

Package ‘gsDesignTune’

May 8, 2026

Title Dependency-Aware Scenario Exploration for Group Sequential Designs

Version 0.1.0

Description Provides systematic, dependency-aware exploration of group sequential designs created with 'gsDesign'. Supports reproducible grid and random search over user-defined candidate sets, parallel evaluation via the 'future' framework, standardized metric extraction, and auditable reporting for design-space evaluation and trade-off analysis. Methods for group sequential design are described in Anderson (2025) <[doi:10.32614/CRAN.package.gsDesign](https://doi.org/10.32614/CRAN.package.gsDesign)>. The 'future' framework for parallel processing is described in Bengtsson (2021) <[doi:10.32614/RJ-2021-048](https://doi.org/10.32614/RJ-2021-048)>.

License MIT + file LICENSE

URL <https://nanx.me/gsDesignTune/>,
<https://github.com/nanxstats/gsDesignTune>

BugReports <https://github.com/nanxstats/gsDesignTune/issues>

Encoding UTF-8

Depends R (>= 4.1.0)

Imports digest, future.apply, ggplot2, gsDesign, progressr, R6, rlang

Suggests future, knitr, rmarkdown, testthat (>= 3.0.0)

VignetteBuilder knitr

Config/testthat/edition 3

RoxygenNote 7.3.3

NeedsCompilation no

Author Nan Xiao [aut, cre, cph] (ORCID:
<<https://orcid.org/0000-0002-0250-5673>>)

Maintainer Nan Xiao <me@nanx.me>

Repository CRAN

Date/Publication 2026-02-04 18:10:08 UTC

Contents

gsDesignTune	2
GSDTuneJob	3
gsSurvCalendarTune	6
gsSurvTune	7
SpendingFamily	8
SpendingSpec	9
spending_specs	10
toString.function	10
tune_choice	11
tune_dep	11
tune_fixed	12
tune_int	12
tune_seq	13
tune_specs	13
tune_values	14

Index	15
--------------	-----------

gsDesignTune	<i>Create a tune job for gsDesign::gsDesign()</i>
--------------	---

Description

gsDesignTune() is a drop-in replacement for `gsDesign::gsDesign()` that returns a tune job object instead of immediately running a single design.

Usage

```
gsDesignTune(..., upper = NULL, lower = NULL)
```

Arguments

...	Arguments to <code>gsDesign::gsDesign()</code> . Any argument can be replaced by a <code>tune_*()</code> specification.
upper, lower	Optional spending specifications provided as <code>SpendingSpec</code> or <code>SpendingFamily</code> . When supplied, these are translated to the underlying <code>(sfu, sfupar) / (sfl, sflpar)</code> arguments.

Details

Any argument can be replaced by a tuning specification created by `tune_*()`. Use `SpendingSpec` / `SpendingFamily` via `upper=` and `lower=` for dependency-aware spending function tuning.

Value

A `GSDTuneJob` R6 object.

Examples

```
job <- gsDesignTune(  
  k = 3,  
  test.type = 4,  
  alpha = tune_values(list(0.025, 0.03))  
)  
  
job$run(strategy = "grid", parallel = FALSE, seed = 1)  
utils::head(job$results())
```

GSDTuneJob

GSDTuneJob

Description

GSDTuneJob

GSDTuneJob

Details

R6 class representing a dependency-aware tuning job for group sequential designs created by `gsDesign::gsDesign()` or `gsDesign::gsSurv()`.

Value

An R6 class generator. Use `$new()` to create a GSDTuneJob object.

Public fields

`target` Target design function name ("gsDesign" or "gsSurv").
`base_args` Named list of fixed arguments passed to the target function.
`tune_specs` Named list of tuning specifications for explored arguments.
`param_space` Internal parameter space used for configuration generation.
`spec` Audit record including base/tuned args and `sessionInfo()`.

Methods

Public methods:

- `GSDTuneJob$new()`
- `GSDTuneJob$run()`
- `GSDTuneJob$results()`
- `GSDTuneJob$summarize()`
- `GSDTuneJob$design()`
- `GSDTuneJob$call_args()`

- `GSDTuneJob$best()`
- `GSDTuneJob$pareto()`
- `GSDTuneJob$plot()`
- `GSDTuneJob$report()`
- `GSDTuneJob$clone()`

Method `new()`: Create a new tune job.

Usage:

```
GSDTuneJob$new(target = c("gsDesign", "gsSurv", "gsSurvCalendar"), args)
```

Arguments:

`target` Target function name ("gsDesign", "gsSurv", or "gsSurvCalendar").
`args` Named list of evaluated arguments.

Method `run()`: Evaluate configurations under a search strategy.

Usage:

```
GSDTuneJob$run(
  strategy = c("grid", "random"),
  n = NULL,
  parallel = TRUE,
  seed = NULL,
  cache_dir = NULL,
  metrics_fun = NULL
)
```

Arguments:

`strategy` Search strategy ("grid" or "random").
`n` Number of configurations for random search.
`parallel` Whether to evaluate configurations in parallel.
`seed` Optional seed for reproducibility.
`cache_dir` Optional directory to cache design objects as RDS.
`metrics_fun` Optional metric hook.

Method `results()`: Return the results data.frame.

Usage:

```
GSDTuneJob$results()
```

Method `summarize()`: Summarize the run (counts + numeric metric summaries).

Usage:

```
GSDTuneJob$summarize()
```

Method `design()`: Retrieve a design object for configuration `i`.

Usage:

```
GSDTuneJob$design(i)
```

Arguments:

`i` Row index of the configuration.

Method `call_args()`: Return the underlying argument list for configuration `i`.

Usage:

```
GSDTuneJob$call_args(i)
```

Arguments:

`i` Row index of the configuration.

Method `best()`: Rank configurations by a metric (with optional constraints).

Usage:

```
GSDTuneJob$best(metric, direction = c("min", "max"), constraints = NULL)
```

Arguments:

`metric` Metric column name.

`direction` Ranking direction ("min" or "max").

`constraints` Optional constraints (function or expression).

Method `pareto()`: Compute a Pareto (non-dominated) set for multiple metrics.

Usage:

```
GSDTuneJob$pareto(metrics, directions)
```

Arguments:

`metrics` Metric column names.

`directions` Directions for each metric ("min"/"max").

Method `plot()`: Create a quick exploration plot.

Usage:

```
GSDTuneJob$plot(metric, x, color = NULL, facet = NULL)
```

Arguments:

`metric` Y-axis metric column name.

`x` X-axis column name.

`color` Optional color column name.

`facet` Optional faceting column name.

Method `report()`: Render an HTML report.

Usage:

```
GSDTuneJob$report(path)
```

Arguments:

`path` Output HTML file path.

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

Usage:

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

Arguments:

`deep` Whether to make a deep clone.

Examples

```
job <- GSDTuneJob$new(target = "gsDesign", args = list(k = 3, alpha = 0.025))
job$spec$target
```

gsSurvCalendarTune *Create a tune job for gsDesign::gsSurvCalendar()*

Description

gsSurvCalendarTune() is a drop-in replacement for `gsDesign::gsSurvCalendar()` that returns a tune job object instead of immediately running a single design.

Usage

```
gsSurvCalendarTune(..., upper = NULL, lower = NULL)
```

Arguments

... Arguments to `gsDesign::gsSurvCalendar()`. Any argument can be replaced by a `tune_*`() specification.

upper, lower Optional spending specifications provided as `SpendingSpec` or `SpendingFamily`. When supplied, these are translated to the underlying `(sfu, sfupar) / (sf1, sf1par)` arguments.

Details

Any argument can be replaced by a tuning specification created by `tune_*`(). Use `SpendingSpec` / `SpendingFamily` via `upper=` and `lower=` for dependency-aware spending function tuning.

Value

A `GSDTuneJob` R6 object.

Examples

```
job <- gsSurvCalendarTune(
  calendarTime = tune_values(list(c(12, 24, 36), c(12, 24, 48))),
  spending = c("information", "calendar")
)

job$run(strategy = "grid", parallel = FALSE, seed = 1)
utils::head(job$results())
```

gsSurvTune	<i>Create a tune job for <code>gsDesign::gsSurv()</code></i>
------------	--

Description

`gsSurvTune()` is a drop-in replacement for `gsDesign::gsSurv()` that returns a tune job object instead of immediately running a single design.

Usage

```
gsSurvTune(..., upper = NULL, lower = NULL)
```

Arguments

<code>...</code>	Arguments to <code>gsDesign::gsSurv()</code> . Any argument can be replaced by a <code>tune_*</code> () specification.
<code>upper, lower</code>	Optional spending specifications provided as <code>SpendingSpec</code> or <code>SpendingFamily</code> . When supplied, these are translated to the underlying <code>(sfu, sfupar) / (sf1, sf1par)</code> arguments.

Details

Any argument can be replaced by a tuning specification created by `tune_*`(). Use `SpendingSpec` / `SpendingFamily` via `upper=` and `lower=` for dependency-aware spending function tuning.

Value

A `GSDTuneJob` R6 object.

Examples

```
job <- gsSurvTune(
  k = 3,
  test.type = 4,
  hr = tune_values(list(0.6, 0.7))
)

job$run(strategy = "grid", parallel = FALSE, seed = 1)
utils::head(job$results())
```

SpendingFamily

SpendingFamily

Description

SpendingFamily

SpendingFamily

Details

An R6 class representing a set of spending function specifications. Each family member is a SpendingSpec.

Value

An R6 class generator. Use `$new()` to create a SpendingFamily object.

Public fields

`members` List of SpendingSpec objects.

Methods

Public methods:

- [SpendingFamily\\$new\(\)](#)
- [SpendingFamily\\$expand\(\)](#)
- [SpendingFamily\\$clone\(\)](#)

Method `new()`: Create a new spending family from one or more SpendingSpec.

Usage:

```
SpendingFamily$new(...)
```

Arguments:

... SpendingSpec objects.

Method `expand()`: Expand all members to spending settings.

Usage:

```
SpendingFamily$expand()
```

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

Usage:

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

Arguments:

`deep` Whether to make a deep clone.

Examples

```
fam <- SpendingFamily$new(
  SpendingSpec$new(gsDesign::sfHSD, par = tune_fixed(-4)),
  SpendingSpec$new(gsDesign::sfLD0F, par = tune_fixed(0))
)
fam$expand()
```

SpendingSpec

SpendingSpec

Description

SpendingSpec

SpendingSpec

Details

An R6 class representing a single spending function (fun) and a tuning specification for its parameter (par).

Value

An R6 class generator. Use `$new()` to create a SpendingSpec object.

Public fields

fun Spending function (callable with signature (alpha, t, param)).

fun_label Label captured from the constructor call (used for plotting).

par Tuning specification for the spending parameter.

Methods**Public methods:**

- [SpendingSpec\\$new\(\)](#)
- [SpendingSpec\\$expand\(\)](#)
- [SpendingSpec\\$clone\(\)](#)

Method `new()`: Create a new spending specification.

Usage:

```
SpendingSpec$new(fun, par = tune_fixed(NULL))
```

Arguments:

fun Spending function.

par Spending parameter specification.

Method `expand()`: Expand to a list of spending settings (fun + concrete parameter values).

Usage:

```
SpendingSpec$expand()
```

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

Usage:

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

Arguments:

deep Whether to make a deep clone.

Examples

```
spec <- SpendingSpec$new(gsDesign::sfHSD, par = tune_seq(-4, -2, length_out = 2))
spec$expand()
```

spending_specs	<i>Spending function specifications</i>
----------------	---

Description

SpendingSpec and SpendingFamily provide a dependency-aware and user-friendly way to tune spending functions and their parameters.

toString.function	<i>Convert a function to a short label string</i>
-------------------	---

Description

`gsDesignTune()` uses function-valued columns (for example, spending functions) in results tables. This method provides a stable, readable label for such functions to keep printing and plotting robust.

Usage

```
## S3 method for class ``function``
toString(x, ...)
```

Arguments

x	A function.
...	Unused (included for S3 method compatibility).

Value

A character scalar.

Examples

```
toString(stats::rnorm)
```

tune_choice	<i>Categorical choices</i>
-------------	----------------------------

Description

tune_choice() defines a finite set of categorical choices. Each argument in ... is treated as one choice (including functions and other objects).

Usage

```
tune_choice(...)
```

Arguments

... Candidate values.

Value

A gstune_spec object.

Examples

```
tune_choice("A", "B")
```

tune_dep	<i>Dependent tuning specification</i>
----------	---------------------------------------

Description

tune_dep() defines candidates for one argument as a function of other arguments.

Usage

```
tune_dep(depends_on, map)
```

Arguments

depends_on Character vector of argument names this specification depends on.
map A function returning either a tune_*() specification or a fixed value. The function should have arguments matching depends_on (or use ...).

Value

A gstune_spec object.

Examples

```
# sfupar depends on sfu
tune_dep(
  depends_on = "sfu",
  map = function(sfu) {
    if (identical(sfu, gsDesign::sfLDOF)) tune_fixed(0) else tune_seq(-4, 4, 9)
  }
)
```

tune_fixed	<i>Fixed (non-tuned) value</i>
------------	--------------------------------

Description

Use `tune_fixed()` to explicitly mark a value as fixed. This is mainly useful inside dependent specifications such as `tune_dep()`.

Usage

```
tune_fixed(x)
```

Arguments

x Any R object.

Value

A `gstune_spec` object.

Examples

```
tune_fixed(0.025)
```

tune_int	<i>Integer sequence candidates</i>
----------	------------------------------------

Description

Integer sequence candidates

Usage

```
tune_int(from, to, by = 1)
```

Arguments

from, to Integer scalars.
by Integer scalar step size.

Value

A `gstune_spec` object.

Examples

```
tune_int(2, 5)
```

tune_seq	<i>Numeric sequence candidates</i>
----------	------------------------------------

Description

Numeric sequence candidates

Usage

```
tune_seq(from, to, length_out)
```

Arguments

from, to Numeric scalars.
length_out Integer scalar, the number of candidates.

Value

A `gstune_spec` object.

Examples

```
tune_seq(0.55, 0.75, length_out = 5)
```

tune_specs	<i>Tune specifications</i>
------------	----------------------------

Description

`gsDesignTune()` and `gsSurvTune()` treat most arguments as fixed values. Wrap an argument in a `tune_*` specification to explore candidate values.

tune_values	<i>Explicit candidate values</i>
-------------	----------------------------------

Description

tune_values() defines a finite set of candidate values. Values are provided as a list so vector-valued candidates (for example, timing) are treated as atomic.

Usage

```
tune_values(values)
```

Arguments

values A list of candidate values.

Value

A gstune_spec object.

Examples

```
tune_values(list(0.55, 0.65, 0.75))  
tune_values(list(c(0.33, 0.67, 1), c(0.5, 0.75, 1)))
```

Index

`gsDesign::gsDesign()`, 2, 3
`gsDesign::gsSurv()`, 3, 7
`gsDesign::gsSurvCalendar()`, 6
`gsDesignTune`, 2
`gsDesignTune()`, 10
`GSDTuneJob`, 3
`gsSurvCalendarTune`, 6
`gsSurvTune`, 7

`spending_specs`, 10
`SpendingFamily`, 8
`SpendingSpec`, 9

`toString`.function, 10
`tune_choice`, 11
`tune_dep`, 11
`tune_fixed`, 12
`tune_int`, 12
`tune_seq`, 13
`tune_specs`, 13
`tune_values`, 14