

# Package ‘metaheur’

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**Type** Package

**Title** Metaheuristic Optimization Framework for Preprocessing  
Combinations

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**Description** Automation of preprocessing often requires computationally costly preprocessing combinations. This package helps to find near-best combinations faster. Metaheuristics supported are taboo search, simulated annealing, reheating and late acceptance. Start conditions include random and grid starts. End conditions include all iteration rounds completed, objective threshold reached and convergence. Metaheuristics, start and end conditions can be hybridized and hyperparameters optimized. Parallel computations are supported. The package is intended to be used with package 'preprocomb' and takes its 'GridClass' object as input.

**License** GPL-2

**LazyData** TRUE

**Depends** R (>= 2.10)

**Imports** utils, methods, stats, reshape2, ggplot2, preprocomb (>= 0.3.0), doParallel, foreach

**Suggests** testthat, knitr, rmarkdown, rpart

**RoxygenNote** 5.0.1

**VignetteBuilder** knitr

**NeedsCompilation** no

**Repository** CRAN

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examplegrid	<i>preprocessing combinations example</i>
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## Description

An example grid object made of modified Iris-data with package preprocomb.  
 Contains 540 preprocessing combinations and corresponding preprocessed data sets.  
 Can be used with metaheur() or metaheurhyper() functions as an example grid.

## Usage

```
examplegrid
```

## Format

A GridClass object

## Details

```
modifiediris <- droplevels(iris[-c(1:60),])
examplegrid <- preprocomb::setgrid(phases=c("scaling", "smoothing", "outliers", "selection", "sampling"), data=modifiediris)
```

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examplehyperparam      *hyperparameter optimization example*

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**Description**

An example of metaheuristic hyperparameter optimization. Can be plotted with `plotsearchpath(examplehyperparam)`.

**Usage**

`examplehyperparam`

**Format**

list

**Details**

`examplehyperparam <- metaheurgrid(cores=2, trials=10, iterations=50, nholdout=4)`

NOTE: the above uses `examplegrid` as default grid. Computation time 3,5 hours with Intel Celeron 1.4 Ghz, 2 cores

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examplesearch      *metaheuristic optimization example*

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**Description**

An example of metaheuristic search with `examplegrid`.  
50 iterations and 10 times repeated holdout validation.

**Usage**

`examplesearch`

**Format**

A metaheur class object

**Details**

`examplesearch <- metaheur(examplegrid, iterations=50, nholdout=10, cores=2)`

getbestheur                    *get the best preprocessing combination*

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**Description**

get the best combination and its classification accuracy

**Usage**

```
getbestheur(x)
```

**Arguments**

x                    (metaheur class object) output of function metaheur()

**Value**

(list) best combination, classification accuracy of the best combination

**Examples**

```
##result <- metaheur(examplegrid)
##getbestheur(result)
```

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getlogs                    *get the logs of a metaheur search*

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**Description**

get the logs of a metaheur search

**Usage**

```
getlogs(x, n = NULL)
```

**Arguments**

x                    (metaheur class object) output of function metaheur()  
n                    (integer) number of log entries show, default to all entries

**Examples**

```
##getlogs(examplesearch)
```

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getwalltime	<i>get the execution wall-clock time</i>
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**Description**

get the execution wall-clock time

**Usage**

```
getwalltime(x)
```

**Arguments**

x (metaheur class object) output of function metaheur()

**Examples**

```
##getwalltime(examplesearch)
```

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metaheur	<i>metaheuristic optimization of preprocessing combinations</i>
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**Description**

metaheuristic optimization of preprocessing combinations

**Usage**

```
metaheur(gridclassobject, startgrid = 0, startnum = 1, iterations = 10,
  taboostringlength = 1, initialtemperature = 0.01, tempconst = 0.01,
  reheat = 0.01, nholdout = 2, late = 0, stopcond = 1,
  stopvalue = 0.99, deltafive = 0.05, model = "rpart", cores = 1)
```

**Arguments**

gridclassobject (GridClass) created by setgrid function in preprocomb package

startgrid (integer) 0 random restart (default), 1 grid restart

startnum (integer) number of restarts

iterations (integer) number of iterations done for a restart, defaults to 10

taboostringlength (integer) number of previous solution that can not be revisited, must be 1 or more

initialtemperature	(numeric) initial propability for accepting an inferior candidate, between 0 and 1
tempest	(numeric) multiplier for decreasing temperature on each iteration
reheat	(numeric) propability of increasing temperature on each iteration
nholdout	(integer) number of holdout rounds, defaults to 2
late	(integer) location of previous best solution a candidate is compared to, defaults to 0 for last
stopcond	(integer) type of stopping condition in addition to iterations, default to 1 for threshold, 2 for convergence
stopvalue	(numeric) threshold for stopping, defaults to 0.99
deltafive	(numeric) convergence criteria for last five iterations, defaults to 0.05
model	(character) caret name of predictive model, defaults to "rpart"
cores	(integer) number of cores used in computation of classification accuracy holdout rounds, defaults to 1

### Examples

```
## result <- metaheur(examplegrid, startnum=2, nholdout=2, cores=2)
## getbestheur(result)
```

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metaheur-class	<i>An S4 class to represent metaheuristic optimization results</i>
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### Description

An S4 class to represent metaheuristic optimization results

### Slots

`solutionlist` (list) of best solutions, i.e. preprocessing combinations for each start

`iterationhistory` (list) of iteration classification accuracies for each start

`logs` (list) event log for each start

`walltime` (integer) execution wall-clock time in minutes

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metaheurhyper	<i>search for best hyperparameters for metaheuristic optimization</i>
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**Description**

search for best hyperparameters for metaheuristic optimization

**Usage**

```
metaheurhyper(gridclassobject = examplegrid, searchtype = "grid",
  nrohyperparams = 3, iterations = 10, cores = 1, nholdout = 2,
  trials = 3, model = "rpart")
```

**Arguments**

gridclassobject	(GridClass) created by setgrid function in preprocomb package, defaults to examplegrid
searchtype	(character) grid or random search
nrohyperparams	(integer) number of hyperparameters used in random search, between 1 and 5, default to 3
iterations	(integer) number of iterations done for a restart
cores	(integer) number of cores used in computation of classification accuracies hold-out rounds
nholdout	(integer) number of holdout rounds in computing classification accuracies
trials	(integer) number of trials
model	(character) caret name of predictive model, defaults to "rpart"

**Examples**

```
## result <- metaheurhyper(cores=2, trials=2, iterations=30)
```

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metaheurhyper-class	<i>An S4 class to represent hyperparameter optimization results</i>
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**Description**

An S4 class to represent hyperparameter optimization results

**Slots**

res	(matrix) of classification accuracy results, rows for iterations and columns for parameter combinations
namegrid	(list) parameter combinations
baseheur	(list) metaheur objects
walltime	(integer) execution wall-clock time in minutes

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<code>plotsearchpath</code>	<i>plot search path</i>
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**Description**

Plots the search path, i.e. classification accuracy by iteration. metaheur class plots (output of metaheur function) can include restarts. List of metaheurhyper class objects (output of metaheurhyper function) plot includes best, median and worst scenarios.

**Usage**

```
plotsearchpath(x)
```

**Arguments**

x (metaheur object or list of metaheurgrid class objects) object to be plotted

**Examples**

```
plotsearchpath(examplesearch)  
plotsearchpath(examplehyperparam)
```



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