

# Package ‘dials’

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**Title** Tools for Creating Tuning Parameter Values

**Version** 1.1.0

**Description** Many models contain tuning parameters (i.e. parameters that cannot be directly estimated from the data). These tools can be used to define objects for creating, simulating, or validating values for such parameters.

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**BugReports** <https://github.com/tidymodels/dials/issues>

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activation	<i>Activation functions between network layers</i>
------------	--

---

**Description**

Activation functions between network layers

**Usage**

```
activation(values = values_activation)
```

```
values_activation
```

**Arguments**

values	A character string of possible values. See values_activation in examples below.
--------	---

**Format**

An object of class character of length 5.

**Details**

This parameter is used in parsnip models for neural networks such as `parsnip::mlp()`.

**Examples**

```
values_activation
activation()
```

---

adjust_deg_free	<i>Parameters to adjust effective degrees of freedom</i>
-----------------	--

---

**Description**

This parameter can be used to moderate smoothness of spline or other terms used in generalized additive models.

**Usage**

```
adjust_deg_free(range = c(0.25, 4), trans = NULL)
```

**Arguments**

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as <code>scales::log10_trans()</code> or <code>scales::reciprocal_trans()</code> . If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Details**

Used in `parsnip::gen_additive_mod()`.

**Examples**

```
adjust_deg_free()
```

---

all_neighbors	<i>Parameter to determine which neighbors to use</i>
---------------	--

---

**Description**

Used in `themis::step_bsmote()`.

**Usage**

```
all_neighbors(values = c(TRUE, FALSE))
```

**Arguments**

`values` A vector of possible values (TRUE or FALSE).

**Examples**

```
all_neighbors()
```

---

bart-param	<i>Parameters for BART models These parameters are used for constructing Bayesian adaptive regression tree (BART) models.</i>
------------	---

---

**Description**

Parameters for BART models These parameters are used for constructing Bayesian adaptive regression tree (BART) models.

**Usage**

```
prior_terminal_node_coef(range = c(0, 1), trans = NULL)
```

```
prior_terminal_node_expo(range = c(1, 3), trans = NULL)
```

```
prior_outcome_range(range = c(0, 5), trans = NULL)
```

**Arguments**

`range` A two-element vector holding the *defaults* for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the *transformed units*.

`trans` A `trans` object from the `scales` package, such as `scales::log10_trans()` or `scales::reciprocal_trans()`. If not provided, the default is used which matches the units used in `range`. If no transformation, `NULL`.

**Details**

These parameters are often used with Bayesian adaptive regression trees (BART) via `parsnip::bart()`.

---

class_weights	<i>Parameters for class weights for imbalanced problems</i>
---------------	---

---

**Description**

This parameter can be used to moderate how much influence certain classes receive during training.

**Usage**

```
class_weights(range = c(1, 10), trans = NULL)
```

**Arguments**

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as scales::log10_trans() or scales::reciprocal_trans(). If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Details**

Used in brulee::brulee\_logistic\_reg() and brulee::brulee\_mlp()

**Examples**

```
class_weights()
```

---

conditional_min_criterion	<i>Parameters for possible engine parameters for partykit models</i>
---------------------------	--

---

**Description**

Parameters for possible engine parameters for partykit models

**Usage**

```
conditional_min_criterion(
  range = c(1.386294, 15),
  trans = scales::logit_trans()
)

values_test_type
```

```
conditional_test_type(values = values_test_type)

values_test_statistic

conditional_test_statistic(values = values_test_statistic)
```

### Arguments

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively.
trans	A trans object from the scales package, such as scales::log10_trans() or scales::reciprocal_trans(). If not provided, the default is used which matches the units used in range. If no transformation, NULL.
values	A character string of possible values.

### Format

An object of class character of length 4.  
 An object of class character of length 2.

### Details

The range of conditional\_min\_criterion() corresponds to roughly 0.80 to 0.99997 in the natural units. For several test types, this parameter corresponds to  $1 - \{p\text{-value}\}$ .

### Value

For the functions, they return a function with classes "param" and either "quant\_param" or "qual\_param".

---

confidence_factor	<i>Parameters for possible engine parameters for C5.0</i>
-------------------	---

---

### Description

These parameters are auxiliary to tree-based models that use the "C5.0" engine. They correspond to tuning parameters that would be specified using set\_engine("C5.0", ...).

### Usage

```
confidence_factor(range = c(-1, 0), trans = log10_trans())

no_global_pruning(values = c(TRUE, FALSE))

predictor_winning(values = c(TRUE, FALSE))

fuzzy_thresholding(values = c(TRUE, FALSE))

rule_bands(range = c(2L, 500L), trans = NULL)
```

**Arguments**

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as scales::log10_trans() or scales::reciprocal_trans(). If not provided, the default is used which matches the units used in range. If no transformation, NULL.
values	For no_global_pruning(), predictor_winning(), and fuzzy_thresholding() either TRUE or FALSE.

**Details**

To use these, check ?cost to see how they are used.

**Examples**

```
confidence_factor()
no_global_pruning()
predictor_winning()
fuzzy_thresholding()
rule_bands()
```

---

cost

*Support vector machine parameters*

---

**Description**

Parameters related to the SVM objective function(s).

**Usage**

```
cost(range = c(-10, 5), trans = log2_trans())
```

```
svm_margin(range = c(0, 0.2), trans = NULL)
```

**Arguments**

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as scales::log10_trans() or scales::reciprocal_trans(). If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Examples**

```
cost()
svm_margin()
```



---

degree

*Parameters for exponents*

---

## Description

These parameters help model cases where an exponent is of interest (e.g. `degree()` or `spline_degree()`) or a product is used (e.g. `prod_degree`).

## Usage

```
degree(range = c(1, 3), trans = NULL)
```

```
degree_int(range = c(1L, 3L), trans = NULL)
```

```
spline_degree(range = c(1L, 10L), trans = NULL)
```

```
prod_degree(range = c(1L, 2L), trans = NULL)
```

## Arguments

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as <code>scales::log10_trans()</code> or <code>scales::reciprocal_trans()</code> . If not provided, the default is used which matches the units used in range. If no transformation, NULL.

## Details

`degree()` is helpful for parameters that are real number exponents (e.g.  $x^{\text{degree}}$ ) whereas `degree_int()` is for cases where the exponent should be an integer.

The difference between `degree_int()` and `spline_degree()` is the default ranges (which is based on the context of how/where they are used).

`prod_degree()` is used by `parsnip::mars()` for the number of terms in interactions (and generates an integer).

## Examples

```
degree()  
degree_int()  
spline_degree()  
prod_degree()
```

---

deg_free	<i>Degrees of freedom (integer)</i>
----------	-------------------------------------

---

**Description**

The number of degrees of freedom used for model parameters.

**Usage**

```
deg_free(range = c(1L, 5L), trans = NULL)
```

**Arguments**

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as scales::log10_trans() or scales::reciprocal_trans(). If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Details**

One context in which this parameter is used is spline basis functions.

**Examples**

```
deg_free()
```

---

dist_power	<i>Minkowski distance parameter</i>
------------	-------------------------------------

---

**Description**

Used in parsnip::nearest\_neighbor().

**Usage**

```
dist_power(range = c(1, 2), trans = NULL)
```

**Arguments**

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as scales::log10_trans() or scales::reciprocal_trans(). If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Details**

This parameter controls how distances are calculated. For example, `dist_power = 1` corresponds to Manhattan distance while `dist_power = 2` is Euclidean distance.

**Examples**

```
dist_power()
```

---

dropout

*Neural network parameters*

---

**Description**

These functions generate parameters that are useful for neural network models.

**Usage**

```
dropout(range = c(0, 1), trans = NULL)
```

```
epochs(range = c(10L, 1000L), trans = NULL)
```

```
hidden_units(range = c(1L, 10L), trans = NULL)
```

```
batch_size(range = c(unknown(), unknown()), trans = log2_trans())
```

**Arguments**

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as <code>scales::log10_trans()</code> or <code>scales::reciprocal_trans()</code> . If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Details**

- `dropout()`: The parameter dropout rate. (See `parsnip::mlp()`).
- `epochs()`: The number of iterations of training. (See `parsnip::mlp()`).
- `hidden_units()`: The number of hidden units in a network layer. (See `parsnip::mlp()`).
- `batch_size()`: The mini-batch size for neural networks.

**Examples**

```
dropout()
```

---

extrapolation	<i>Parameters for possible engine parameters for Cubist</i>
---------------	---

---

### Description

These parameters are auxiliary to models that use the "Cubist" engine. They correspond to tuning parameters that would be specified using `set_engine("Cubist0", ...)`.

### Usage

```
extrapolation(range = c(1, 110), trans = NULL)
```

```
unbiased_rules(values = c(TRUE, FALSE))
```

```
max_rules(range = c(1L, 100L), trans = NULL)
```

### Arguments

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as <code>scales::log10_trans()</code> or <code>scales::reciprocal_trans()</code> . If not provided, the default is used which matches the units used in range. If no transformation, NULL.
values	For <code>unbiased_rules()</code> , either TRUE or FALSE.

### Details

To use these, check `?Cubist::cubistControl` to see how they are used.

### Examples

```
extrapolation()
unbiased_rules()
max_rules()
```

---

finalize	<i>Functions to finalize data-specific parameter ranges</i>
----------	---

---

### Description

These functions take a parameter object and modify the unknown parts of ranges based on a data set and simple heuristics.

**Usage**

```

finalize(object, ...)

## S3 method for class 'list'
finalize(object, x, force = TRUE, ...)

## S3 method for class 'param'
finalize(object, x, force = TRUE, ...)

## S3 method for class 'parameters'
finalize(object, x, force = TRUE, ...)

## S3 method for class 'logical'
finalize(object, x, force = TRUE, ...)

## Default S3 method:
finalize(object, x, force = TRUE, ...)

get_p(object, x, log_vals = FALSE, ...)

get_log_p(object, x, ...)

get_n_frac(object, x, log_vals = FALSE, frac = 1/3, ...)

get_n_frac_range(object, x, log_vals = FALSE, frac = c(1/10, 5/10), ...)

get_n(object, x, log_vals = FALSE, ...)

get_rbf_range(object, x, seed = sample.int(10^5, 1), ...)

get_batch_sizes(object, x, frac = c(1/10, 1/3), ...)

```

**Arguments**

object	A param object or a list of param objects.
...	Other arguments to pass to the underlying parameter finalizer functions. For example, for <code>get_rbf_range()</code> , the dots are passed along to <code>kernlab::sigest()</code> .
x	The predictor data. In some cases (see below) this should only include numeric data.
force	A single logical that indicates that even if the parameter object is complete, should it update the ranges anyway?
log_vals	A logical: should the ranges be set on the log10 scale?
frac	A double for the fraction of the data to be used for the upper bound. For <code>get_n_frac_range()</code> and <code>get_batch_sizes()</code> , a vector of two fractional values are required.
seed	An integer to control the randomness of the calculations.

## Details

`finalize()` runs the embedded finalizer function contained in the param object (`object$finalize`) and returns the updated version. The finalization function is one of the `get_*`() helpers.

The `get_*`() helper functions are designed to be used with the pipe and update the parameter object in-place.

`get_p()` and `get_log_p()` set the upper value of the range to be the number of columns in the data (on the natural and log10 scale, respectively).

`get_n()` and `get_n_frac()` set the upper value to be the number of rows in the data or a fraction of the total number of rows.

`get_rbf_range()` sets both bounds based on the heuristic defined in `kernlab::sigest()`. It requires that all columns in `x` be numeric.

## Value

An updated param object or a list of updated param objects depending on what is provided in object.

## Examples

```
library(dplyr)
car_pred <- select(mtcars, -mpg)

# Needs an upper bound
mtry()
finalize(mtry(), car_pred)

# Nothing to do here since no unknowns
penalty()
finalize(penalty(), car_pred)

library(kernlab)
library(tibble)
library(purrr)

params <-
  tribble(
    ~parameter, ~object,
    "mtry", mtry(),
    "num_terms", num_terms(),
    "rbf_sigma", rbf_sigma()
  )
params

# Note that `rbf_sigma()` has a default range that does not need to be
# finalized but will be changed if used in the function:
complete_params <-
  params %>%
  mutate(object = map(object, finalize, car_pred))
complete_params
```

```

params %>%
  dplyr::filter(parameter == "rbf_sigma") %>%
  pull(object)
complete_params %>%
  dplyr::filter(parameter == "rbf_sigma") %>%
  pull(object)

```

---

freq_cut	<i>Near-zero variance parameters</i>
----------	--------------------------------------

---

### Description

These parameters control the specificity of the filter for near-zero variance parameters in `recipes::step_nzv()`.

### Usage

```

freq_cut(range = c(5, 25), trans = NULL)
unique_cut(range = c(0, 100), trans = NULL)

```

### Arguments

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as <code>scales::log10_trans()</code> or <code>scales::reciprocal_trans()</code> . If not provided, the default is used which matches the units used in range. If no transformation, NULL.

### Details

Smaller values of `freq_cut()` and `unique_cut()` make the filter less sensitive.

### Examples

```

freq_cut()
unique_cut()

```

---

grid\_max\_entropy      *Space-filling parameter grids*

---

### Description

Experimental designs for computer experiments are used to construct parameter grids that try to cover the parameter space such that any portion of the space has an observed combination that is not too far from it.

### Usage

```
grid_max_entropy(  
  x,  
  ...,  
  size = 3,  
  original = TRUE,  
  variogram_range = 0.5,  
  iter = 1000  
)  
  
## S3 method for class 'parameters'  
grid_max_entropy(  
  x,  
  ...,  
  size = 3,  
  original = TRUE,  
  variogram_range = 0.5,  
  iter = 1000  
)  
  
## S3 method for class 'list'  
grid_max_entropy(  
  x,  
  ...,  
  size = 3,  
  original = TRUE,  
  variogram_range = 0.5,  
  iter = 1000  
)  
  
## S3 method for class 'param'  
grid_max_entropy(  
  x,  
  ...,  
  size = 3,  
  original = TRUE,  
  variogram_range = 0.5,
```



```

    iter = 1000
  )

## S3 method for class 'workflow'
grid_max_entropy(
  x,
  ...,
  size = 3,
  original = TRUE,
  variogram_range = 0.5,
  iter = 1000
)

grid_latin_hypercube(x, ..., size = 3, original = TRUE)

## S3 method for class 'parameters'
grid_latin_hypercube(x, ..., size = 3, original = TRUE)

## S3 method for class 'list'
grid_latin_hypercube(x, ..., size = 3, original = TRUE)

## S3 method for class 'param'
grid_latin_hypercube(x, ..., size = 3, original = TRUE)

## S3 method for class 'workflow'
grid_latin_hypercube(x, ..., size = 3, original = TRUE)

```

### Arguments

x	A param object, list, or parameters.
...	One or more param objects (such as <a href="#">mtry()</a> or <a href="#">penalty()</a> ). None of the objects can have <code>unknown()</code> values in the parameter ranges or values.
size	A single integer for the total number of parameter value combinations returned. If duplicate combinations are generated from this size, the smaller, unique set is returned.
original	A logical: should the parameters be in the original units or in the transformed space (if any)?
variogram_range	A numeric value greater than zero. Larger values reduce the likelihood of empty regions in the parameter space.
iter	An integer for the maximum number of iterations used to find a good design.

### Details

The types of designs supported here are latin hypercube designs and designs that attempt to maximize the determinant of the spatial correlation matrix between coordinates. Both designs use random sampling of points in the parameter space.

Note that there may a difference in grids depending on how the function is called. If the call uses the parameter objects directly the possible ranges come from the objects in `dials`. For example:

```
mixture()

## Proportion of Lasso Penalty (quantitative)
## Range: [0, 1]

set.seed(283)
mix_grid_1 <- grid_latin_hypercube(mixture(), size = 1000)
range(mix_grid_1$mixture)

## [1] 0.0001530482 0.9999530388
```

However, in some cases, the `parsnip` and `recipe` packages overrides the default ranges for specific models and preprocessing steps. If the grid function uses a `parameters` object created from a model or recipe, the ranges may have different defaults (specific to those models). Using the example above, the `mixture` argument above is different for `glmnet` models:

```
library(parsnip)
library(tune)

# When used with glmnet, the range is [0.05, 1.00]
glmnet_mod <-
  linear_reg(mixture = tune()) %>%
  set_engine("glmnet")

set.seed(283)
mix_grid_2 <- grid_latin_hypercube(extract_parameter_set_dials(glmnet_mod), size = 1000)
range(mix_grid_2$mixture)

## [1] 0.0501454 0.9999554
```

## References

- Sacks, Jerome & Welch, William & J. Mitchell, Toby, and Wynn, Henry. (1989). Design and analysis of computer experiments. With comments and a rejoinder by the authors. *Statistical Science*. 4. 10.1214/ss/1177012413.
- Santner, Thomas, Williams, Brian, and Notz, William. (2003). *The Design and Analysis of Computer Experiments*. Springer.
- Dupuy, D., Helbert, C., and Franco, J. (2015). `DiceDesign` and `DiceEval`: Two R packages for design and analysis of computer experiments. *Journal of Statistical Software*, 65(11)

**Examples**

```

grid_max_entropy(
  hidden_units(),
  penalty(),
  epochs(),
  activation(),
  learn_rate(c(0, 1), trans = scales::log_trans()),
  size = 10,
  original = FALSE
)

grid_latin_hypercube(penalty(), mixture(), original = TRUE)

```

---

grid_regular	<i>Create grids of tuning parameters</i>
--------------	--

---

**Description**

Random and regular grids can be created for any number of parameter objects.

**Usage**

```

grid_regular(x, ..., levels = 3, original = TRUE, filter = NULL)

## S3 method for class 'parameters'
grid_regular(x, ..., levels = 3, original = TRUE, filter = NULL)

## S3 method for class 'list'
grid_regular(x, ..., levels = 3, original = TRUE, filter = NULL)

## S3 method for class 'param'
grid_regular(x, ..., levels = 3, original = TRUE, filter = NULL)

## S3 method for class 'workflow'
grid_regular(x, ..., levels = 3, original = TRUE, filter = NULL)

grid_random(x, ..., size = 5, original = TRUE, filter = NULL)

## S3 method for class 'parameters'
grid_random(x, ..., size = 5, original = TRUE, filter = NULL)

## S3 method for class 'list'
grid_random(x, ..., size = 5, original = TRUE, filter = NULL)

## S3 method for class 'param'
grid_random(x, ..., size = 5, original = TRUE, filter = NULL)

## S3 method for class 'workflow'
grid_random(x, ..., size = 5, original = TRUE, filter = NULL)

```

**Arguments**

<code>x</code>	A param object, list, or parameters.
<code>...</code>	One or more param objects (such as <code>mtry()</code> or <code>penalty()</code> ). None of the objects can have <code>unknown()</code> values in the parameter ranges or values.
<code>levels</code>	An integer for the number of values of each parameter to use to make the regular grid. <code>levels</code> can be a single integer or a vector of integers that is the same length as the number of parameters in <code>...</code> . <code>levels</code> can be a named integer vector, with names that match the <code>id</code> values of parameters.
<code>original</code>	A logical: should the parameters be in the original units or in the transformed space (if any)?
<code>filter</code>	A logical: should the parameters be filtered prior to generating the grid. Must be a single expression referencing parameter names that evaluates to a logical vector.
<code>size</code>	A single integer for the total number of parameter value combinations returned for the random grid. If duplicate combinations are generated from this size, the smaller, unique set is returned.

**Details**

Note that there may a difference in grids depending on how the function is called. If the call uses the parameter objects directly the possible ranges come from the objects in `dials`. For example:

```
mixture()

## Proportion of Lasso Penalty (quantitative)
## Range: [0, 1]

set.seed(283)
mix_grid_1 <- grid_random(mixture(), size = 1000)
range(mix_grid_1$mixture)

## [1] 0.001490161 0.999741096
```

However, in some cases, the `parsnip` and `recipe` packages overrides the default ranges for specific models and preprocessing steps. If the grid function uses a `parameters` object created from a model or recipe, the ranges may have different defaults (specific to those models). Using the example above, the `mixture` argument above is different for `glmnet` models:

```
library(parsnip)
library(tune)

# When used with glmnet, the range is [0.05, 1.00]
glmnet_mod <-
  linear_reg(mixture = tune()) %>%
  set_engine("glmnet")
```

```

set.seed(283)
mix_grid_2 <- grid_random(extract_parameter_set_dials(glmn_mod), size = 1000)
range(mix_grid_2$mixture)

## [1] 0.05141565 0.99975404

```

**Value**

A tibble. There are columns for each parameter and a row for every parameter combination.

**Examples**

```

# filter arg will allow you to filter subsequent grid data frame based on some condition.
p <- parameters(penalty(), mixture())
grid_regular(p)
grid_regular(p, filter = penalty <= .01)

# Will fail due to unknowns:
# grid_regular(mtry(), min_n())

grid_regular(penalty(), mixture())
grid_regular(penalty(), mixture(), levels = 3:4)
grid_regular(penalty(), mixture(), levels = c(mixture = 4, penalty = 3))
grid_random(penalty(), mixture())

```

---

Laplace

*Laplace correction parameter*


---

**Description**

Laplace correction for smoothing low-frequency counts.

**Usage**

```
Laplace(range = c(0, 3), trans = NULL)
```

**Arguments**

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as <code>scales::log10_trans()</code> or <code>scales::reciprocal_trans()</code> . If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Details**

This parameter is often used to correct for zero-count data in tables or proportions.

**Value**

A function with classes "quant\_param" and "param".

**Examples**

```
Laplace()
```

---

```
learn_rate
```

```
Learning rate
```

---

**Description**

The parameter is used in boosting methods (`parsnip::boost_tree()`) or some types of neural network optimization methods.

**Usage**

```
learn_rate(range = c(-10, -1), trans = log10_trans())
```

**Arguments**

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as <code>scales::log10_trans()</code> or <code>scales::reciprocal_trans()</code> . If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Details**

The parameter is used on the log10 scale. The units for the range function are on this scale.

`learn_rate()` corresponds to eta in **xgboost**.

**Examples**

```
learn_rate()
```

---

max_nodes	<i>Parameters for possible engine parameters for randomForest</i>
-----------	---

---

**Description**

These parameters are auxiliary to random forest models that use the "randomForest" engine. They correspond to tuning parameters that would be specified using `set_engine("randomForest", ...)`.

**Usage**

```
max_nodes(range = c(100L, 10000L), trans = NULL)
```

**Arguments**

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as <code>scales::log10_trans()</code> or <code>scales::reciprocal_trans()</code> . If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Examples**

```
max_nodes()
```

---

max_num_terms	<i>Parameters for possible engine parameters for earth models</i>
---------------	---

---

**Description**

These parameters are auxiliary to models that use the "earth" engine. They correspond to tuning parameters that would be specified using `set_engine("earth", ...)`.

**Usage**

```
max_num_terms(range = c(20L, 200L), trans = NULL)
```

**Arguments**

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as <code>scales::log10_trans()</code> or <code>scales::reciprocal_trans()</code> . If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Details**

To use these, check `?earth::earth` to see how they are used.

**Examples**

```
max_num_terms()
```

---

max_times	<i>Word frequencies for removal</i>
-----------	-------------------------------------

---

**Description**

Used in `textrecipes::step_tokenfilter()`.

**Usage**

```
max_times(range = c(1L, as.integer(10^5)), trans = NULL)
```

```
min_times(range = c(0L, 1000L), trans = NULL)
```

**Arguments**

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as <code>scales::log10_trans()</code> or <code>scales::reciprocal_trans()</code> . If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Examples**

```
max_times()
min_times()
```

---

max_tokens	<i>Maximum number of retained tokens</i>
------------	--

---

**Description**

Used in `textrecipes::step_tokenfilter()`.

**Usage**

```
max_tokens(range = c(0L, as.integer(10^3)), trans = NULL)
```



**Arguments**

- range A two-element vector holding the *defaults* for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the *transformed units*.
- trans A trans object from the scales package, such as scales::log10\_trans() or scales::reciprocal\_trans(). If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Examples**

```
max_tokens()
```

---

min_dist	<i>Parameter for the effective minimum distance between embedded points</i>
----------	---

---

**Description**

Used in embed::step\_umap().

**Usage**

```
min_dist(range = c(-4, 0), trans = log10_trans())
```

**Arguments**

- range A two-element vector holding the *defaults* for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the *transformed units*.
- trans A trans object from the scales package, such as scales::log10\_trans() or scales::reciprocal\_trans(). If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Examples**

```
min_dist()
```

---

min_unique	<i>Number of unique values for pre-processing</i>
------------	---

---

**Description**

Some pre-processing parameters require a minimum number of unique data points to proceed.

**Usage**

```
min_unique(range = c(5L, 15L), trans = NULL)
```

**Arguments**

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as scales::log10_trans() or scales::reciprocal_trans(). If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Examples**

```
min_unique()
```

---

mixture	<i>Mixture of penalization terms</i>
---------	--------------------------------------

---

**Description**

A numeric parameter function representing the relative amount of penalties (e.g. L1, L2, etc) in regularized models.

**Usage**

```
mixture(range = c(0, 1), trans = NULL)
```

**Arguments**

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as scales::log10_trans() or scales::reciprocal_trans(). If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Details**

This parameter is used for regularized or penalized models such as `parsnip::linear_reg()`, `parsnip::logistic_reg()`, and others. It is formulated as the proportion of L1 regularization (i.e. lasso) in the model. In the `glmnet` model, `mixture = 1` is a pure lasso model while `mixture = 0` indicates that ridge regression is being used.

**Examples**

```
mixture()
```

---

momentum	<i>Gradient descent momentum parameter</i>
----------	--

---

**Description**

A useful parameter for neural network models using gradient descent

**Usage**

```
momentum(range = c(0, 1), trans = NULL)
```

**Arguments**

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as <code>scales::log10_trans()</code> or <code>scales::reciprocal_trans()</code> . If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Examples**

```
momentum()
```

---

mtry	<i>Number of randomly sampled predictors</i>
------	--

---

**Description**

The number of predictors that will be randomly sampled at each split when creating tree models.

**Usage**

```
mtry(range = c(1L, unknown()), trans = NULL)
```

```
mtry_long(range = c(0L, unknown()), trans = log10_trans())
```

## Arguments

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as <code>scales::log10_trans()</code> or <code>scales::reciprocal_trans()</code> . If not provided, the default is used which matches the units used in range. If no transformation, NULL.

## Details

This parameter is used for regularized or penalized models such as `parsnip::rand_forest()` and others. `mtry_long()` has the values on the log10 scale and is helpful when the data contain a large number of predictors.

Since the scale of the parameter depends on the number of columns in the data set, the upper bound is set to unknown but can be filled in via the `finalize()` method.

## Interpretation

`mtry_prop()` is a variation on `mtry()` where the value is interpreted as the *proportion* of predictors that will be randomly sampled at each split rather than the *count*.

This parameter is not intended for use in accommodating engines that take in this argument as a proportion; `mtry` is often a main model argument rather than an engine-specific argument, and thus should not have an engine-specific interface.

When wrapping modeling engines that interpret `mtry` in its sense as a proportion, use the `mtry()` parameter in `parsnip::set_model_arg()` and process the passed argument in an internal wrapping function as `mtry / number_of_predictors`. In addition, introduce a logical argument `counts` to the wrapping function, defaulting to TRUE, that indicates whether to interpret the supplied argument as a count rather than a proportion.

For an example implementation, see `parsnip::xgb_train()`.

## See Also

`mtry_prop`

## Examples

```
mtry(c(1L, 10L)) # in original units
mtry_long(c(0, 5)) # in log10 units
```

---

mtry\_prop

*Proportion of Randomly Selected Predictors*


---

**Description**

The proportion of predictors that will be randomly sampled at each split when creating tree models.

**Usage**

```
mtry_prop(range = c(0.1, 1), trans = NULL)
```

**Arguments**

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as scales::log10_trans() or scales::reciprocal_trans(). If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Value**

A dial object with classes "quant\_param" and "param". The range element of the object is always converted to a list with elements "lower" and "upper".

**Interpretation**

`mtry_prop()` is a variation on `mtry()` where the value is interpreted as the *proportion* of predictors that will be randomly sampled at each split rather than the *count*.

This parameter is not intended for use in accommodating engines that take in this argument as a proportion; `mtry` is often a main model argument rather than an engine-specific argument, and thus should not have an engine-specific interface.

When wrapping modeling engines that interpret `mtry` in its sense as a proportion, use the `mtry()` parameter in `parsnip::set_model_arg()` and process the passed argument in an internal wrapping function as `mtry / number_of_predictors`. In addition, introduce a logical argument `counts` to the wrapping function, defaulting to TRUE, that indicates whether to interpret the supplied argument as a count rather than a proportion.

For an example implementation, see `parsnip::xgb_train()`.

**See Also**

`mtry`, `mtry_long`

**Examples**

```
mtry_prop()
```

---

neighbors	<i>Number of neighbors</i>
-----------	----------------------------

---

### Description

The number of neighbors is used for models (`parsnip::nearest_neighbor()`), imputation (`recipes::step_impute_knn()`) and dimension reduction (`recipes::step_isomap()`).

### Usage

```
neighbors(range = c(1L, 10L), trans = NULL)
```

### Arguments

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as <code>scales::log10_trans()</code> or <code>scales::reciprocal_trans()</code> . If not provided, the default is used which matches the units used in range. If no transformation, NULL.

### Details

A static range is used but a broader range should be used if the data set is large or more neighbors are required.

### Examples

```
neighbors()
```

---

new-param	<i>Tools for creating new parameter objects</i>
-----------	---

---

### Description

These functions are used to construct new parameter objects. Generally, these functions are called from higher level parameter generating functions like `mtry()`.

**Usage**

```

new_quant_param(
  type = c("double", "integer"),
  range = NULL,
  inclusive = NULL,
  default = deprecated(),
  trans = NULL,
  values = NULL,
  label = NULL,
  finalize = NULL
)

new_qual_param(
  type = c("character", "logical"),
  values,
  default = deprecated(),
  label = NULL,
  finalize = NULL
)

```

**Arguments**

type	A single character value. For quantitative parameters, valid choices are "double" and "integer" while for qualitative factors they are "character" and "logical".
range	A two-element vector with the smallest or largest possible values, respectively. If these cannot be set when the parameter is defined, the <code>unknown()</code> function can be used. If a transformation is specified, these values should be in the <i>transformed units</i> . If <code>values</code> is supplied, and <code>range</code> is <code>NULL</code> , <code>range</code> will be set to <code>range(values)</code> .
inclusive	A two-element logical vector for whether the range values should be inclusive or exclusive. If <code>values</code> is supplied, and <code>inclusive</code> is <code>NULL</code> , <code>inclusive</code> will be set to <code>c(TRUE, TRUE)</code> .
default	<b>[Deprecated]</b> No longer used. If a value is supplied, it will be ignored and a warning will be thrown.
trans	A <code>trans</code> object from the <b>scales</b> package, such as <code>scales::log10_trans()</code> or <code>scales::reciprocal_trans()</code> . Create custom transforms with <code>scales::trans_new()</code> .
values	A vector of possible values that is required when <code>type</code> is "character" or "logical" but optional otherwise. For quantitative parameters, this can be used as an alternative to <code>range</code> and <code>inclusive</code> . If set, these will be used by <code>value_seq()</code> and <code>value_sample()</code> .
label	An optional named character string that can be used for printing and plotting. The name should match the object name (e.g. "mtry", "neighbors", etc.)
finalize	A function that can be used to set the data-specific values of a parameter (such as the range).

**Value**

An object of class "param" with the primary class being either "quant\_param" or "qual\_param". The range element of the object is always converted to a list with elements "lower" and "upper".

**Examples**

```
# Create a function that generates a quantitative parameter
# corresponding to the number of subgroups.
num_subgroups <- function(range = c(1L, 20L), trans = NULL) {
  new_quant_param(
    type = "integer",
    range = range,
    inclusive = c(TRUE, TRUE),
    trans = trans,
    label = c(num_subgroups = "# Subgroups"),
    finalize = NULL
  )
}

num_subgroups()

num_subgroups(range = c(3L, 5L))

# Custom parameters instantly have access
# to sequence generating functions
value_seq(num_subgroups(), 5)
```

---

num\_breaks

*Number of cut-points for binning*


---

**Description**

This parameter controls how many bins are used when discretizing predictors.

**Usage**

```
num_breaks(range = c(2L, 10L), trans = NULL)
```

**Arguments**

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as scales::log10_trans() or scales::reciprocal_trans(). If not provided, the default is used which matches the units used in range. If no transformation, NULL.



**Examples**

```
num_breaks()
```

---

num_clusters	<i>Number of Clusters</i>
--------------	---------------------------

---

**Description**

Used in most tidyclust models.

**Usage**

```
num_clusters(range = c(1L, 10L), trans = NULL)
```

**Arguments**

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as scales::log10_trans() or scales::reciprocal_trans(). If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Examples**

```
num_clusters()
```

---

num_comp	<i>Number of new features</i>
----------	-------------------------------

---

**Description**

The number of derived predictors from models or feature engineering methods.

**Usage**

```
num_comp(range = c(1L, unknown()), trans = NULL)
```

```
num_terms(range = c(1L, unknown()), trans = NULL)
```

**Arguments**

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as scales::log10_trans() or scales::reciprocal_trans(). If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Details**

Since the scale of these parameters often depends on the number of columns in the data set, the upper bound is set to unknown. For example, the number of PCA components is limited by the number of columns and so on.

The difference between num\_comp() and num\_terms() is semantics.

**Examples**

```
num_terms()
num_terms(c(2L, 10L))
```

---

num_hash	<i>Text hashing parameters</i>
----------	--------------------------------

---

**Description**

Used in textrecipes::step\_texthash().

**Usage**

```
num_hash(range = c(8L, 12L), trans = log2_trans())

signed_hash(values = c(TRUE, FALSE))
```

**Arguments**

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as scales::log10_trans() or scales::reciprocal_trans(). If not provided, the default is used which matches the units used in range. If no transformation, NULL.
values	A vector of possible values (TRUE or FALSE).

**Examples**

```
num_hash()
signed_hash()
```

---

num_knots	<i>Number of knots (integer)</i>
-----------	----------------------------------

---

**Description**

The number of knots used for spline model parameters.

**Usage**

```
num_knots(range = c(0L, 5L), trans = NULL)
```

**Arguments**

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as scales::log10_trans() or scales::reciprocal_trans(). If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Details**

One context in which this parameter is used is spline basis functions.

**Examples**

```
num_knots()
```

---

num_leaves	<i>Possible engine parameters for lightgbm</i>
------------	--

---

**Description**

These parameters are auxiliary to tree-based models that use the "lightgbm" engine. They correspond to tuning parameters that would be specified using set\_engine("lightgbm", ...).

**Usage**

```
num_leaves(range = c(5, 100), trans = NULL)
```

**Arguments**

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as scales::log10_trans() or scales::reciprocal_trans(). If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Details**

"lightgbm" is an available engine in the parsnip extension package [bonsai](#)

For more information, see the [lightgbm webpage](#).

**Examples**

```
num_leaves()
```

---

num_tokens	<i>Parameter to determine number of tokens in ngram</i>
------------	---

---

**Description**

Used in `textrecipes::step_ngram()`.

**Usage**

```
num_tokens(range = c(1, 3), trans = NULL)
```

**Arguments**

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as <code>scales::log10_trans()</code> or <code>scales::reciprocal_trans()</code> . If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Examples**

```
num_tokens()
```

---

over_ratio	<i>Parameters for class-imbalance sampling</i>
------------	--

---

**Description**

For up- and down-sampling methods, these parameters control how much data are added or removed from the training set.

**Usage**

```
over_ratio(range = c(0.8, 1.2), trans = NULL)
```

```
under_ratio(range = c(0.8, 1.2), trans = NULL)
```

**Arguments**

**range** A two-element vector holding the *defaults* for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the *transformed units*.

**trans** A trans object from the scales package, such as `scales::log10_trans()` or `scales::reciprocal_trans()`. If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Details**

See `recipes::step_upsample()` and `recipes::step_downsample()` for the interpretation of these parameters.

**Examples**

```
under_ratio()
over_ratio()
```

---

parameters

*Information on tuning parameters within an object*

---

**Description**

Information on tuning parameters within an object

**Usage**

```
parameters(x, ...)
```

```
## Default S3 method:
```

```
parameters(x, ...)
```

```
## S3 method for class 'param'
```

```
parameters(x, ...)
```

```
## S3 method for class 'list'
```

```
parameters(x, ...)
```

**Arguments**

x	An object, such as a list of param objects or an actual param object.
...	Only used for the param method so that multiple param objects can be passed to the function.

---

penalty	<i>Amount of regularization/penalization</i>
---------	--

---

**Description**

A numeric parameter function representing the amount of penalties (e.g. L1, L2, etc) in regularized models.

**Usage**

```
penalty(range = c(-10, 0), trans = log10_trans())
```

**Arguments**

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as scales::log10_trans() or scales::reciprocal_trans(). If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Details**

This parameter is used for regularized or penalized models such as parsnip::linear\_reg(), parsnip::logistic\_reg(), and others.

**Examples**

```
penalty()
```

---

predictor\_prop      *Proportion of predictors*

---

### Description

The parameter is used in models where a parameter is the proportion of predictor variables.

### Usage

```
predictor_prop(range = c(0, 1), trans = NULL)
```

### Arguments

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as scales::log10_trans() or scales::reciprocal_trans(). If not provided, the default is used which matches the units used in range. If no transformation, NULL.

### Details

predictor\_prop() is used in step\_pls().

### Examples

```
predictor_prop()
```

---

prior\_slab\_dispersion      *Bayesian PCA parameters*

---

### Description

A numeric parameter function representing parameters for the spike-and-slab prior used by embed::step\_pca\_sparse\_bayes

### Usage

```
prior_slab_dispersion(range = c(-1/2, log10(3)), trans = log10_trans())
```

```
prior_mixture_threshold(range = c(0, 1), trans = NULL)
```

**Arguments**

- range            A two-element vector holding the *defaults* for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the *transformed units*.
- trans            A trans object from the scales package, such as scales::log10\_trans() or scales::reciprocal\_trans(). If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Details**

prior\_slab\_dispersion() is related to the prior for the case where a PCA loading is selected (i.e. non-zero). Smaller values result in an increase in zero coefficients.

prior\_mixture\_threshold() is used to threshold the prior to determine which parameters are non-zero or zero. Increasing this parameter increases the number of zero coefficients.

**Examples**

```
mixture()
```

---

```
prune_method            MARS pruning methods
```

---

**Description**

MARS pruning methods

**Usage**

```
prune_method(values = values_prune_method)
```

```
values_prune_method
```

**Arguments**

- values            A character string of possible values. See values\_prune\_method in examples below.

**Format**

An object of class character of length 6.

**Details**

This parameter is used in parsnip::mars().

**Examples**

```
values_prune_method
prune_method()
```



---

range\_validate      *Tools for working with parameter ranges*

---

## Description

Setters, getters, and validators for parameter ranges.

## Usage

```
range_validate(object, range, ukn_ok = TRUE)
```

```
range_get(object, original = TRUE)
```

```
range_set(object, range)
```

## Arguments

object	An object with class <code>quant_param</code> .
range	A two-element numeric vector or list (including <code>Inf</code> ). Values can include <code>unknown()</code> when <code>ukn_ok = TRUE</code> .
ukn_ok	A single logical for whether <code>unknown()</code> is an acceptable value.
original	A single logical. Should the range values be in the natural units ( <code>TRUE</code> ) or in the transformed space ( <code>FALSE</code> , if applicable)?

## Value

`range_validate()` returns the new range if it passes the validation process (and throws an error otherwise).

`range_get()` returns the current range of the object.

`range_set()` returns an updated version of the parameter object with a new range.

## Examples

```
library(dplyr)

my_lambda <- penalty() %>%
  value_set(-4:-1)

try(
  range_validate(my_lambda, c(-10, NA)),
  silent = TRUE
) %>%
  print()

range_get(my_lambda)

my_lambda %>%
```

```
range_set(c(-10, 2)) %>%
range_get()
```

---

rbf\_sigma

*Kernel parameters*


---

### Description

Parameters related to the radial basis or other kernel functions.

### Usage

```
rbf_sigma(range = c(-10, 0), trans = log10_trans())
scale_factor(range = c(-10, -1), trans = log10_trans())
kernel_offset(range = c(0, 2), trans = NULL)
```

### Arguments

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as scales::log10_trans() or scales::reciprocal_trans(). If not provided, the default is used which matches the units used in range. If no transformation, NULL.

### Details

degree() can also be used in kernel functions.

### Examples

```
rbf_sigma()
scale_factor()
kernel_offset()
```

---

regularization\_factor *Parameters for possible engine parameters for ranger*

---

### Description

These parameters are auxiliary to random forest models that use the "ranger" engine. They correspond to tuning parameters that would be specified using `set_engine("ranger", ...)`.

### Usage

```
regularization_factor(range = c(0, 1), trans = NULL)

regularize_depth(values = c(TRUE, FALSE))

significance_threshold(range = c(-10, 0), trans = log10_trans())

lower_quantile(range = c(0, 1), trans = NULL)

splitting_rule(values = ranger_split_rules)

ranger_class_rules

ranger_reg_rules

ranger_split_rules

num_random_splits(range = c(1L, 15L), trans = NULL)
```

### Arguments

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as <code>scales::log10_trans()</code> or <code>scales::reciprocal_trans()</code> . If not provided, the default is used which matches the units used in range. If no transformation, NULL.
values	For <code>splitting_rule()</code> , a character string of possible values. See <code>ranger_split_rules</code> , <code>ranger_class_rules</code> , and <code>ranger_reg_rules</code> for appropriate values. For <code>regularize_depth()</code> , either TRUE or FALSE.

### Format

An object of class character of length 4.  
 An object of class character of length 3.  
 An object of class character of length 7.

**Details**

To use these, check `?ranger::ranger` to see how they are used. Some are conditional on others. For example, `significance_threshold()`, `num_random_splits()`, and others are only used when `splitting_rule = "extratrees"`.

**Examples**

```
regularization_factor()
regularize_depth()
```

---

regularization\_method *Estimation methods for regularized models*

---

**Description**

Estimation methods for regularized models

**Usage**

```
regularization_method(values = values_regularization_method)

values_regularization_method
```

**Arguments**

`values` A character string of possible values. See `values_regularization_method` in examples below.

**Format**

An object of class character of length 4.

**Details**

This parameter is used in `parsnip::discrim_linear()`.

**Examples**

```
values_regularization_method
regularization_method()
```

---

scale_pos_weight	<i>Parameters for possible engine parameters for xgboost</i>
------------------	--

---

**Description**

These parameters are auxiliary to tree-based models that use the "xgboost" engine. They correspond to tuning parameters that would be specified using `set_engine("xgboost", ...)`.

**Usage**

```
scale_pos_weight(range = c(0.8, 1.2), trans = NULL)
```

```
penalty_L2(range = c(-10, 1), trans = log10_trans())
```

```
penalty_L1(range = c(-10, 1), trans = log10_trans())
```

**Arguments**

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as <code>scales::log10_trans()</code> or <code>scales::reciprocal_trans()</code> . If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Details**

For more information, see the [xgboost webpage](#).

**Examples**

```
scale_pos_weight()
penalty_L2()
penalty_L1()
```

---

scheduler-param	<i>Parameters for neural network learning rate schedulers These parameters are used for constructing neural network models.</i>
-----------------	---

---

**Description**

Parameters for neural network learning rate schedulers These parameters are used for constructing neural network models.

**Usage**

```

rate_initial(range = c(-3, -1), trans = log10_trans())
rate_largest(range = c(-1, -1/2), trans = log10_trans())
rate_reduction(range = c(1/5, 1), trans = NULL)
rate_steps(range = c(2, 10), trans = NULL)
rate_step_size(range = c(2, 20), trans = NULL)
rate_decay(range = c(0, 2), trans = NULL)
rate_schedule(values = values_scheduler)
values_scheduler

```

**Arguments**

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as scales::log10_trans() or scales::reciprocal_trans(). If not provided, the default is used which matches the units used in range. If no transformation, NULL.
values	A character string of possible values. See values_scheduler in examples below.

**Format**

An object of class character of length 5.

**Details**

These parameters are often used with neural networks via parsnip::mlp(engine = "brulee").

The details for how the **brulee** schedulers change the rates:

- schedule\_decay\_time():  $rate(epoch) = initial / (1 + decay \times epoch)$
- schedule\_decay\_expo():  $rate(epoch) = initial \exp(-decay \times epoch)$
- schedule\_step():  $rate(epoch) = initial \times reduction^{floor(epoch/steps)}$
- schedule\_cyclic():  $cycle = floor(1 + (epoch/2/stepsizes)), x = abs((epoch/stepsizes) - (2 * cycle) + 1)$ , and  $rate(epoch) = initial + (largest - initial) * \max(0, 1 - x)$

---

select_features	<i>Parameter to enable feature selection</i>
-----------------	--

---

**Description**

Used in `parsnip::gen_additive_mod()`.

**Usage**

```
select_features(values = c(TRUE, FALSE))
```

**Arguments**

`values` A vector of possible values (TRUE or FALSE).

**Examples**

```
select_features()
```

---

shrinkage_correlation	<i>Parameters for possible engine parameters for sda models</i>
-----------------------	---

---

**Description**

These functions can be used to optimize engine-specific parameters of `sda::sda()` via `parsnip::discrim_linear()`.

**Usage**

```
shrinkage_correlation(range = c(0, 1), trans = NULL)
```

```
shrinkage_variance(range = c(0, 1), trans = NULL)
```

```
shrinkage_frequencies(range = c(0, 1), trans = NULL)
```

```
diagonal_covariance(values = c(TRUE, FALSE))
```

**Arguments**

`range` A two-element vector holding the *defaults* for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the *transformed units*.

`trans` A trans object from the scales package, such as `scales::log10_trans()` or `scales::reciprocal_trans()`. If not provided, the default is used which matches the units used in range. If no transformation, NULL.

`values` A vector of possible values (TRUE or FALSE).

**Details**

These functions map to `sda::sda()` arguments via:

- `shrinkage_correlation()` to `lambda`
- `shrinkage_variance()` to `lambda.var`
- `shrinkage_frequencies()` to `lambda.freqs`
- `diagonal_covariance()` to `diagonal`

**Value**

For the functions, they return a function with classes "param" and either "quant\_param" or "qual\_param".

---

smoothness

*Kernel Smoothness*

---

**Description**

Used in `discrim::naive_Bayes()`.

**Usage**

```
smoothness(range = c(0.5, 1.5), trans = NULL)
```

**Arguments**

- |       |   |
|-------|---|
| range | A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .                                 |
| trans | A trans object from the scales package, such as <code>scales::log10_trans()</code> or <code>scales::reciprocal_trans()</code> . If not provided, the default is used which matches the units used in range. If no transformation, NULL. |

**Examples**

```
smoothness()
```



---

stop_iter	<i>Early stopping parameter</i>
-----------	---------------------------------

---

**Description**

For some models, the effectiveness of the model can decrease as training iterations continue. `stop_iter()` can be used to tune how many iterations without an improvement in the objective function occur before training should be halted.

**Usage**

```
stop_iter(range = c(3L, 20L), trans = NULL)
```

**Arguments**

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as <code>scales::log10_trans()</code> or <code>scales::reciprocal_trans()</code> . If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Examples**

```
stop_iter()
```

---

summary_stat	<i>Rolling summary statistic for moving windows</i>
--------------	---

---

**Description**

This parameter is used in `recipes::step_window()`.

**Usage**

```
summary_stat(values = values_summary_stat)
```

```
values_summary_stat
```

**Arguments**

values	A character string of possible values. See <code>values_summary_stat</code> in examples below.
--------	--

**Format**

An object of class character of length 8.

**Examples**

```
values_summary_stat  
summary_stat()
```

---

survival_link	<i>Survival Model Link Function</i>
---------------	-------------------------------------

---

**Description**

Survival Model Link Function

**Usage**

```
survival_link(values = values_survival_link)  
  
values_survival_link
```

**Arguments**

values	A character string of possible values. See values_survival_link in examples below.
--------	--

**Format**

An object of class character of length 3.

**Details**

This parameter is used in `parsnip::set_engine('flexsurvspline')`.

**Examples**

```
values_survival_link  
survival_link()
```

---

surv_dist	<i>Parametric distributions for censored data</i>
-----------	---

---

**Description**

Parametric distributions for censored data

**Usage**

```
surv_dist(values = values_surv_dist)
values_surv_dist
```

**Arguments**

values            A character string of possible values. See values\_surv\_dist in examples below.

**Format**

An object of class character of length 6.

**Details**

This parameter is used in `parsnip::survival_reg()`.

**Examples**

```
values_surv_dist
surv_dist()
```

---

threshold	<i>General thresholding parameter</i>
-----------	---------------------------------------

---

**Description**

In a number of cases, there are arguments that are threshold values for data falling between zero and one. For example, `recipes::step_other()` and so on.

**Usage**

```
threshold(range = c(0, 1), trans = NULL)
```

**Arguments**

- range            A two-element vector holding the *defaults* for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the *transformed units*.
- trans            A trans object from the scales package, such as `scales::log10_trans()` or `scales::reciprocal_trans()`. If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Examples**

```
threshold()
```

---

token	<i>Token types</i>
-------	--------------------

---

**Description**

Token types

**Usage**

```
token(values = values_token)
values_token
```

**Arguments**

- values            A character string of possible values. See `values_token` in examples below.

**Format**

An object of class character of length 12.

**Details**

This parameter is used in `textrecipes::step_tokenize()`.

**Examples**

```
values_token
token()
```

trees

*Parameter functions related to tree- and rule-based models.***Description**

These are parameter generating functions that can be used for modeling, especially in conjunction with the **parsnip** package.

**Usage**

```
trees(range = c(1L, 2000L), trans = NULL)

min_n(range = c(2L, 40L), trans = NULL)

sample_size(range = c(unknown(), unknown()), trans = NULL)

sample_prop(range = c(1/10, 1), trans = NULL)

loss_reduction(range = c(-10, 1.5), trans = log10_trans())

tree_depth(range = c(1L, 15L), trans = NULL)

prune(values = c(TRUE, FALSE))

cost_complexity(range = c(-10, -1), trans = log10_trans())
```

**Arguments**

range	A two-element vector holding the <i>defaults</i> for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the <i>transformed units</i> .
trans	A trans object from the scales package, such as <code>scales::log10_trans()</code> or <code>scales::reciprocal_trans()</code> . If not provided, the default is used which matches the units used in range. If no transformation, NULL.
values	A vector of possible values (TRUE or FALSE).

**Details**

These functions generate parameters that are useful when the model is based on trees or rules.

- `trees()`: The number of trees contained in a random forest or boosted ensemble. In the latter case, this is equal to the number of boosting iterations. (See `parsnip::rand_forest()` and `parsnip::boost_tree()`).
- `min_n()`: The minimum number of data points in a node that is required for the node to be split further. (See `parsnip::rand_forest()` and `parsnip::boost_tree()`).
- `sample_size()`: The size of the data set used for modeling within an iteration of the modeling algorithm, such as stochastic gradient boosting. (See `parsnip::boost_tree()`).

- `sample_prop()`: The same as `sample_size()` but as a proportion of the total sample.
- `loss_reduction()`: The reduction in the loss function required to split further. (See `parsnip::boost_tree()`). This corresponds to `gamma` in **xgboost**.
- `tree_depth()`: The maximum depth of the tree (i.e. number of splits). (See `parsnip::boost_tree()`).
- `prune()`: A logical for whether a tree or set of rules should be pruned.
- `cost_complexity()`: The cost-complexity parameter in classical CART models.

### Examples

```
trees()
min_n()
sample_size()
loss_reduction()
tree_depth()
prune()
cost_complexity()
```

---

unknown

*Placeholder for unknown parameter values*

---

### Description

`unknown()` creates an expression used to signify that the value will be specified at a later time.

### Usage

```
unknown()

is_unknown(x)

has_unknowns(object)
```

### Arguments

<code>x</code>	An object or vector or objects to test for unknown-ness.
<code>object</code>	An object of class <code>param</code> .

### Value

`unknown()` returns expression value for `unknown()`.

`is_unknown()` returns a vector of logicals as long as `x` that are TRUE is the element of `x` is unknown, and FALSE otherwise.

`has_unknowns()` returns a single logical indicating if the range of a `param` object has any unknown values.

## Examples

```
# Just returns an expression
unknown()

# Of course, true!
is_unknown(unknown())

# Create a range with a minimum of 1
# and an unknown maximum
range <- c(1, unknown())

range

# The first value is known, the
# second is not
is_unknown(range)

# mtry()'s maximum value is not known at
# creation time
has_unknowns(mtry())
```

---

update.parameters	<i>Update a single parameter in a parameter set</i>
-------------------	---

---

## Description

Update a single parameter in a parameter set

## Usage

```
## S3 method for class 'parameters'
update(object, ...)
```

## Arguments

object	A parameter set.
...	One or more unquoted named values separated by commas. The names should correspond to the id values in the parameter set. The values should be parameter objects or NA values.

## Value

The modified parameter set.

**Examples**

```

params <- list(lambda = penalty(), alpha = mixture(), `rand forest` = mtry())
pset <- parameters(params)
pset

update(pset, `rand forest` = finalize(mtry(), mtcars), alpha = mixture(c(.1, .2)))

```

value\_validate

*Tools for working with parameter values***Description**

Setters and validators for parameter values. Additionally, tools for creating sequences of parameter values and for transforming parameter values are provided.

**Usage**

```

value_validate(object, values)

value_seq(object, n, original = TRUE)

value_sample(object, n, original = TRUE)

value_transform(object, values)

value_inverse(object, values)

value_set(object, values)

```

**Arguments**

object	An object with class <code>quant_param</code> .
values	A numeric vector or list (including <code>Inf</code> ). Values <i>cannot</i> include <code>unknown()</code> . For <code>value_validate()</code> , the units should be consistent with the parameter object's definition.
n	An integer for the (maximum) number of values to return. In some cases where a sequence is requested, the result might have less than <code>n</code> values. See <code>Details</code> .
original	A single logical. Should the range values be in the natural units ( <code>TRUE</code> ) or in the transformed space ( <code>FALSE</code> , if applicable)?

**Details**

For sequences of integers, the code uses `unique(floor(seq(min, max, length.out = n)))` and this may generate an uneven set of values shorter than `n`. This also means that if `n` is larger than the range of the integers, a smaller set will be generated. For qualitative parameters, the first `n` values are returned.



For quantitative parameters, any values contained in the object are sampled with replacement. Otherwise, a sequence of values between the range values is returned. It is possible that less than  $n$  values are returned.

For qualitative parameters, sampling of the values is conducted with replacement. For qualitative values, a random uniform distribution is used.

### Value

`value_validate()` throws an error or silently returns values if they are contained in the values of the object.

`value_transform()` and `value_inverse()` return a *vector* of numeric values.

`value_seq()` and `value_sample()` return a vector of values consistent with the type field of object.

### Examples

```
library(dplyr)

penalty() %>% value_set(-4:-1)

# Is a specific value valid?
penalty()
penalty() %>% range_get()
value_validate(penalty(), 17)

# get a sequence of values
cost_complexity()
cost_complexity() %>% value_seq(4)
cost_complexity() %>% value_seq(4, original = FALSE)

on_log_scale <- cost_complexity() %>% value_seq(4, original = FALSE)
nat_units <- value_inverse(cost_complexity(), on_log_scale)
nat_units
value_transform(cost_complexity(), nat_units)

# random values in the range
set.seed(3666)
cost_complexity() %>% value_sample(2)
```

---

vocabulary_size	<i>Number of tokens in vocabulary</i>
-----------------	---------------------------------------

---

### Description

Used in `textrecipes::step_tokenize_sentencepiece()` and `textrecipes::step_tokenize_bpe()`.

**Usage**

```
vocabulary_size(range = c(1000L, 32000L), trans = NULL)
```

**Arguments**

**range** A two-element vector holding the *defaults* for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the *transformed units*.

**trans** A trans object from the scales package, such as `scales::log10_trans()` or `scales::reciprocal_trans()`. If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Examples**

```
vocabulary_size()
```

---

weight	<i>Parameter for "double normalization" when creating token counts</i>
--------	--

---

**Description**

Used in `textrecipes::step_tf()`.

**Usage**

```
weight(range = c(-10, 0), trans = log10_trans())
```

**Arguments**

**range** A two-element vector holding the *defaults* for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the *transformed units*.

**trans** A trans object from the scales package, such as `scales::log10_trans()` or `scales::reciprocal_trans()`. If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Examples**

```
weight()
```

---

weight_func	<i>Kernel functions for distance weighting</i>
-------------	--

---

**Description**

Kernel functions for distance weighting

**Usage**

```
weight_func(values = values_weight_func)
```

```
values_weight_func
```

**Arguments**

values	A character string of possible values. See values_weight_func in examples below.
--------	--

**Format**

An object of class character of length 10.

**Details**

This parameter is used in `parsnip::nearest_neighbors()`.

**Examples**

```
values_weight_func
weight_func()
```

---

weight_scheme	<i>Term frequency weighting methods</i>
---------------	---

---

**Description**

Term frequency weighting methods

**Usage**

```
weight_scheme(values = values_weight_scheme)
```

```
values_weight_scheme
```

**Arguments**

values            A character string of possible values. See values\_weight\_scheme in examples below.

**Format**

An object of class character of length 5.

**Details**

This parameter is used in textrecipes::step\_tf().

**Examples**

```
values_weight_scheme
weight_scheme()
```

---

window_size	<i>Parameter for the moving window size</i>
-------------	---

---

**Description**

Used in recipes::step\_window().

**Usage**

```
window_size(range = c(3L, 11L), trans = NULL)
```

**Arguments**

range            A two-element vector holding the *defaults* for the smallest and largest possible values, respectively. If a transformation is specified, these values should be in the *transformed units*.

trans            A trans object from the scales package, such as scales::log10\_trans() or scales::reciprocal\_trans(). If not provided, the default is used which matches the units used in range. If no transformation, NULL.

**Examples**

```
window_size()
```

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