  
  electrodes,  
  type = SIGNAL_TYPERES,  
  add = FALSE  
)
```

Arguments:

electrodes integer vectors

type signal type of electrodes, see [SIGNAL_TYPERES](#)

add whether to add to current settings

Method set_sample_rates(): set sample frequency

Usage:

```
RAVEPreprocessSettings$set_sample_rates(srate, type = SIGNAL_TYPERES)
```

Arguments:

srate sample rate, must be positive number

type electrode type to set sample rate. In 'rave', all electrodes with the same signal type must have the same sample rate.

Method migrate(): convert old format to new formats

Usage:

```
RAVEPreprocessSettings$migrate(force = FALSE)
```

Arguments:

force whether to force migrate and save settings

Method electrode_info(): get electrode information

Usage:

```
RAVEPreprocessSettings$electrode_info(electrode)
```

Arguments:

electrode integer

Returns: list of electrode type, number, etc.

Method save(): save settings to hard disk

Usage:

```
RAVEPreprocessSettings$save()
```

Examples

```
# The following example require downloading demo subject (~700 MB) from
# https://github.com/beauchamplab/rave/releases/tag/v0.1.9-beta

## Not run:

conf <- RAVEPreprocessSettings$new(subject = 'demo/DemoSubject')
conf$blocks # "008" "010" "011" "012"

conf$electrodes # 5 electrodes

# Electrode 14 information
conf$electrode_info(electrode = 14)

conf$data_imported # All 5 electrodes are imported

conf$data_locked # Whether block, sample rates should be locked

## End(Not run)
```

RAVEProject

Definition for 'RAVE' project class

Description

Definition for 'RAVE' project class

Definition for 'RAVE' project class

Active bindings

path project folder, absolute path

name project name, character

pipeline_path path to pipeline scripts under project's folder

Methods**Public methods:**

- [RAVEProject\\$print\(\)](#)
- [RAVEProject\\$new\(\)](#)
- [RAVEProject\\$subjects\(\)](#)
- [RAVEProject\\$has_subject\(\)](#)
- [RAVEProject\\$group_path\(\)](#)
- [RAVEProject\\$clone\(\)](#)

Method print(): override print method

Usage:

```
RAVEProject$print(...)
```

Arguments:

... ignored

Method new(): constructor

Usage:

```
RAVEProject$new(project_name, strict = TRUE)
```

Arguments:

project_name character

strict whether to check project path

Method subjects(): get all imported subjects within project

Usage:

```
RAVEProject$subjects()
```

Returns: character vector

Method has_subject(): whether a specific subject exists in this project

Usage:

```
RAVEProject$has_subject(subject_code)
```

Arguments:

subject_code character, subject name

Returns: true or false whether subject is in the project

Method group_path(): get group data path for 'rave' module

Usage:

```
RAVEProject$group_path(module_id, must_work = FALSE)
```

Arguments:

module_id character, 'rave' module ID

must_work whether the directory must exist; if not exists, should a new one be created?

Method clone(): The objects of this class are cloneable with this method.

Usage:

```
RAVEProject$clone(deep = FALSE)
```

Arguments:

deep Whether to make a deep clone.

RAVESubject	<i>Defines 'RAVE' subject class</i>
-------------	-------------------------------------

Description

R6 class definition

Active bindings

project project instance of current subject; see [RAVEProject](#)
 project_name character string of project name
 subject_code character string of subject code
 subject_id subject ID: "project/subject"
 path subject root path
 rave_path 'rave' directory under subject root path
 meta_path meta data directory for current subject
 freesurfer_path 'FreeSurfer' directory for current subject. If no path exists, values will be NA
 preprocess_path preprocess directory under subject 'rave' path
 data_path data directory under subject 'rave' path
 cache_path path to 'FST' copies under subject 'data' path
 pipeline_path path to pipeline scripts under subject's folder
 note_path path that stores 'RAVE' related subject notes
 epoch_names possible epoch names
 reference_names possible reference names
 reference_path reference path under 'rave' folder
 preprocess_settings preprocess instance; see [RAVEPreprocessSettings](#)
 blocks subject experiment blocks in current project
 electrodes all electrodes, no matter excluded or not
 raw_sample_rates voltage sample rate
 power_sample_rate power spectrum sample rate
 has_wavelet whether electrodes have wavelet transforms
 notch_filtered whether electrodes are Notch-filtered
 electrode_types electrode signal types

Methods**Public methods:**

- `RAVESubject$print()`
- `RAVESubject$new()`
- `RAVESubject$meta_data()`
- `RAVESubject$valid_electrodes()`
- `RAVESubject$initialize_paths()`
- `RAVESubject$set_default()`
- `RAVESubject$get_default()`
- `RAVESubject$get_note_summary()`
- `RAVESubject$get_epoch()`
- `RAVESubject$get_reference()`
- `RAVESubject$get_electrode_table()`
- `RAVESubject$get_frequency()`
- `RAVESubject$clone()`

Method `print()`: override print method

Usage:

```
RAVESubject$print(...)
```

Arguments:

... ignored

Method `new()`: constructor

Usage:

```
RAVESubject$new(project_name, subject_code = NULL, strict = TRUE)
```

Arguments:

`project_name` character project name

`subject_code` character subject code

`strict` whether to check if subject folders exist

Method `meta_data()`: get subject meta data located in "meta/" folder

Usage:

```
RAVESubject$meta_data(
  meta_type = c("electrodes", "frequencies", "time_points", "epoch", "references"),
  meta_name = "default"
)
```

Arguments:

`meta_type` choices are 'electrodes', 'frequencies', 'time_points', 'epoch', 'references'

`meta_name` if `meta_type='epoch'`, read in 'epoch_<meta_name>.csv'; if `meta_type='references'`, read in 'reference_<meta_name>.csv'.

Returns: data frame

Method `valid_electrodes()`: get valid electrode numbers

Usage:

```
RAVESubject$valid_electrodes(reference_name, refresh = FALSE)
```

Arguments:

reference_name character, reference name, see meta_name in self\$meta_data or [load_meta2](#) when meta_type is 'reference'

refresh whether to reload reference table before obtaining data, default is false

Returns: integer vector of valid electrodes

Method initialize_paths(): create subject's directories on hard disk

Usage:

```
RAVESubject$initialize_paths(include_freesurfer = TRUE)
```

Arguments:

include_freesurfer whether to create 'FreeSurfer' path

Method set_default(): set default key-value pair for the subject, used by 'RAVE' modules

Usage:

```
RAVESubject$set_default(key, value, namespace = "default")
```

Arguments:

key character

value value of the key

namespace file name of the note (without post-fix)

Returns: The same as value

Method get_default(): get default key-value pairs for the subject, used by 'RAVE' modules

Usage:

```
RAVESubject$get_default(
  ...,
  default_if_missing = NULL,
  simplify = TRUE,
  namespace = "default"
)
```

Arguments:

... single key, or a vector of character keys

default_if_missing default value is any key is missing

simplify whether to simplify the results if there is only one key to fetch; default is TRUE

namespace file name of the note (without post-fix)

Returns: A named list of key-value pairs, or if one key is specified and simplify=TRUE, then only the value will be returned.

Method get_note_summary(): get summary table of all the key-value pairs used by 'RAVE' modules for the subject

Usage:

```
RAVESubject$get_note_summary(namespaces, include_history = FALSE)
```


Arguments:

`namespaces` namespaces for the entries; see method `get_default` or `set_default`. Default is all possible namespaces

`include_history` whether to include history entries; default is false

Returns: A data frame with four columns: 'namespace' for the group name of the entry (entries within the same namespace usually share same module), 'timestamp' for when the entry was registered. 'entry_name' is the name of the entry. If `include_history` is true, then multiple entries with the same 'entry_name' might appear since the obsolete entries are included. 'entry_value' is the value of the corresponding entry.

Method `get_epoch()`: check and get subject's epoch information

Usage:

```
RAVESubject$get_epoch(epoch_name, as_table = FALSE, trial_starts = 0)
```

Arguments:

`epoch_name` epoch name, depending on the subject's meta files

`as_table` whether to convert to [data.frame](#); default is false

`trial_starts` the start of the trial relative to epoch time; default is 0

Returns: If `as_table` is FALSE, then returns as [RAVEEpoch](#) instance; otherwise returns epoch table; will raise errors when file is missing or the epoch is invalid.

Method `get_reference()`: check and get subject's reference information

Usage:

```
RAVESubject$get_reference(reference_name, simplify = FALSE)
```

Arguments:

`reference_name` reference name, depending on the subject's meta file settings

`simplify` whether to only return the reference column

Returns: If `simplify` is true, returns a vector of reference electrode names, otherwise returns the whole table; will raise errors when file is missing or the reference is invalid.

Method `get_electrode_table()`: check and get subject's electrode table with electrodes that are load-able

Usage:

```
RAVESubject$get_electrode_table(
  electrodes,
  reference_name,
  subset = FALSE,
  simplify = FALSE
)
```

Arguments:

`electrodes` characters indicating integers such as "1-14,20-30", or integer vector of electrode numbers

`reference_name` see method `get_reference`

`subset` whether to subset the resulting data table

simplify whether to only return electrodes

Returns: If simplify is true, returns a vector of electrodes that are valid (or won't be excluded) under given reference; otherwise returns a table. If subset is true, then the table will be subset and only rows with electrodes to be loaded will be kept.

Method `get_frequency()`: check and get subject's frequency table, time-frequency decomposition is needed.

Usage:

```
RAVEsubject$get_frequency(simplify = TRUE)
```

Arguments:

simplify whether to simplify as vector

Returns: If simplify is true, returns a vector of frequencies; otherwise returns a table.

Method `clone()`: The objects of this class are cloneable with this method.

Usage:

```
RAVEsubject$clone(deep = FALSE)
```

Arguments:

deep Whether to make a deep clone.

See Also

[load_meta2](#)

rave_brain

Load 'FreeSurfer' or 'AFNI/SUMA' brain from 'RAVE'

Description

Create 3D visualization of the brain and visualize with modern web browsers

Usage

```
rave_brain(
  subject,
  surfaces = "pial",
  use_141 = TRUE,
  recache = FALSE,
  clean_before_cache = FALSE,
  compute_template = FALSE,
  usetemplateifmissing = FALSE,
  include_electrodes = TRUE
)
```

Arguments

subject	character, list, or RAVESubject instance; for list or other objects, make sure subject\$subject_id is a valid 'RAVE' subject 'ID'
surfaces	one or more brain surface types from "pial", "white", "smoothwm", "pial-outer-smoothed", etc.; check freesurfer_brain2
use_141	whether to use 'AFNI/SUMA' standard 141 brain
recache	whether to re-calculate cache; only should be used when the original 'FreeSurfer' or 'AFNI/SUMA' files are changed; such as new files are added
clean_before_cache	whether to clean the original cache before recache; only set it to be true if original cached files are corrupted
compute_template	whether to compute template mappings; useful when template mapping with multiple subjects are needed
usetemplateifmissing	whether to use template brain when the subject brain files are missing. If set to true, then a template (usually 'N27') brain will be displayed as an alternative solution, and electrodes will be rendered according to their 'MNI305' coordinates, or 'VertexNumber' if given.
include_electrodes	whether to include electrode in the model; default is true

Value

A 'threeBrain' instance if brain is found or usetemplateifmissing is set to true; otherwise returns NULL

Examples

```
# Please make sure DemoSubject is correctly installed
# The subject is ~1GB from Github
brain <- rave_brain("demo/DemoSubject")

brain

if(interactive() && !is.null(brain)){
  brain$plot()
}
```

rave_command_line_path

Find and execute external command-line tools

Description

Find and execute external command-line tools

Usage

```
normalize_commandline_path(  
  path,  
  type = c("dcm2niix", "freesurfer", "fsl", "afni", "others"),  
  unset = NA  
)
```

```
cmd_dcm2niix(error_on_missing = TRUE, unset = NA)
```

```
cmd_freesurfer_home(error_on_missing = TRUE, unset = NA)
```

```
cmd_fsl_home(error_on_missing = TRUE, unset = NA)
```

```
cmd_afni_home(error_on_missing = TRUE, unset = NA)
```

```
cmd_homebrew(error_on_missing = TRUE, unset = NA)
```

```
is_dry_run()
```

Arguments

path	path to normalize
type	type of command
unset	default to return if the command is not found
error_on_missing	whether to raise errors if command is missing

Value

Normalized path to the command, or unset if command is missing.

rave_directories	<i>Returns a list of 'RAVE' directories</i>
------------------	---

Description

This function is internally used and should not be called directly.

Usage

```
rave_directories(
  subject_code,
  project_name,
  blocks = NULL,
  .force_format = c("", "native", "BIDS")
)
```

Arguments

subject_code	'RAVE' subject code
project_name	'RAVE' project name
blocks	session or block names, optional
.force_format	format of the data, default is automatically detected.

Value

A list of directories

rave_export	<i>Export 'RAVE' data</i>
-------------	---------------------------

Description

Export portable data for custom analyses.

Usage

```
rave_export(x, path, ...)

## Default S3 method:
rave_export(x, path, format = c("rds", "yaml", "json"), ...)

## S3 method for class 'rave_prepare_subject_raw_voltage_with_epoch'
rave_export(x, path, zip = FALSE, ...)

## S3 method for class 'rave_prepare_subject_voltage_with_epoch'
```

```
rave_export(x, path, zip = FALSE, ...)

## S3 method for class 'rave_prepare_power'
rave_export(x, path, zip = FALSE, ...)
```

Arguments

x	R object or 'RAVE' repositories
path	path to save to
...	passed to other methods
format	export format
zip	whether to zip the files

Value

Exported data path

Examples

```
x <- "my data"
path <- tempfile()
rave_export(x, path)

readRDS(path)

## Not run:
# Needs demo subject
path <- tempfile()
x <- prepare_subject_power("demo/DemoSubject")

# Export power data to path
rave_export(x, path)

## End(Not run)
```

rave_import

Import data into 'rave' projects

Description

Import files with predefined structures. Supported file formats include 'Matlab', 'HDF5', 'EDF(+)', 'BrainVision' ('.eeg/.dat/.vhdr'). Supported file structures include 'rave' native structure and 'BIDS' (very limited) format. Please see <https://openwetware.org/wiki/RAVE:ravepreprocess> for tutorials.

Usage

```

rave_import(
  project_name,
  subject_code,
  blocks,
  electrodes,
  format,
  sample_rate,
  conversion = NA,
  data_type = "LFP",
  task_runs = NULL,
  add = FALSE,
  ...
)

```

Arguments

project_name	project name, for 'rave' native structure, this can be any character; for 'BIDS' format, this must be consistent with 'BIDS' project name. For subjects with multiple tasks, see Section "'RAVE' Project"
subject_code	subject code in character. For 'rave' native structure, this is a folder name under raw directory. For 'BIDS', this is subject label without "sub-" prefix
blocks	characters, for 'rave' native format, this is the folder names subject directory; for 'BIDS', this is session name with "ses-". Section "Block vs. Session" for different meaning of "blocks" in 'rave' and 'BIDS'
electrodes	integers electrode numbers
format	integer from 1 to 6, or character. For characters, you can get options by running <code>names(IMPORT_FORMATS)</code>
sample_rate	sample frequency, must be positive
conversion	physical unit conversion, choices are NA, V, mV, uV
data_type	electrode signal type; see SIGNAL_TYPES
task_runs	for 'BIDS' formats only, see Section "Block vs. Session"
add	whether to add electrodes. If set to true, then only new electrodes are allowed to be imported, blocks will be ignored and trying to import electrodes that have been imported will still result in error.
...	other parameters

Value

None

'RAVE' Project

A 'rave' project can be very flexible. A project can refer to a task, a research objective, or "arbitrarily" as long as you find common research interests among subjects. One subject can appear in

multiple projects with different blocks, hence `project_name` should be objective-based. There is no concept of "project" in 'rave' raw directory. When importing data, you choose subset of blocks from subjects forming a project.

When importing 'BIDS' data into 'rave', `project_name` must be consistent with 'BIDS' project name as a compromise. Once imported, you may change the project folder name in imported rave data directory to other names. Because once raw traces are imported, 'rave' data will become self-contained and 'BIDS' data are no longer required for analysis. This naming inconsistency will also be ignored.

Block vs. Session

'rave' and 'BIDS' have different definitions for a "chunk" of signals. In 'rave', we use "block". it means combination of session (days), task, and run, i.e. a block of continuous signals captured. Raw data files are supposed to be stored in file hierarchy of `<raw-root>/<subject_code>/<block>/<datafiles>`. In 'BIDS', sessions, tasks, and runs are separated, and only session names are indicated under subject folder. Because some previous compatibility issues, argument 'block' refers to direct folder names under subject directories. This means when importing data from 'BIDS' format, block argument needs to be session names to comply with 'subject/block' structure, and there is an additional mandatory argument `task_runs` especially designed for 'BIDS' format.

For 'rave' native raw data format, block will be as-is once imported.

For 'BIDS' format, `task_runs` will be treated as blocks once imported.

File Formats

Following file structure. Here use project "demo" and subject "YAB" and block "008"), electrode 14 as an example.

format=1, **or** ".mat/.h5 file per electrode per block" folder `<raw>/YAB/008` contains 'Matlab' or 'HDF5' files per electrode. Data file name should look like "xxx_14.mat"

format=2, **or** "Single .mat/.h5 file per block" `<raw>/YAB/008` contains only one 'Matlab' or 'HDF5' file. Data within the file should be a 2-dimensional matrix, where the column 14 is signal recorded from electrode 14

format=3, **or** "Single EDF(+) file per block" `<raw>/YAB/008` contains only one 'edf' file

format=4, **or** "Single BrainVision file (.vhdr+.eeg, .vhdr+.dat) per block" `<raw>/YAB/008` contains only one 'vhdr' file, and the data file must be inferred from the header file

format=5, **or** "BIDS & EDF(+)" `<bids>/demo/sub-YAB/ses-008/` must contains *_electrodes.tsv, each run must have channel file. The channel files and electrode file must be consistent in names.

Argument `task_runs` is mandatory, characters, combination of session, task name, and run number. For example, a task header file in BIDS with name 'sub-YAB_ses-008_task-visual_run-01_ieeg.edf' has `task_runs` name as '008-visual-01', where the first '008' refers to session, 'visual' is task name, and the second '01' is run number.

format=6, **or** "BIDS & BrainVision (.vhdr+.eeg, .vhdr+.dat)" Same as previous format "BIDS & EDF(+)", but data files have 'BrainVision' formats.

 rave_subject_format_conversion

Compatibility support for 'RAVE' 1.0 format

Description

Convert 'RAVE' subject generated by 2.0 pipeline such that 1.0 modules can use the data. The subject must have valid electrodes. The data must be imported, with time-frequency transformed to pass the validation before converting.

Usage

```
rave_subject_format_conversion(subject, verbose = TRUE, ...)
```

Arguments

subject	'RAVE' subject characters, such as 'demo/YAB', or a subject instance generated from RAVESubject
verbose	whether to verbose the messages
...	ignored, reserved for future use

Value

Nothing

 read-brainvision-eeg *Load from 'BrainVision' file*

Description

Read in 'eeg' or 'ieeg' data from 'BrainVision' files with .eeg or .dat extensions.

Usage

```
read_eeg_header(file)
```

```
read_eeg_data(header, path = NULL)
```

Arguments

file	path to 'vhdr' header file
header	header object returned by read_eeg_header
path	optional, path to data file if original data file is missing or renamed; must be absolute path.

Details

A 'BrainVision' dataset is usually stored separately in header file (.vhdr), marker file (.vmrk, optional) and data file (.eeg or .dat). These files must store under a same folder to be read into R.

Header data contains channel information. Data "channel" contains channel name, reference, resolution and physical unit. "resolution" times digital data values is the physical value of the recorded data. `read_eeg_data` makes this conversion internally. "unit" is the physical unit of recordings. By default 'uV' means micro-volts.

Marker file that ends with .vmrk is optional. If the file is indicated by header file and exists, then a marker table will be included when reading headers. A marker table contains six columns: marker number, type, description, start position (in data point), size (duration in data points), and target channel (0 means applied for all channels).

Signal file name is usually contained within header file. Therefore it is desired that the signal file name never changed once created. However, in some cases when the signal files are renamed and cannot be indexed by header files, please specify path to force load signals from a different file.

Value

`read_eeg_header` returns a list containing information below:

<code>raw</code>	raw header contents
<code>common</code>	a list of descriptors of header
<code>channels</code>	table of channels, including number, reference, resolution and unit
<code>sample_rate</code>	sampling frequency
<code>root_path</code>	directory to where the data is stored
<code>channel_counts</code>	total channel counts
<code>markers</code>	NULL if marker file is missing, or list of marker description and table containing 6 columns.

`read_eeg_data` returns header, signal data and data description:

<code>data</code>	a matrix of signal values. Each row is a channel and each column is a time point.
-------------------	---

Examples

```
header_file <- 'sub-01_ses-01_task-visual_run-01_ieeg.vhdr'

if( file.exists(header_file) ){
  # load a subject header
  header <- read_eeg_header(header_file)

  # load entire signal
  data <- read_eeg_data(header)

  data$description
}
```

read-write-fst	<i>Read a 'fst' file</i>
----------------	--------------------------

Description

Read a 'fst' file

Usage

```
save_fst(x, path, ...)

load_fst(path, ..., as.data.table = TRUE)
```

Arguments

x	data frame to write to path
path	path to 'fst' file: must not be connection.
...	passed to read_fst or write_fst
as.data.table	passed to read_fst in fst package

read_csv_ieeg	<i>Read comma separated value file and ignore headers</i>
---------------	---

Description

Resolved some irregular 'iEEG' format where the header could be missing.

Usage

```
read_csv_ieeg(file, nrows = Inf, drop = NULL)
```

Arguments

file	comma separated value file to read from. The file must contains all numerical values
nrows	number of rows to read
drop	passed to fread

Details

The function checks the first two rows of comma separated value file. If the first row has different [storage.mode](#) than the second row, then the first row is considered header, otherwise header is treated missing. Note file must have at least two rows.

read_edf_header	<i>Read 'EDF(+)' or 'BDF(+)' file headers</i>
-----------------	---

Description

Wrapper of `readEdfHeader`, but added some information

Usage

```
read_edf_header(path)
```

Arguments

path file path, passed to `readEdfHeader`

Details

The added names are: `isAnnot2`, `sampleRate2`, and `unit2`. To avoid conflict with other names, there is a "2" appended to each names. `isAnnot2` indicates whether each channel is annotation channel or recorded signals. `sampleRate2` is a vector of sample rates for each channels. `unit2` is physical unit of recorded signals. For 'iEEG' data, this is electric potential unit, and choices are 'V' for volt, 'mV' for millivolt, and 'uV' for micro-volt. For more details, see <https://www.edfplus.info/specs/edftexts.html>

Value

A list is header information of an 'EDF/BDF' file.

See Also

[readEdfHeader](#)

read_edf_signal	<i>Read 'EDF(+)' or 'BDF(+)' file signals</i>
-----------------	---

Description

Read 'EDF(+)' or 'BDF(+)' file signals

Usage

```
read_edf_signal(  
  path,  
  signal_numbers = NULL,  
  convert_volt = c("NA", "V", "mV", "uV")  
)
```

Arguments

path	file path, passed to readEdfHeader
signal_numbers	channel/electrode numbers
convert_volt	convert voltage (electric potential) to a new unit, NA means no conversion, other choices are 'V', 'mV', and 'uV'.

Value

A list containing header information, signal lists, and channel/electrode names. If `signal_numbers` is specified, the corresponding names should appear as `selected_signal_names`. `get_signal()` can get physical signals after unit conversion.

read_mat	<i>Read 'Matlab' files</i>
----------	----------------------------

Description

A compatible reader that can read both 'Matlab' files prior and after version 6.0

Usage

```
read_mat(file, ram = TRUE)
read_mat2(file, ram = TRUE)
```

Arguments

file	path to a 'Matlab' file
ram	whether to load data into memory. Only available when the file is in 'HDF5' format. Default is false and will load arrays, if set to true, then lazy-load data. This is useful when array is very large.

Details

[readMat](#) can only read 'Matlab' files prior to version 6. After version 6, 'Matlab' uses 'HDF5' format to store its data, and `read_mat` can handle both cases.

The performance of `read_mat` can be limited when the file is too big or has many datasets as it reads all the data contained in 'Matlab' file into memory.

Value

A list of All the data stored in the file

See Also

[readMat](#), [load_h5](#)

Examples

```
# Matlab .mat <= v7.3
x <- matrix(1:16, 4)
f <- tempfile()
R.matlab::writeMat(con = f, x = x)

read_mat(f)

# Matlab .mat >= v7.3, using hdf5
# Make sure you have installed hdf5r
if( dipsaus::package_installed('hdf5r') ){

f <- tempfile()
save_h5(x, file = f, name = 'x')

read_mat(f)

# For v7.3, you don't have to load all data into RAM
dat <- read_mat(f, ram = FALSE)
dat

dat$x[]

}
```

read_nsx_nev

Read 'BlackRock' event and signal files

Description

Current implementation supports minimum 2.3 file specification version. Please contact the package maintainer to add specification configurations if you want us to support older versions.

Usage

```
read_nsx_nev(
  paths,
  nev_path = NULL,
  header_only = FALSE,
  nev_data = TRUE,
  verbose = TRUE,
  ram = FALSE,
  force_update = FALSE,
  temp_path = file.path(tempdir(), "blackrock-temp")
)
```

Arguments

paths	'NSx' signal files, usually with file extensions such as '.ns1', '.ns2', '.ns3', '.ns4', '.ns5'.
nev_path	'NEV' event files, with file extension '.nev'
header_only	whether to load header information only and avoid reading signal arrays
nev_data	whether to load '.nev' comments and 'waveforms'
verbose	whether to print out progress when loading signal array
ram	whether to load signals into the memory rather than storing with <code>filearray</code> ; default is false
force_update	force updating the channel data even if the headers haven't changed
temp_path	temporary directory to store the channel data

safe_read_csv	<i>Read comma separated value files with given column classes</i>
---------------	---

Description

Read comma separated value files with given column classes

Usage

```
safe_read_csv(
  file,
  header = TRUE,
  sep = ",",
  colClasses = NA,
  skip = 0,
  quote = "\"",
  ...,
  stringsAsFactors = FALSE
)
```

Arguments

file, header, sep, colClasses, skip, quote, stringsAsFactors, ...
passed to read.csv

Details

Reading a comma separated value file using builtin function `read.csv` might result in some unexpected behavior. `safe_read_csv` does some preprocessing on the format so that it take cares of the following cases.

1. If `skip` exceeds the maximum rows of the data, return a blank data frame instead of raising error.

2. If row names are included in the file, colClasses automatically skip that column and starts from the second column
3. If length of colClasses does not equal to the number of columns, instead of cycling the class types, we set those columns to be NA type and let read.csv decide the default types.
4. stringsAsFactors is by default FALSE to be consistent with R 4.0, if the function is called in R 3.x.

Value

A data frame

Examples

```
f <- tempfile()
x <- data.frame(a = letters[1:10], b = 1:10, c = 2:11)

# ----- Auto-detect row names -----
# Write with rownames
utils::write.csv(x, f, row.names = LETTERS[2:11])

# read csv with base library utils
table1 <- utils::read.csv(f, colClasses = c('character', 'character'))

# 4 columns including row names
str(table1)

# read csv via safe_read_csv
table2 <- safe_read_csv(f, colClasses = c('character', 'character'))

# row names are automatically detected, hence 3 columns
# Only first columns are characters, the third column is auto
# detected as numeric
str(table2)

# read table without row names
utils::write.csv(x, f, row.names = FALSE)
table2 <- safe_read_csv(f, colClasses = c('character', 'character'))

# still 3 columns, and row names are 1:nrow
str(table2)

# ----- Blank data frame when nrow too large -----
# instead of raising errors, return blank data frame
safe_read_csv(f, skip = 1000)
```

safe_write_csv	<i>Save data to comma separated value files with backups</i>
----------------	--

Description

Save comma separated value files, if file exists, backup original file.

Usage

```
safe_write_csv(x, file, ..., quiet = FALSE)
```

Arguments

x, file, ...	pass to write.csv
quiet	whether to suppress overwrite message

Value

Normalized path of file

Examples

```
f <- tempfile()
x <- data.frame(a = 1:10)

# File not exists, same as write file, returns normalized `f`
safe_write_csv(x, f)

# Check whether file exists
file.exists(f)

# write again, and the old file will be copied
safe_write_csv(x, f)
```

save_h5	<i>Save objects to 'HDF5' file without trivial checks</i>
---------	---

Description

Save objects to 'HDF5' file without trivial checks

Usage

```
save_h5(
  x,
  file,
  name,
  chunk = "auto",
  level = 4,
  replace = TRUE,
  new_file = FALSE,
  ctype = NULL,
  quiet = FALSE,
  ...
)
```

Arguments

x	an array, a matrix, or a vector
file	path to 'HDF5' file
name	path/name of the data; for example, "group/data_name"
chunk	chunk size
level	compress level from 0 - no compression to 10 - max compression
replace	should data be replaced if exists
new_file	should removing the file if old one exists
ctype	data type such as "character", "integer", or "numeric". If set to NULL then automatically detect types. Note for complex data please store separately the real and imaginary parts.
quiet	whether to suppress messages, default is false
...	passed to other LazyH5\$save

Value

Absolute path of the file saved

See Also

[load_h5](#)

Examples

```
file <- tempfile()
x <- array(1:120, dim = 2:5)

# save x to file with name /group/dataset/1
save_h5(x, file, '/group/dataset/1', chunk = dim(x))

# read data
```

```
y <- load_h5(file, '/group/dataset/1')
y[]
```

save_json	<i>Save or load R object in 'JSON' format</i>
-----------	---

Description

Save or load R object in 'JSON' format

Usage

```
save_json(
  x,
  con = stdout(),
  ...,
  digits = ceiling(-log10(.Machine$double.eps)),
  pretty = TRUE,
  serialize = TRUE
)

load_json(con, ..., map = NULL)
```

Arguments

x	R object to save
con	file or connection
...	other parameters to pass into toJSON or fromJSON
digits	number of digits to save
pretty	whether the output should be pretty
serialize	whether to save a serialized version of x; see 'Examples'.
map	a map to save the results

Value

save_json returns nothing; load_json returns an R object.

Examples

```
# Serialize
save_json(list(a = 1, b = function(){}))

# use toJSON
save_json(list(a = 1, b = function(){}), serialize = FALSE)
```

```
# Demo of using serializer
f1 <- tempfile(fileext = ".json")
save_json(x ~ y + 1, f1)

load_json(f1)

unlink(f1)
```

save_meta2 *Function to save meta data to 'RAVE' subject*

Description

Function to save meta data to 'RAVE' subject

Usage

```
save_meta2(data, meta_type, project_name, subject_code)
```

Arguments

data	data table
meta_type	see load meta
project_name	project name
subject_code	subject code

Value

Either none if no meta matched or the absolute path of file saved.

save_yaml *Write named list to file*

Description

Write named list to file

Usage

```
save_yaml(x, file, ..., sorted = FALSE)
```

Arguments

<code>x</code>	a named list, fastmap2 , or anything that can be transformed into named list via <code>as.list</code>
<code>file, ...</code>	passed to write_yaml
<code>sorted</code>	whether to sort the results by name; default is false

Value

Normalized file path

See Also

[fastmap2](#), [load_yaml](#), [read_yaml](#), [write_yaml](#)

Examples

```
x <- list(a = 1, b = 2)
f <- tempfile()

save_yaml(x, f)

load_yaml(f)

map <- dipsaus::fastmap2(missing_default = NA)
map$c <- 'lol'
load_yaml(f, map = map)

map$a
map$d
```

Tensor

R6 Class for large Tensor (Array) in Hybrid Mode

Description

can store on hard drive, and read slices of GB-level data in seconds

Public fields

`dim` dimension of the array
`dimnames` dimension names of the array
`use_index` whether to use one dimension as index when storing data as multiple files
`hybrid` whether to allow data to be written to disk
`last_used` timestamp of the object was read
`temporary` whether to remove the files once garbage collected

Active bindings

`varnames` dimension names (read-only)

`read_only` whether to protect the swap files from being changed

`swap_file` file or files to save data to

Methods**Public methods:**

- `Tensor$finalize()`
- `Tensor$print()`
- `Tensor$.use_multi_files()`
- `Tensor$new()`
- `Tensor$subset()`
- `Tensor$flatten()`
- `Tensor$to_swap()`
- `Tensor$to_swap_now()`
- `Tensor$get_data()`
- `Tensor$set_data()`
- `Tensor$collapse()`
- `Tensor$operate()`

Method `finalize()`: release resource and remove files for temporary instances

Usage:

```
Tensor$finalize()
```

Method `print()`: print out the data dimensions and snapshot

Usage:

```
Tensor$print(...)
```

Arguments:

... ignored

Returns: self

Method `.use_multi_files()`: Internally used, whether to use multiple files to cache data instead of one

Usage:

```
Tensor$.use_multi_files(mult)
```

Arguments:

mult logical

Method `new()`: constructor

Usage:

```

Tensor$new(
  data,
  dim,
  dimnames,
  varnames,
  hybrid = FALSE,
  use_index = FALSE,
  swap_file = temp_tensor_file(),
  temporary = TRUE,
  multi_files = FALSE
)

```

Arguments:

`data` numeric array

`dim` dimension of the array

`dimnames` dimension names of the array

`varnames` characters, names of `dimnames`

`hybrid` whether to enable hybrid mode

`use_index` whether to use the last dimension for indexing

`swap_file` where to store the data in hybrid mode files to save data by index; default stores in `raveio_getopt('tensor_temp_path')`

`temporary` whether to remove temporary files when existing

`multi_files` if `use_index` is true, whether to use multiple

Method `subset()`: subset tensor*Usage:*

```
Tensor$subset(..., drop = FALSE, data_only = FALSE, .env = parent.frame())
```

Arguments:

`...` dimension slices

`drop` whether to apply `drop` on subset data

`data_only` whether just return the data value, or wrap them as a Tensor instance

`.env` environment where `...` is evaluated

Returns: the sliced data

Method `flatten()`: converts tensor (array) to a table (data frame)*Usage:*

```
Tensor$flatten(include_index = FALSE, value_name = "value")
```

Arguments:

`include_index` logical, whether to include dimension names

`value_name` character, column name of the value

Returns: a data frame with the dimension names as index columns and `value_name` as value column

Method `to_swap()`: Serialize tensor to a file and store it via `write_fst`

Usage:

```
Tensor$to_swap(use_index = FALSE, delay = 0)
```

Arguments:

`use_index` whether to use one of the dimension as index for faster loading

`delay` if greater than 0, then check when last used, if not long ago, then do not swap to hard drive. If the difference of time is greater than `delay` in seconds, then swap immediately.

Method `to_swap_now()`: Serialize tensor to a file and store it via `write_fst` immediately

Usage:

```
Tensor$to_swap_now(use_index = FALSE)
```

Arguments:

`use_index` whether to use one of the dimension as index for faster loading

Method `get_data()`: restore data from hard drive to memory

Usage:

```
Tensor$get_data(drop = FALSE, gc_delay = 3)
```

Arguments:

`drop` whether to apply `drop` to the data

`gc_delay` seconds to delay the garbage collection

Returns: original array

Method `set_data()`: set/replace data with given array

Usage:

```
Tensor$set_data(v)
```

Arguments:

`v` the value to replace the old one, must have the same dimension

notice the a tensor is an environment. If you change at one place, the data from all other places will change. So use it carefully.

Method `collapse()`: apply mean, sum, or median to collapse data

Usage:

```
Tensor$collapse(keep, method = "mean")
```

Arguments:

`keep` which dimensions to keep

`method` "mean", "sum", or "median"

Returns: the collapsed data

Method `operate()`: apply the tensor by anything along given dimension

Usage:


```
Tensor$operate(
  by,
  fun = .Primitive("/"),
  match_dim,
  mem_optimize = FALSE,
  same_dimension = FALSE
)
```

Arguments:

by R object

fun function to apply

match_dim which dimensions to match with the data

mem_optimize optimize memory

same_dimension whether the return value has the same dimension as the original instance

Examples

```
if(interactive()){ # Avoid checkings from CRAN

# Create a tensor
ts <- Tensor$new(
  data = 1:18000000, c(3000,300,20),
  dimnames = list(A = 1:3000, B = 1:300, C = 1:20),
  varnames = c('A', 'B', 'C'))

# Size of tensor when in memory is usually large
# `lobstr::obj_size(ts)` -> 8.02 MB

# Enable hybrid mode
ts$to_swap_now()

# Hybrid mode, usually less than 1 MB
# `lobstr::obj_size(ts)` -> 814 kB

# Subset data
start1 <- Sys.time()
subset(ts, C ~ C < 10 & C > 5, A ~ A < 10)
#> Dimension: 9 x 300 x 4
#> - A: 1, 2, 3, 4, 5, 6,...
#> - B: 1, 2, 3, 4, 5, 6,...
#> - C: 6, 7, 8, 9
end1 <- Sys.time(); end1 - start1
#> Time difference of 0.188035 secs

# Join tensors
ts <- lapply(1:20, function(ii){
  Tensor$new(
    data = 1:9000, c(30,300,1),
    dimnames = list(A = 1:30, B = 1:300, C = ii),
    varnames = c('A', 'B', 'C'), use_index = 2)
})
```

```
ts <- join_tensors(ts, temporary = TRUE)
}
```

test_hdspeed	<i>Simple hard disk speed test</i>
--------------	------------------------------------

Description

Simple hard disk speed test

Usage

```
test_hdspeed(
  path = tempdir(),
  file_size = 1e+06,
  quiet = FALSE,
  abort_if_slow = TRUE,
  use_cache = FALSE
)
```

Arguments

path	an existing directory where to test speed, default is temporary local directory.
file_size	in bytes, default is 1 MB.
quiet	should verbose messages be suppressed?
abort_if_slow	abort test if hard drive is too slow. This usually happens when the hard drive is connected via slow internet: if the write speed is less than 0.1 MB per second.
use_cache	if hard drive speed was tested before, abort testing and return cached results or not; default is false.

Value

A vector of two: writing and reading speed in MB per seconds.

time_diff2	<i>Calculate time difference in seconds</i>
------------	---

Description

Calculate time difference in seconds

Usage

```
time_diff2(start, end, units = "secs", label = "")
```

Arguments

start, end	start and end of timer
units	passed to time_delta
label	rave-units label for display purpose.

Value

A number inherits rave-units class.

See Also

[as_rave_unit](#)

Examples

```
start <- Sys.time()
Sys.sleep(0.1)
end <- Sys.time()
dif <- time_diff2(start, end, label = 'Running ')
print(dif, digits = 4)

is.numeric(dif)

dif + 1
```

url_neurosynth	<i>Get 'Neurosynth' website address using 'MNI152' coordinates</i>
----------------	--

Description

Get 'Neurosynth' website address using 'MNI152' coordinates

Usage

```
url_neurosynth(x, y, z)
```

Arguments

x, y, z	numerical values: the right-anterior-superior 'RAS' coordinates in 'MNI152' space
---------	---

Value

'Neurosynth' website address

validate_subject	<i>Validate subject data integrity</i>
------------------	--

Description

Check against existence, validity, and consistency

Arguments

subject	subject ID (character), or RAVESubject instance
method	validation method, choices are 'normal' (default) or 'basic' for fast checks; if set to 'normal', four additional validation parts will be tested (see parts with * in Section 'Value').
verbose	whether to print out the validation messages
version	data version, choices are 1 for 'RAVE' 1.0 data format, and 2 ('RAVE' 2.0 data format); default is 2

Value

A list of nested validation results. The validation process consists of the following parts in order:

Data paths (paths)

path the subject's root folder

path the subject's 'RAVE' folder (the 'rave' folder under the root directory)

raw_path the subject's raw data folder

data_path a directory storing all the voltage, power, phase data (before reference)

meta_path meta directory containing all the electrode coordinates, reference table, epoch information, etc.

reference_path a directory storing calculated reference signals

preprocess_path a directory storing all the preprocessing information

cache_path (**low priority**) data caching path

freesurfer_path (**low priority**) subject's 'FreeSurfer' directory

note_path (**low priority**) subject's notes

pipeline_path (**low priority**) a folder containing all saved pipelines for this subject

Preprocessing information (preprocess)

electrodes_set whether the subject has a non-empty electrode set

blocks_set whether the session block length is non-zero

sample_rate_set whether the raw sampling frequency is set to a valid, proper positive number

data_imported whether all the assigning electrodes have been imported

notch_filtered whether all the 'LFP' and 'EKG' signals have been 'Notch' filtered

has_wavelet whether all the 'LFP' signals are wavelet-transformed

has_reference at least one reference has been generated in the meta folder

has_epoch at least one epoch file has been generated in the meta folder

has_electrode_file meta folder has electrodes.csv file

Meta information (meta)

meta_data_valid this item only exists when the previous preprocess validation is failed or incomplete

meta_electrode_table the electrodes.csv file in the meta folder has correct format and consistent electrodes numbers to the preprocess information

meta_reference_xxx (xxx will be replaced with actual reference names) checks whether the reference table contains all electrodes and whether each reference data exists

meta_epoch_xxx (xxx will be replaced with actual epoch names) checks whether the epoch table has the correct formats and whether there are missing blocks indicated in the epoch files

Voltage data (voltage_data*)

voltage_preprocessing whether the raw preprocessing voltage data are valid. This includes data lengths are the same within the same blocks for each signal type

voltage_data whether the voltage data (after 'Notch' filters) exist and readable. Besides, the lengths of the data must be consistent with the raw signals

Spectral power and phase (power_phase_data*)

power_data whether the power data exists for all 'LFP' signals. Besides, to pass the validation process, the frequency and time-point lengths must be consistent with the preprocess record

power_data same as power_data but for the phase data

Epoch table (epoch_tables*) One or more sub-items depending on the number of epoch tables.

To pass the validation, the event time for each session block must not exceed the actual signal duration. For example, if one session lasts for 200 seconds, it will invalidate the result if a trial onset time is later than 200 seconds.

Reference table (reference_tables*) One or more sub-items depending on the number of reference tables.

To pass the validation, the reference data must be valid. The inconsistencies, for example, missing file, wrong frequency size, invalid time-point lengths will result in failure

validate_time_window *Validate time windows to be used*

Description

Make sure the time windows are valid intervals and returns a reshaped window list

Usage

```
validate_time_window(time_windows)
```

Arguments

time_windows vectors or a list of time intervals

Value

A list of time intervals (ordered, length of 2)

Examples

```
# Simple time window
validate_time_window(c(-1, 2))

# Multiple windows
validate_time_window(c(-1, 2, 3, 5))

# alternatively
validate_time_window(list(c(-1, 2), c(3, 5)))
validate_time_window(list(list(-1, 2), list(3, 5)))

## Not run:
```

```

# Incorrect usage (will raise errors)

# Invalid interval (length must be two for each intervals)
validate_time_window(list(c(-1, 2, 3, 5)))

# Time intervals must be in ascending order
validate_time_window(c(2, 1))

## End(Not run)

```

voltage_baseline	<i>Calculate voltage baseline</i>
------------------	-----------------------------------

Description

Calculate voltage baseline

Usage

```

voltage_baseline(
  x,
  baseline_windows,
  method = c("percentage", "zscore", "subtract_mean"),
  units = c("Trial", "Electrode"),
  ...
)

## S3 method for class 'rave_prepare_subject_raw_voltage_with_epoch'
voltage_baseline(
  x,
  baseline_windows,
  method = c("percentage", "zscore", "subtract_mean"),
  units = c("Trial", "Electrode"),
  electrodes,
  baseline_mean,
  baseline_sd,
  ...
)

## S3 method for class 'rave_prepare_subject_voltage_with_epoch'
voltage_baseline(
  x,
  baseline_windows,
  method = c("percentage", "zscore", "subtract_mean"),
  units = c("Trial", "Electrode"),

```

```

    electrodes,
    baseline_mean,
    baseline_sd,
    ...
)

## S3 method for class 'FileArray'
voltage_baseline(
  x,
  baseline_windows,
  method = c("percentage", "zscore", "subtract_mean"),
  units = c("Trial", "Electrode"),
  filebase = NULL,
  ...
)

## S3 method for class 'array'
voltage_baseline(
  x,
  baseline_windows,
  method = c("percentage", "zscore", "subtract_mean"),
  units = c("Trial", "Electrode"),
  ...
)

```

Arguments

x	R array, filearray , or 'rave_prepare_power' object created by prepare_subject_raw_voltage_wit
baseline_windows	list of baseline window (intervals)
method	baseline method; choices are 'percentage' and 'zscore'; see 'Details' in baseline_array
units	the unit of the baseline; see 'Details'
...	passed to other methods
electrodes	the electrodes to be included in baseline calculation; for power repository object produced by prepare_subject_power only; default is all available electrodes in each of <code>signal_types</code>
baseline_mean, baseline_sd	internally used by 'RAVE' repository, provided baseline is not contained in the data. This is useful for calculating the baseline with data from other blocks.
filebase	where to store the output; default is NULL and is automatically determined

Details

The arrays must be three-mode tensor and must have valid named [dimnames](#). The dimension names must be 'Trial', 'Time', 'Electrode', case sensitive.

The `baseline_windows` determines the baseline windows that are used to calculate time-points of baseline to be included. This can be one or more intervals and must pass the validation function `validate_time_window`.

The `units` determines the unit of the baseline. It can be either or both of 'Trial', 'Electrode'. The default value is both, i.e., baseline for each combination of trial and electrode.

Value

The same type as the inputs

Examples

```
## Not run:
# The following code need to download additional demo data
# Please see https://rave.wiki/ for more details

library(raveio)
repo <- prepare_subject_raw_voltage_with_epoch(
  subject = "demo/DemoSubject",
  time_windows = c(-1, 3),
  electrodes = c(14, 15))

##### Direct baseline on repository
voltage_baseline(
  x = repo, method = "zscore",
  baseline_windows = list(c(-1, 0), c(2, 3))
)

voltage_mean <- repo$raw_voltage$baselined$collapse(
  keep = c(1,3), method = "mean")
matplot(voltage_mean, type = "l", lty = 1,
  x = repo$raw_voltage$dimnames$Time,
  xlab = "Time (s)", ylab = "Voltage (z-scored)",
  main = "Mean coltage over trial (Baseline: -1~0 & 2~3)")
abline(v = 0, lty = 2, col = 'darkgreen')
text(x = 0, y = -0.5, "Aud-Onset ", col = "darkgreen", cex = 0.6, adj = c(1,1))

##### Alternatively, baseline on each electrode channel
voltage_mean2 <- sapply(repo$raw_voltage$data_list, function(inst) {
  re <- voltage_baseline(
    x = inst, method = "zscore",
    baseline_windows = list(c(-1, 0), c(2, 3)))
  rowMeans(re[])
})

# Same with floating difference
max(abs(voltage_mean - voltage_mean2)) < 1e-8

## End(Not run)
```

with_future_parallel *Enable parallel computing provided by 'future' package within the context*

Description

Enable parallel computing provided by 'future' package within the context

Usage

```
with_future_parallel(
  expr,
  env = parent.frame(),
  quoted = FALSE,
  on_failure = "multisession",
  max_workers = NA,
  ...
)
```

Arguments

expr	the expression to be evaluated
env	environment of the expr
quoted	whether expr has been quoted; default is false
on_failure	alternative 'future' plan to use if forking a process is disallowed; this usually occurs on 'Windows' machines; see details.
max_workers	maximum of workers; default is automatically set by <code>raveio_getopt("max_worker", 1L)</code>
...	additional parameters passing into <code>make_forked_clusters</code>

Details

Some 'RAVE' functions such as `prepare_subject_power` support parallel computing to speed up. However, the parallel computing is optional. You can enable it by wrapping the function calls within `with_future_parallel` (see examples).

The default plan is to use 'forked' R sessions. This is a convenient, fast, and relative simple way to create multiple R processes that share the same memories. However, on some machines such as 'Windows' the support has not yet been implemented. In such cases, the plan fall backs to a back-up specified by `on_failure`. By default, `on_failure` is 'multisession', a heavier implementation than forking the process, and slightly longer ramp-up time. However, the difference should be marginal for most of the functions.

When parallel computing is enabled, the number of parallel workers is specified by the option `raveio_getopt("max_worker", 1L)`.

Value

The evaluation results of expr

Examples

```
library(raveio)

demo_subject <- as_rave_subject("demo/DemoSubject", strict = FALSE)

if(dir.exists(demo_subject$path)) {
  with_future_parallel({
    prepare_subject_power("demo/DemoSubject")
  })
}
```

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