Package 'mlr3learners'

March 13, 2024

Title Recommended Learners for 'mlr3'

Version 0.6.0

Description Recommended Learners for 'mlr3'. Extends 'mlr3' with interfaces to essential machine learning packages on CRAN. This includes, but is not limited to: (penalized) linear and logistic regression, linear and quadratic discriminant analysis, k-nearest neighbors, naive Bayes, support vector machines, and gradient boosting.

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URL https://mlr3learners.mlr-org.com, https://github.com/mlr-org/mlr3learners

BugReports https://github.com/mlr-org/mlr3learners/issues

Depends mlr3 (>= 0.17.1), R (>= 3.1.0)

Imports checkmate, data.table, mlr3misc (>= 0.9.4), paradox, R6

Suggests DiceKriging, e1071, glmnet, kknn, knitr, lgr, MASS, nnet, pracma, ranger, rgenoud, rmarkdown, testthat (>= 3.0.0), xgboost (>= 1.6.0)

Config/testthat/edition 3

Encoding UTF-8

NeedsCompilation no

RoxygenNote 7.3.1

Collate 'aaa.R' 'LearnerClassifCVGlmnet.R' 'LearnerClassifGlmnet.R' 'LearnerClassifKKNN.R' 'LearnerClassifLDA.R' 'LearnerClassifLogReg.R' 'LearnerClassifMultinom.R' 'LearnerClassifNaiveBayes.R' 'LearnerClassifNnet.R' 'LearnerClassifQDA.R' 'LearnerClassifRanger.R' 'LearnerClassifSVM.R' 'LearnerClassifXgboost.R' 'LearnerRegrCVGlmnet.R' 'LearnerRegrGlmnet.R' 'LearnerRegrKKNN.R' 'LearnerRegrKM.R' 'LearnerRegrLM.R' 'LearnerRegrNnet.R' 'LearnerRegrRanger.R' 'LearnerRegrSVM.R' 'LearnerRegrXgboost.R' 'bibentries.R' 'helpers.R' 'helpers_glmnet.R' 'helpers_ranger.R' 'zzz.R'

Author Michel Lang [cre, aut] (<https://orcid.org/0000-0001-9754-0393>),
Quay Au [aut] (<https://orcid.org/0000-0002-5252-8902>),
Stefan Coors [aut] (<https://orcid.org/0000-0002-7465-2146>),
Patrick Schratz [aut] (<https://orcid.org/0000-0003-0748-6624>)

Maintainer Michel Lang <michellang@gmail.com>

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R topics documented:

`mlr3learners-package` *mlr3learners: Recommended Learners for 'mlr3'*

Description

More learners are implemented in the mlr3extralearners package. A guide on how to create custom learners is covered in the book: `https://mlr3book.mlr-org.com`. Feel invited to contribute a missing learner to the **mlr3** ecosystem!

Author(s)

Maintainer: Michel Lang <michellang@gmail.com> (ORCID)

Authors:

- Quay Au <quayau@gmail.com> (ORCID)
- Stefan Coors <mail@stefancoors.de> (ORCID)
- Patrick Schratz <patrick.schratz@gmail.com> (ORCID)

See Also

Useful links:

- https://mlr3learners.mlr-org.com
- https://github.com/mlr-org/mlr3learners
- Report bugs at https://github.com/mlr-org/mlr3learners/issues

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`mlr_learners_classif.cv_glmnet`
GLM with Elastic Net Regularization Classification Learner

Description

Generalized linear models with elastic net regularization. Calls `glmnet::cv.glmnet()` from package **glmnet**.

The default for hyperparameter `family` is set to `"binomial"` or `"multinomial"`, depending on the number of classes.

Dictionary

This Learner can be instantiated via the dictionary mlr_learners or with the associated sugar function `lrn()`:

```
mlr_learners$get("classif.cv_glmnet")
lrn("classif.cv_glmnet")
```

Meta Information

- Task type: "classif"
- Predict Types: "response", "prob"
- Feature Types: "logical", "integer", "numeric"
- Required Packages: **mlr3**, **mlr3learners**, **glmnet**

Parameters

Id	Type	Default	Levels	Range
alignment	character	lambda	lambda, fraction	-
alpha	numeric	1		$[0, 1]$
big	numeric	9.9e+35		$(-\infty, \infty)$
devmax	numeric	0.999		$[0, 1]$
dfmax	integer	-		$[0, \infty)$
epsnr	numeric	1e-08		$[0, 1]$
eps	numeric	1e-06		$[0, 1]$
exclude	integer	-		$[1, \infty)$
exmx	numeric	250		$(-\infty, \infty)$
fdev	numeric	1e-05		$[0, 1]$
foldid	untyped			-
gamma	untyped	-		-
grouped	logical	TRUE	TRUE, FALSE	-
intercept	logical	TRUE	TRUE, FALSE	-
keep	logical	FALSE	TRUE, FALSE	-
lambda.min.ratio	numeric	-		$[0, 1]$
lambda	untyped	-		-
lower.limits	untyped	-		-
maxit	integer	100000		$[1, \infty)$
mnlam	integer	5		$[1, \infty)$
mxitnr	integer	25		$[1, \infty)$
mxit	integer	100		$[1, \infty)$
nfolds	integer	10		$[3, \infty)$
nlambda	integer	100		$[1, \infty)$
offset	untyped			-
parallel	logical	FALSE	TRUE, FALSE	-
penalty.factor	untyped	-		-
pmax	integer	-		$[0, \infty)$
pmin	numeric	1e-09		$[0, 1]$
prec	numeric	1e-10		$(-\infty, \infty)$
predict.gamma	numeric	gamma.1se		$(-\infty, \infty)$
relax	logical	FALSE	TRUE, FALSE	-
s	numeric	lambda.1se		$[0, \infty)$
standardize	logical	TRUE	TRUE, FALSE	-
standardize.response	logical	FALSE	TRUE, FALSE	-
thresh	numeric	1e-07		$[0, \infty)$
trace.it	integer	0		$[0, 1]$
type.gaussian	character	-	covariance, naive	-
type.logistic	character	-	Newton, modified.Newton	-
type.measure	character	deviance	deviance, class, auc, mse, mae	-
type.multinomial	character	-	ungrouped, grouped	-
upper.limits	untyped	-		-

Internal Encoding

Starting with **mlr3** v0.5.0, the order of class labels is reversed prior to model fitting to comply to the `stats::glm()` convention that the negative class is provided as the first factor level.

Super classes

`mlr3::Learner` -> `mlr3::LearnerClassif` -> `LearnerClassifCVGlmnet`

Methods

Public methods:

- `LearnerClassifCVGlmnet$new()`
- `LearnerClassifCVGlmnet$selected_features()`
- `LearnerClassifCVGlmnet$clone()`

Method `new()`**:** Creates a new instance of this R6 class.

Usage:

```
LearnerClassifCVGlmnet$new()
```

Method `selected_features()`**:** Returns the set of selected features as reported by `glmnet::predict.glmnet()` with `type` set to `"nonzero"`.

Usage:

```
LearnerClassifCVGlmnet$selected_features(lambda = NULL)
```

Arguments:

`lambda` (`numeric(1)`)
Custom `lambda`, defaults to the active lambda depending on parameter set.

Returns: (`character()`) of feature names.

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

Usage:

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

Arguments:

`deep` Whether to make a deep clone.

References

Friedman J, Hastie T, Tibshirani R (2010). "Regularization Paths for Generalized Linear Models via Coordinate Descent." *Journal of Statistical Software*, **33**(1), 1–22. doi:10.18637/jss.v033.i01.

See Also

- Chapter in the mlr3book: `https://mlr3book.mlr-org.com/chapters/chapter2/data_and_basic_modeling.html#sec-learners`
- Package mlr3extralearners for more learners.
- Dictionary of Learners: mlr_learners

- `as.data.table(mlr_learners)` for a table of available Learners in the running session (depending on the loaded packages).
- **mlr3pipelines** to combine learners with pre- and postprocessing steps.
- Extension packages for additional task types:
  - **mlr3proba** for probabilistic supervised regression and survival analysis.
  - **mlr3cluster** for unsupervised clustering.
- **mlr3tuning** for tuning of hyperparameters, **mlr3tuningspaces** for established default tuning spaces.

Other Learner: `mlr_learners_classif.glmnet`, `mlr_learners_classif.kknn`, `mlr_learners_classif.lda`, `mlr_learners_classif.log_reg`, `mlr_learners_classif.multinom`, `mlr_learners_classif.naive_bayes`, `mlr_learners_classif.nnet`, `mlr_learners_classif.qda`, `mlr_learners_classif.ranger`, `mlr_learners_classif.svm`, `mlr_learners_classif.xgboost`, `mlr_learners_regr.cv_glmnet`, `mlr_learners_regr.glmnet`, `mlr_learners_regr.kknn`, `mlr_learners_regr.km`, `mlr_learners_regr.lm`, `mlr_learners_regr.nnet`, `mlr_learners_regr.ranger`, `mlr_learners_regr.svm`, `mlr_learners_regr.xgboost`

Examples

```
if (requireNamespace("glmnet", quietly = TRUE)) {
# Define the Learner and set parameter values
learner = lrn("classif.cv_glmnet")
print(learner)

# Define a Task
task = tsk("sonar")

# Create train and test set
ids = partition(task)

# Train the learner on the training ids
learner$train(task, row_ids = ids$train)

# print the model
print(learner$model)

# importance method
if("importance" %in% learner$properties) print(learner$importance)

# Make predictions for the test rows
predictions = learner$predict(task, row_ids = ids$test)

# Score the predictions
predictions$score()
}
```

`mlr_learners_classif.glmnet`

GLM with Elastic Net Regularization Classification Learner

Description

Generalized linear models with elastic net regularization. Calls `glmnet::glmnet()` from package **glmnet**.

Details

Caution: This learner is different to learners calling `glmnet::cv.glmnet()` in that it does not use the internal optimization of parameter `lambda`. Instead, `lambda` needs to be tuned by the user (e.g., via **mlr3tuning**). When `lambda` is tuned, the `glmnet` will be trained for each tuning iteration. While fitting the whole path of `lambda`s would be more efficient, as is done by default in `glmnet::glmnet()`, tuning/selecting the parameter at prediction time (using parameter `s`) is currently not supported in **mlr3** (at least not in efficient manner). Tuning the `s` parameter is, therefore, currently discouraged.

When the data are i.i.d. and efficiency is key, we recommend using the respective auto-tuning counterparts in `mlr_learners_classif.cv_glmnet()` or `mlr_learners_regr.cv_glmnet()`. However, in some situations this is not applicable, usually when data are imbalanced or not i.i.d. (longitudinal, time-series) and tuning requires custom resampling strategies (blocked design, stratification).

Dictionary

This Learner can be instantiated via the dictionary mlr_learners or with the associated sugar function `lrn()`:

```
mlr_learners$get("classif.glmnet")
lrn("classif.glmnet")
```

Meta Information

- Task type: "classif"
- Predict Types: "response", "prob"
- Feature Types: "logical", "integer", "numeric"
- Required Packages: **mlr3**, **mlr3learners**, **glmnet**

Parameters

Id	Type	Default	Levels	Range
alpha	numeric	1		$[0, 1]$
big	numeric	9.9e+35		$(-\infty, \infty)$
devmax	numeric	0.999		$[0, 1]$
dfmax	integer	-		$[0, \infty)$
eps	numeric	1e-06		$[0, 1]$
epsnr	numeric	1e-08		$[0, 1]$
exact	logical	FALSE	TRUE, FALSE	-
exclude	integer	-		$[1, \infty)$
exmx	numeric	250		$(-\infty, \infty)$
fdev	numeric	1e-05		$[0, 1]$

gamma	numeric	1		$(-\infty, \infty)$
intercept	logical	TRUE	TRUE, FALSE	-
lambda	untyped	-		-
lambda.min.ratio	numeric	-		$[0, 1]$
lower.limits	untyped	-		-
maxit	integer	100000		$[1, \infty)$
mnlam	integer	5		$[1, \infty)$
mxit	integer	100		$[1, \infty)$
mxitnr	integer	25		$[1, \infty)$
nlambda	integer	100		$[1, \infty)$
newoffset	untyped	-		-
offset	untyped			-
penalty.factor	untyped	-		-
pmax	integer	-		$[0, \infty)$
pmin	numeric	1e-09		$[0, 1]$
prec	numeric	1e-10		$(-\infty, \infty)$
relax	logical	FALSE	TRUE, FALSE	-
s	numeric	0.01		$[0, \infty)$
standardize	logical	TRUE	TRUE, FALSE	-
standardize.response	logical	FALSE	TRUE, FALSE	-
thresh	numeric	1e-07		$[0, \infty)$
trace.it	integer	0		$[0, 1]$
type.gaussian	character	-	covariance, naive	-
type.logistic	character	-	Newton, modified.Newton	-
type.multinomial	character	-	ungrouped, grouped	-
upper.limits	untyped	-		-

Internal Encoding

Starting with **mlr3** v0.5.0, the order of class labels is reversed prior to model fitting to comply to the `stats::glm()` convention that the negative class is provided as the first factor level.

Super classes

`mlr3::Learner` -> `mlr3::LearnerClassif` -> `LearnerClassifGlmnet`

Methods

Public methods:

- `LearnerClassifGlmnet$new()`
- `LearnerClassifGlmnet$selected_features()`
- `LearnerClassifGlmnet$clone()`

Method `new()`**:** Creates a new instance of this R6 class.

Usage:

```
LearnerClassifGlmnet$new()
```

Method `selected_features()`**:** Returns the set of selected features as reported by `glmnet::predict.glmnet()` with `type` set to `"nonzero"`.

Usage:

```
LearnerClassifGlmnet$selected_features(lambda = NULL)
```

Arguments:

`lambda` (`numeric(1)`)
Custom `lambda`, defaults to the active lambda depending on parameter set.

Returns: (`character()`) of feature names.

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

Usage:

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

Arguments:

`deep` Whether to make a deep clone.

References

Friedman J, Hastie T, Tibshirani R (2010). "Regularization Paths for Generalized Linear Models via Coordinate Descent." *Journal of Statistical Software*, **33**(1), 1–22. doi:10.18637/jss.v033.i01.

See Also

- Chapter in the mlr3book: `https://mlr3book.mlr-org.com/chapters/chapter2/data_and_basic_modeling.html#sec-learners`
- Package mlr3extralearners for more learners.
- Dictionary of Learners: mlr_learners
- `as.data.table(mlr_learners)` for a table of available Learners in the running session (depending on the loaded packages).
- **mlr3pipelines** to combine learners with pre- and postprocessing steps.
- Extension packages for additional task types:
  - **mlr3proba** for probabilistic supervised regression and survival analysis.
  - **mlr3cluster** for unsupervised clustering.
- **mlr3tuning** for tuning of hyperparameters, **mlr3tuningspaces** for established default tuning spaces.

Other Learner: `mlr_learners_classif.cv_glmnet`, `mlr_learners_classif.kknn`, `mlr_learners_classif.lda`, `mlr_learners_classif.log_reg`, `mlr_learners_classif.multinom`, `mlr_learners_classif.naive_bayes`, `mlr_learners_classif.nnet`, `mlr_learners_classif.qda`, `mlr_learners_classif.ranger`, `mlr_learners_classif.svm`, `mlr_learners_classif.xgboost`, `mlr_learners_regr.cv_glmnet`, `mlr_learners_regr.glmnet`, `mlr_learners_regr.kknn`, `mlr_learners_regr.km`, `mlr_learners_regr.lm`, `mlr_learners_regr.nnet`, `mlr_learners_regr.ranger`, `mlr_learners_regr.svm`, `mlr_learners_regr.xgboost`

Examples

```
if (requireNamespace("glmnet", quietly = TRUE)) {
# Define the Learner and set parameter values
learner = lrn("classif.glmnet")
print(learner)

# Define a Task
task = tsk("sonar")

# Create train and test set
ids = partition(task)

# Train the learner on the training ids
learner$train(task, row_ids = ids$train)

# print the model
print(learner$model)

# importance method
if("importance" %in% learner$properties) print(learner$importance)

# Make predictions for the test rows
predictions = learner$predict(task, row_ids = ids$test)

# Score the predictions
predictions$score()
}
```

---

mlr_learners_classif.kknn

k-Nearest-Neighbor Classification Learner

Description

k-Nearest-Neighbor classification. Calls `kknn::kknn()` from package **kknn**.

Initial parameter values

- `store_model`:
  - See note.

Dictionary

This Learner can be instantiated via the dictionary mlr_learners or with the associated sugar function `lrn()`:

```
mlr_learners$get("classif.kknn")
lrn("classif.kknn")
```

Meta Information

- Task type: "classif"
- Predict Types: "response", "prob"
- Feature Types: "logical", "integer", "numeric", "factor", "ordered"
- Required Packages: **mlr3**, **mlr3learners**, **kknn**

Parameters

Id	Type	Default	Levels
k	integer	7	
distance	numeric	2	
kernel	character	optimal	rectangular, triangular, epanechnikov, biweight, triweight, cos, inv, gaussian, rank, optim
scale	logical	TRUE	TRUE, FALSE
ykernel	untyped		
store_model	logical	FALSE	TRUE, FALSE

Super classes

`mlr3::Learner` -> `mlr3::LearnerClassif` -> `LearnerClassifKKNN`

Methods

Public methods:

- `LearnerClassifKKNN$new()`
- `LearnerClassifKKNN$clone()`

Method `new()`**:** Creates a new instance of this R6 class.

Usage:

```
LearnerClassifKKNN$new()
```

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

Usage:

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

Arguments:

`deep` Whether to make a deep clone.

Note

There is no training step for k-NN models, just storing the training data to process it during the predict step. Therefore, `$model` returns a list with the following elements:

- `formula`: Formula for calling `kknn::kknn()` during `$predict()`.

- data: Training data for calling kknn::kknn() during $predict().
- pv: Training parameters for calling kknn::kknn() during $predict().
- kknn: Model as returned by kknn::kknn(), only available **after** $predict() has been called. This is not stored by default, you must set hyperparameter store_model to TRUE.

References

Hechenbichler, Klaus, Schliep, Klaus (2004). "Weighted k-nearest-neighbor techniques and ordinal classification." Technical Report Discussion Paper 399, SFB 386, Ludwig-Maximilians University Munich. doi:10.5282/ubm/epub.1769.

Samworth, J R (2012). "Optimal weighted nearest neighbour classifiers." *The Annals of Statistics*, **40**(5), 2733–2763. doi:10.1214/12AOS1049.

Cover, Thomas, Hart, Peter (1967). "Nearest neighbor pattern classification." *IEEE transactions on information theory*, **13**(1), 21–27. doi:10.1109/TIT.1967.1053964.

See Also

- Chapter in the mlr3book: https://mlr3book.mlr-org.com/chapters/chapter2/data_and_basic_modeling.html#sec-learners
- Package mlr3extralearners for more learners.
- Dictionary of Learners: mlr_learners
- as.data.table(mlr_learners) for a table of available Learners in the running session (depending on the loaded packages).
- **mlr3pipelines** to combine learners with pre- and postprocessing steps.
- Extension packages for additional task types:
  - **mlr3proba** for probabilistic supervised regression and survival analysis.
  - **mlr3cluster** for unsupervised clustering.
- **mlr3tuning** for tuning of hyperparameters, **mlr3tuningspaces** for established default tuning spaces.

Other Learner: mlr_learners_classif.cv_glmnet, mlr_learners_classif.glmnet, mlr_learners_classif.lda, mlr_learners_classif.log_reg, mlr_learners_classif.multinom, mlr_learners_classif.naive_bayes, mlr_learners_classif.nnet, mlr_learners_classif.qda, mlr_learners_classif.ranger, mlr_learners_classif.svm, mlr_learners_classif.xgboost, mlr_learners_regr.cv_glmnet, mlr_learners_regr.glmnet, mlr_learners_regr.kknn, mlr_learners_regr.km, mlr_learners_regr.lm, mlr_learners_regr.nnet, mlr_learners_regr.ranger, mlr_learners_regr.svm, mlr_learners_regr.xgboost

Examples

```
if (requireNamespace("kknn", quietly = TRUE)) {
# Define the Learner and set parameter values
learner = lrn("classif.kknn")
print(learner)

# Define a Task
task = tsk("sonar")
```

```
# Create train and test set
ids = partition(task)

# Train the learner on the training ids
learner$train(task, row_ids = ids$train)

# print the model
print(learner$model)

# importance method
if("importance" %in% learner$properties) print(learner$importance)

# Make predictions for the test rows
predictions = learner$predict(task, row_ids = ids$test)

# Score the predictions
predictions$score()
}
```

`mlr_learners_classif.lda`

Linear Discriminant Analysis Classification Learner

Description

Linear discriminant analysis. Calls `MASS::lda()` from package **MASS**.

Details

Parameters `method` and `prior` exist for training and prediction but accept different values for each. Therefore, arguments for the predict stage have been renamed to `predict.method` and `predict.prior`, respectively.

Dictionary

This Learner can be instantiated via the dictionary mlr_learners or with the associated sugar function `lrn()`:

```
mlr_learners$get("classif.lda")
lrn("classif.lda")
```

Meta Information

- Task type: "classif"
- Predict Types: "response", "prob"
- Feature Types: "logical", "integer", "numeric", "factor", "ordered"
- Required Packages: **mlr3**, **mlr3learners**, **MASS**

Parameters

Id	Type	Default	Levels	Range
dimen	untyped	-		-
method	character	moment	moment, mle, mve, t	-
nu	integer	-		$(-\infty, \infty)$
predict.method	character	plug-in	plug-in, predictive, debiased	-
predict.prior	untyped	-		-
prior	untyped	-		-
tol	numeric	-		$(-\infty, \infty)$

Super classes

`mlr3::Learner` -> `mlr3::LearnerClassif` -> `LearnerClassifLDA`

Methods

Public methods:

- `LearnerClassifLDA$new()`
- `LearnerClassifLDA$clone()`

Method `new()`**:** Creates a new instance of this R6 class.

Usage:

```
LearnerClassifLDA$new()
```

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

Usage:

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

Arguments:

`deep` Whether to make a deep clone.

References

Venables WN, Ripley BD (2002). *Modern Applied Statistics with S*, Fourth edition. Springer, New York. ISBN 0-387-95457-0, http://www.stats.ox.ac.uk/pub/MASS4/.

See Also

- Chapter in the mlr3book: https://mlr3book.mlr-org.com/chapters/chapter2/data_and_basic_modeling.html#sec-learners
- Package mlr3extralearners for more learners.
- Dictionary of Learners: mlr_learners
- `as.data.table(mlr_learners)` for a table of available Learners in the running session (depending on the loaded packages).
- **mlr3pipelines** to combine learners with pre- and postprocessing steps.

- Extension packages for additional task types:
  - **mlr3proba** for probabilistic supervised regression and survival analysis.
  - **mlr3cluster** for unsupervised clustering.
- **mlr3tuning** for tuning of hyperparameters, **mlr3tuningspaces** for established default tuning spaces.

Other Learner: mlr_learners_classif.cv_glmnet, mlr_learners_classif.glmnet, mlr_learners_classif.kknn, mlr_learners_classif.log_reg, mlr_learners_classif.multinom, mlr_learners_classif.naive_bayes, mlr_learners_classif.nnet, mlr_learners_classif.qda, mlr_learners_classif.ranger, mlr_learners_classif.svm, mlr_learners_classif.xgboost, mlr_learners_regr.cv_glmnet, mlr_learners_regr.glmnet, mlr_learners_regr.kknn, mlr_learners_regr.km, mlr_learners_regr.lm, mlr_learners_regr.nnet, mlr_learners_regr.ranger, mlr_learners_regr.svm, mlr_learners_regr.xgboost

Examples

```
if (requireNamespace("MASS", quietly = TRUE)) {
# Define the Learner and set parameter values
learner = lrn("classif.lda")
print(learner)

# Define a Task
task = tsk("sonar")

# Create train and test set
ids = partition(task)

# Train the learner on the training ids
learner$train(task, row_ids = ids$train)

# print the model
print(learner$model)

# importance method
if("importance" %in% learner$properties) print(learner$importance)

# Make predictions for the test rows
predictions = learner$predict(task, row_ids = ids$test)

# Score the predictions
predictions$score()
}
```

---

mlr_learners_classif.log_reg

Logistic Regression Classification Learner

Description

Classification via logistic regression. Calls stats::glm() with family set to "binomial".

Internal Encoding

Starting with **mlr3** v0.5.0, the order of class labels is reversed prior to model fitting to comply to the `stats::glm()` convention that the negative class is provided as the first factor level.

Weights

It is not advisable to change the weights of a logistic regression. For more details, see this question on Cross Validated.

Initial parameter values

- `model`:
  - Actual default: `TRUE`.
  - Adjusted default: `FALSE`.
  - Reason for change: Save some memory.

Dictionary

This Learner can be instantiated via the dictionary mlr_learners or with the associated sugar function `lrn()`:

```
mlr_learners$get("classif.log_reg")
lrn("classif.log_reg")
```

Meta Information

- Task type: "classif"
- Predict Types: "response", "prob"
- Feature Types: "logical", "integer", "numeric", "character", "factor", "ordered"
- Required Packages: **mlr3**, **mlr3learners**, 'stats'

Parameters

Id	Type	Default	Levels	Range
dispersion	untyped			-
epsilon	numeric	1e-08		$(-\infty, \infty)$
etastart	untyped	-		-
maxit	numeric	25		$(-\infty, \infty)$
model	logical	TRUE	TRUE, FALSE	-
mustart	untyped	-		-
offset	untyped	-		-
singular.ok	logical	TRUE	TRUE, FALSE	-
start	untyped			-
trace	logical	FALSE	TRUE, FALSE	-
x	logical	FALSE	TRUE, FALSE	-
y	logical	TRUE	TRUE, FALSE	-

Contrasts

To ensure reproducibility, this learner always uses the default contrasts:

- `contr.treatment()` for unordered factors, and
- `contr.poly()` for ordered factors.

Setting the option `"contrasts"` does not have any effect. Instead, set the respective hyperparameter or use **mlr3pipelines** to create dummy features.

Super classes

`mlr3::Learner` -> `mlr3::LearnerClassif` -> `LearnerClassifLogReg`

Methods

Public methods:

- `LearnerClassifLogReg$new()`
- `LearnerClassifLogReg$loglik()`
- `LearnerClassifLogReg$clone()`

Method `new()`**:** Creates a new instance of this R6 class.

Usage:

```
LearnerClassifLogReg$new()
```

Method `loglik()`**:** Extract the log-likelihood (e.g., via `stats::logLik()` from the fitted model.

Usage:

```
LearnerClassifLogReg$loglik()
```

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

Usage:

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

Arguments:

`deep` Whether to make a deep clone.

See Also

- Chapter in the mlr3book: `https://mlr3book.mlr-org.com/chapters/chapter2/data_and_basic_modeling.html#sec-learners`
- Package mlr3extralearners for more learners.
- Dictionary of Learners: mlr_learners
- `as.data.table(mlr_learners)` for a table of available Learners in the running session (depending on the loaded packages).
- **mlr3pipelines** to combine learners with pre- and postprocessing steps.

- Extension packages for additional task types:
  - **mlr3proba** for probabilistic supervised regression and survival analysis.
  - **mlr3cluster** for unsupervised clustering.
- **mlr3tuning** for tuning of hyperparameters, **mlr3tuningspaces** for established default tuning spaces.

Other Learner: mlr_learners_classif.cv_glmnet, mlr_learners_classif.glmnet, mlr_learners_classif.kknn, mlr_learners_classif.lda, mlr_learners_classif.multinom, mlr_learners_classif.naive_bayes, mlr_learners_classif.nnet, mlr_learners_classif.qda, mlr_learners_classif.ranger, mlr_learners_classif.svm, mlr_learners_classif.xgboost, mlr_learners_regr.cv_glmnet, mlr_learners_regr.glmnet, mlr_learners_regr.kknn, mlr_learners_regr.km, mlr_learners_regr.lm, mlr_learners_regr.nnet, mlr_learners_regr.ranger, mlr_learners_regr.svm, mlr_learners_regr.xgboost

Examples

```
if (requireNamespace("stats", quietly = TRUE)) {
# Define the Learner and set parameter values
learner = lrn("classif.log_reg")
print(learner)

# Define a Task
task = tsk("sonar")

# Create train and test set
ids = partition(task)

# Train the learner on the training ids
learner$train(task, row_ids = ids$train)

# print the model
print(learner$model)

# importance method
if("importance" %in% learner$properties) print(learner$importance)

# Make predictions for the test rows
predictions = learner$predict(task, row_ids = ids$test)

# Score the predictions
predictions$score()
}
```

---

mlr_learners_classif.multinom

Multinomial log-linear learner via neural networks

Description

Multinomial log-linear models via neural networks. Calls nnet::multinom() from package **nnet**.

Dictionary

This Learner can be instantiated via the dictionary mlr_learners or with the associated sugar function `lrn()`:

```
mlr_learners$get("classif.multinom")
lrn("classif.multinom")
```

Meta Information

- Task type: "classif"
- Predict Types: "response", "prob"
- Feature Types: "logical", "integer", "numeric", "factor"
- Required Packages: **mlr3**, **mlr3learners**, **nnet**

Parameters

Id	Type	Default	Levels	Range
Hess	logical	FALSE	TRUE, FALSE	-
abstol	numeric	1e-04		$(-\infty, \infty)$
censored	logical	FALSE	TRUE, FALSE	-
decay	numeric	0		$(-\infty, \infty)$
entropy	logical	FALSE	TRUE, FALSE	-
mask	untyped	-		-
maxit	integer	100		$[1, \infty)$
MaxNWts	integer	1000		$[1, \infty)$
model	logical	FALSE	TRUE, FALSE	-
linout	logical	FALSE	TRUE, FALSE	-
rang	numeric	0.7		$(-\infty, \infty)$
reltol	numeric	1e-08		$(-\infty, \infty)$
size	integer	-		$[1, \infty)$
skip	logical	FALSE	TRUE, FALSE	-
softmax	logical	FALSE	TRUE, FALSE	-
summ	character	0	0, 1, 2, 3	-
trace	logical	TRUE	TRUE, FALSE	-
Wts	untyped	-		-

Super classes

`mlr3::Learner` -> `mlr3::LearnerClassif` -> `LearnerClassifMultinom`

Methods

Public methods:

- `LearnerClassifMultinom$new()`

- `LearnerClassifMultinom$loglik()`
- `LearnerClassifMultinom$clone()`

Method `new()`**:** Creates a new instance of this R6 class.

Usage:

```
LearnerClassifMultinom$new()
```

Method `loglik()`**:** Extract the log-likelihood (e.g., via `stats::logLik()` from the fitted model.

Usage:

```
LearnerClassifMultinom$loglik()
```

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

Usage:

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

Arguments:

`deep` Whether to make a deep clone.

See Also

- Chapter in the mlr3book: https://mlr3book.mlr-org.com/chapters/chapter2/data_and_basic_modeling.html#sec-learners
- Package mlr3extralearners for more learners.
- Dictionary of Learners: mlr_learners
- `as.data.table(mlr_learners)` for a table of available Learners in the running session (depending on the loaded packages).
- **mlr3pipelines** to combine learners with pre- and postprocessing steps.
- Extension packages for additional task types:
  - **mlr3proba** for probabilistic supervised regression and survival analysis.
  - **mlr3cluster** for unsupervised clustering.
- **mlr3tuning** for tuning of hyperparameters, **mlr3tuningspaces** for established default tuning spaces.

Other Learner: `mlr_learners_classif.cv_glmnet`, `mlr_learners_classif.glmnet`, `mlr_learners_classif.kknn`, `mlr_learners_classif.lda`, `mlr_learners_classif.log_reg`, `mlr_learners_classif.naive_bayes`, `mlr_learners_classif.nnet`, `mlr_learners_classif.qda`, `mlr_learners_classif.ranger`, `mlr_learners_classif.svm`, `mlr_learners_classif.xgboost`, `mlr_learners_regr.cv_glmnet`, `mlr_learners_regr.glmnet`, `mlr_learners_regr.kknn`, `mlr_learners_regr.km`, `mlr_learners_regr.lm`, `mlr_learners_regr.nnet`, `mlr_learners_regr.ranger`, `mlr_learners_regr.svm`, `mlr_learners_regr.xgboost`

Examples

```
if (requireNamespace("nnet", quietly = TRUE)) {
# Define the Learner and set parameter values
learner = lrn("classif.multinom")
print(learner)
```

```
# Define a Task
task = tsk("sonar")

# Create train and test set
ids = partition(task)

# Train the learner on the training ids
learner$train(task, row_ids = ids$train)

# print the model
print(learner$model)

# importance method
if("importance" %in% learner$properties) print(learner$importance)

# Make predictions for the test rows
predictions = learner$predict(task, row_ids = ids$test)

# Score the predictions
predictions$score()
}
```

`mlr_learners_classif.naive_bayes`

Naive Bayes Classification Learner

Description

Naive Bayes classification. Calls `e1071::naiveBayes()` from package **e1071**.

Dictionary

This Learner can be instantiated via the dictionary mlr_learners or with the associated sugar function `lrn()`:

```
mlr_learners$get("classif.naive_bayes")
lrn("classif.naive_bayes")
```

Meta Information

- Task type: "classif"
- Predict Types: "response", "prob"
- Feature Types: "logical", "integer", "numeric", "factor"
- Required Packages: **mlr3**, **mlr3learners**, **e1071**

Parameters

Id	Type	Default	Range
eps	numeric	0	$(-\infty, \infty)$
laplace	numeric	0	$[0, \infty)$
threshold	numeric	0.001	$(-\infty, \infty)$

Super classes

`mlr3::Learner` -> `mlr3::LearnerClassif` -> `LearnerClassifNaiveBayes`

Methods

Public methods:

- `LearnerClassifNaiveBayes$new()`
- `LearnerClassifNaiveBayes$clone()`

Method `new()`**:** Creates a new instance of this R6 class.

Usage:

```
LearnerClassifNaiveBayes$new()
```

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

Usage:

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

Arguments:

`deep` Whether to make a deep clone.

See Also

- Chapter in the mlr3book: https://mlr3book.mlr-org.com/chapters/chapter2/data_and_basic_modeling.html#sec-learners
- Package mlr3extralearners for more learners.
- Dictionary of Learners: mlr_learners
- `as.data.table(mlr_learners)` for a table of available Learners in the running session (depending on the loaded packages).
- **mlr3pipelines** to combine learners with pre- and postprocessing steps.
- Extension packages for additional task types:
  - **mlr3proba** for probabilistic supervised regression and survival analysis.
  - **mlr3cluster** for unsupervised clustering.

- **mlr3tuning** for tuning of hyperparameters, **mlr3tuningspaces** for established default tuning spaces.

Other Learner: mlr_learners_classif.cv_glmnet, mlr_learners_classif.glmnet, mlr_learners_classif.kknn, mlr_learners_classif.lda, mlr_learners_classif.log_reg, mlr_learners_classif.multinom, mlr_learners_classif.nnet, mlr_learners_classif.qda, mlr_learners_classif.ranger, mlr_learners_classif.svm, mlr_learners_classif.xgboost, mlr_learners_regr.cv_glmnet, mlr_learners_regr.glmnet, mlr_learners_regr.kknn, mlr_learners_regr.km, mlr_learners_regr.lm, mlr_learners_regr.nnet, mlr_learners_regr.ranger, mlr_learners_regr.svm, mlr_learners_regr.xgboost

Examples

```
if (requireNamespace("e1071", quietly = TRUE)) {
# Define the Learner and set parameter values
learner = lrn("classif.naive_bayes")
print(learner)

# Define a Task
task = tsk("sonar")

# Create train and test set
ids = partition(task)

# Train the learner on the training ids
learner$train(task, row_ids = ids$train)

# print the model
print(learner$model)

# importance method
if("importance" %in% learner$properties) print(learner$importance)

# Make predictions for the test rows
predictions = learner$predict(task, row_ids = ids$test)

# Score the predictions
predictions$score()
}
```

---

mlr_learners_classif.nnet

Classification Neural Network Learner

Description

Single Layer Neural Network. Calls nnet::nnet.formula() from package **nnet**.

Note that modern neural networks with multiple layers are connected via package mlr3torch.

Dictionary

This Learner can be instantiated via the dictionary mlr_learners or with the associated sugar function `lrn()`:

```
mlr_learners$get("classif.nnet")
lrn("classif.nnet")
```

Meta Information

- Task type: "classif"
- Predict Types: "response", "prob"
- Feature Types: "integer", "numeric", "factor", "ordered"
- Required Packages: **mlr3**, **mlr3learners**, **nnet**

Parameters

Id	Type	Default	Levels	Range
Hess	logical	FALSE	TRUE, FALSE	-
MaxNWts	integer	1000		$[1, \infty)$
Wts	untyped	-		-
abstol	numeric	1e-04		$(-\infty, \infty)$
censored	logical	FALSE	TRUE, FALSE	-
contrasts	untyped			-
decay	numeric	0		$(-\infty, \infty)$
mask	untyped	-		-
maxit	integer	100		$[1, \infty)$
na.action	untyped	-		-
rang	numeric	0.7		$(-\infty, \infty)$
reltol	numeric	1e-08		$(-\infty, \infty)$
size	integer	3		$[0, \infty)$
skip	logical	FALSE	TRUE, FALSE	-
subset	untyped	-		-
trace	logical	TRUE	TRUE, FALSE	-
formula	untyped	-		-

Initial parameter values

- `size`:
  - Adjusted default: 3L.
  - Reason for change: no default in `nnet()`.

Custom mlr3 parameters

- `formula`: if not provided, the formula is set to `task$formula()`.

Super classes

`mlr3::Learner` -> `mlr3::LearnerClassif` -> `LearnerClassifNnet`

Methods

Public methods:

- `LearnerClassifNnet$new()`
- `LearnerClassifNnet$clone()`

Method `new()`**:** Creates a new instance of this R6 class.

Usage:

```
LearnerClassifNnet$new()
```

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

Usage:

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

Arguments:

`deep` Whether to make a deep clone.

References

Ripley BD (1996). *Pattern Recognition and Neural Networks*. Cambridge University Press. doi:10.1017/cbo9780511812651.

See Also

- Chapter in the mlr3book: `https://mlr3book.mlr-org.com/chapters/chapter2/data_and_basic_modeling.html#sec-learners`
- Package mlr3extralearners for more learners.
- Dictionary of Learners: mlr_learners
- `as.data.table(mlr_learners)` for a table of available Learners in the running session (depending on the loaded packages).
- **mlr3pipelines** to combine learners with pre- and postprocessing steps.
- Extension packages for additional task types:
  - **mlr3proba** for probabilistic supervised regression and survival analysis.
  - **mlr3cluster** for unsupervised clustering.
- **mlr3tuning** for tuning of hyperparameters, **mlr3tuningspaces** for established default tuning spaces.

Other Learner: `mlr_learners_classif.cv_glmnet`, `mlr_learners_classif.glmnet`, `mlr_learners_classif.kknn`, `mlr_learners_classif.lda`, `mlr_learners_classif.log_reg`, `mlr_learners_classif.multinom`, `mlr_learners_classif.naive_bayes`, `mlr_learners_classif.qda`, `mlr_learners_classif.ranger`, `mlr_learners_classif.svm`, `mlr_learners_classif.xgboost`, `mlr_learners_regr.cv_glmnet`, `mlr_learners_regr.glmnet`, `mlr_learners_regr.kknn`, `mlr_learners_regr.km`, `mlr_learners_regr.lm`, `mlr_learners_regr.nnet`, `mlr_learners_regr.ranger`, `mlr_learners_regr.svm`, `mlr_learners_regr.xgboost`

Examples

```
if (requireNamespace("nnet", quietly = TRUE)) {
# Define the Learner and set parameter values
learner = lrn("classif.nnet")
print(learner)

# Define a Task
task = tsk("sonar")

# Create train and test set
ids = partition(task)

# Train the learner on the training ids
learner$train(task, row_ids = ids$train)

# print the model
print(learner$model)

# importance method
if("importance" %in% learner$properties) print(learner$importance)

# Make predictions for the test rows
predictions = learner$predict(task, row_ids = ids$test)

# Score the predictions
predictions$score()
}
```

`mlr_learners_classif.qda`

Quadratic Discriminant Analysis Classification Learner

Description

Quadratic discriminant analysis. Calls `MASS::qda()` from package **MASS**.

Details

Parameters `method` and `prior` exist for training and prediction but accept different values for each. Therefore, arguments for the predict stage have been renamed to `predict.method` and `predict.prior`, respectively.

Dictionary

This Learner can be instantiated via the dictionary mlr_learners or with the associated sugar function `lrn()`:

```
mlr_learners$get("classif.qda")
lrn("classif.qda")
```

Meta Information

- Task type: "classif"
- Predict Types: "response", "prob"
- Feature Types: "logical", "integer", "numeric", "factor", "ordered"
- Required Packages: **mlr3**, **mlr3learners**, **MASS**

Parameters

Id	Type	Default	Levels	Range
method	character	moment	moment, mle, mve, t	-
nu	integer	-		$(-\infty, \infty)$
predict.method	character	plug-in	plug-in, predictive, debiased	-
predict.prior	untyped	-		-
prior	untyped	-		-

Super classes

`mlr3::Learner` -> `mlr3::LearnerClassif` -> `LearnerClassifQDA`

Methods

Public methods:

- `LearnerClassifQDA$new()`
- `LearnerClassifQDA$clone()`

Method `new()`**:** Creates a new instance of this R6 class.

Usage:

```
LearnerClassifQDA$new()
```

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

Usage:

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

Arguments:

`deep` Whether to make a deep clone.

References

Venables WN, Ripley BD (2002). *Modern Applied Statistics with S*, Fourth edition. Springer, New York. ISBN 0-387-95457-0, http://www.stats.ox.ac.uk/pub/MASS4/.

See Also

- Chapter in the mlr3book: https://mlr3book.mlr-org.com/chapters/chapter2/data_and_basic_modeling.html#sec-learners
- Package mlr3extralearners for more learners.
- Dictionary of Learners: mlr_learners
- `as.data.table(mlr_learners)` for a table of available Learners in the running session (depending on the loaded packages).
- **mlr3pipelines** to combine learners with pre- and postprocessing steps.
- Extension packages for additional task types:
  - **mlr3proba** for probabilistic supervised regression and survival analysis.
  - **mlr3cluster** for unsupervised clustering.
- **mlr3tuning** for tuning of hyperparameters, **mlr3tuningspaces** for established default tuning spaces.

Other Learner: `mlr_learners_classif.cv_glmnet`, `mlr_learners_classif.glmnet`, `mlr_learners_classif.kknn`, `mlr_learners_classif.lda`, `mlr_learners_classif.log_reg`, `mlr_learners_classif.multinom`, `mlr_learners_classif.naive_bayes`, `mlr_learners_classif.nnet`, `mlr_learners_classif.ranger`, `mlr_learners_classif.svm`, `mlr_learners_classif.xgboost`, `mlr_learners_regr.cv_glmnet`, `mlr_learners_regr.glmnet`, `mlr_learners_regr.kknn`, `mlr_learners_regr.km`, `mlr_learners_regr.lm`, `mlr_learners_regr.nnet`, `mlr_learners_regr.ranger`, `mlr_learners_regr.svm`, `mlr_learners_regr.xgboost`

Examples

```
if (requireNamespace("MASS", quietly = TRUE)) {
# Define the Learner and set parameter values
learner = lrn("classif.qda")
print(learner)

# Define a Task
task = tsk("sonar")

# Create train and test set
ids = partition(task)

# Train the learner on the training ids
learner$train(task, row_ids = ids$train)

# print the model
print(learner$model)

# importance method
if("importance" %in% learner$properties) print(learner$importance)

# Make predictions for the test rows
predictions = learner$predict(task, row_ids = ids$test)

# Score the predictions
predictions$score()
}
```

`mlr_learners_classif.ranger`
Ranger Classification Learner

Description

Random classification forest. Calls `ranger::ranger()` from package **ranger**.

Custom mlr3 parameters

- `mtry`:
  - This hyperparameter can alternatively be set via our hyperparameter `mtry.ratio` as `mtry = max(ceiling(mtry.ratio * n_features), 1)`. Note that `mtry` and `mtry.ratio` are mutually exclusive.

Initial parameter values

- `num.threads`:
  - Actual default: `NULL`, triggering auto-detection of the number of CPUs.
  - Adjusted value: 1.
  - Reason for change: Conflicting with parallelization via **future**.

Dictionary

This Learner can be instantiated via the dictionary mlr_learners or with the associated sugar function `lrn()`:

```
mlr_learners$get("classif.ranger")
lrn("classif.ranger")
```

Meta Information

- Task type: "classif"
- Predict Types: "response", "prob"
- Feature Types: "logical", "integer", "numeric", "character", "factor", "ordered"
- Required Packages: **mlr3**, **mlr3learners**, **ranger**

Parameters

Id	Type	Default	Levels	Range
alpha	numeric	0.5		$(-\infty, \infty)$
always.split.variables	untyped	-		-
class.weights	untyped			-
holdout	logical	FALSE	TRUE, FALSE	-
importance	character	-	none, impurity, impurity_corrected, permutation	-

keep.inbag	logical	FALSE	TRUE, FALSE	-
max.depth	integer	NULL		$[0, \infty)$
min.bucket	integer	1		$[1, \infty)$
min.node.size	integer	NULL		$[1, \infty)$
minprop	numeric	0.1		$(-\infty, \infty)$
mtry	integer	-		$[1, \infty)$
mtry.ratio	numeric	-		$[0, 1]$
num.random.splits	integer	1		$[1, \infty)$
node.stats	logical	FALSE	TRUE, FALSE	-
num.threads	integer	1		$[1, \infty)$
num.trees	integer	500		$[1, \infty)$
oob.error	logical	TRUE	TRUE, FALSE	-
regularization.factor	untyped	1		-
regularization.usedepth	logical	FALSE	TRUE, FALSE	-
replace	logical	TRUE	TRUE, FALSE	-
respect.unordered.factors	character	ignore	ignore, order, partition	-
sample.fraction	numeric	-		$[0, 1]$
save.memory	logical	FALSE	TRUE, FALSE	-
scale.permutation.importance	logical	FALSE	TRUE, FALSE	-
se.method	character	infjack	jack, infjack	-
seed	integer	NULL		$(-\infty, \infty)$
split.select.weights	untyped			-
splitrule	character	gini	gini, extratrees, hellinger	-
verbose	logical	TRUE	TRUE, FALSE	-
write.forest	logical	TRUE	TRUE, FALSE	-

Super classes

`mlr3::Learner` -> `mlr3::LearnerClassif` -> `LearnerClassifRanger`

Methods

Public methods:

- `LearnerClassifRanger$new()`
- `LearnerClassifRanger$importance()`
- `LearnerClassifRanger$oob_error()`
- `LearnerClassifRanger$clone()`

Method `new()`**:** Creates a new instance of this R6 class.

Usage:

```
LearnerClassifRanger$new()
```

Method `importance()`**:** The importance scores are extracted from the model slot `variable.importance`. Parameter `importance.mode` must be set to `"impurity"`, `"impurity_corrected"`, or `"permutation"`

Usage:

```
LearnerClassifRanger$importance()
```

Returns: Named `numeric()`.

Method `oob_error()`**:** The out-of-bag error, extracted from model slot `prediction.error`.

Usage:

```
LearnerClassifRanger$oob_error()
```

Returns: `numeric(1)`.

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

Usage:

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

Arguments:

`deep` Whether to make a deep clone.

References

Wright, N. M, Ziegler, Andreas (2017). "ranger: A Fast Implementation of Random Forests for High Dimensional Data in C++ and R." *Journal of Statistical Software*, **77**(1), 1–17. doi:10.18637/jss.v077.i01.

Breiman, Leo (2001). "Random Forests." *Machine Learning*, **45**(1), 5–32. ISSN 1573-0565, doi:10.1023/A:1010933404324.

See Also

- Chapter in the mlr3book: `https://mlr3book.mlr-org.com/chapters/chapter2/data_and_basic_modeling.html#sec-learners`
- Package mlr3extralearners for more learners.
- Dictionary of Learners: mlr_learners
- `as.data.table(mlr_learners)` for a table of available Learners in the running session (depending on the loaded packages).
- **mlr3pipelines** to combine learners with pre- and postprocessing steps.
- Extension packages for additional task types:
  - **mlr3proba** for probabilistic supervised regression and survival analysis.
  - **mlr3cluster** for unsupervised clustering.
- **mlr3tuning** for tuning of hyperparameters, **mlr3tuningspaces** for established default tuning spaces.

Other Learner: `mlr_learners_classif.cv_glmnet`, `mlr_learners_classif.glmnet`, `mlr_learners_classif.kknn`, `mlr_learners_classif.lda`, `mlr_learners_classif.log_reg`, `mlr_learners_classif.multinom`, `mlr_learners_classif.naive_bayes`, `mlr_learners_classif.nnet`, `mlr_learners_classif.qda`, `mlr_learners_classif.svm`, `mlr_learners_classif.xgboost`, `mlr_learners_regr.cv_glmnet`, `mlr_learners_regr.glmnet`, `mlr_learners_regr.kknn`, `mlr_learners_regr.km`, `mlr_learners_regr.lm`, `mlr_learners_regr.nnet`, `mlr_learners_regr.ranger`, `mlr_learners_regr.svm`, `mlr_learners_regr.xgboost`

Examples

```
if (requireNamespace("ranger", quietly = TRUE)) {
# Define the Learner and set parameter values
learner = lrn("classif.ranger")
print(learner)

# Define a Task
task = tsk("sonar")

# Create train and test set
ids = partition(task)

# Train the learner on the training ids
learner$train(task, row_ids = ids$train)

# print the model
print(learner$model)

# importance method
if("importance" %in% learner$properties) print(learner$importance)

# Make predictions for the test rows
predictions = learner$predict(task, row_ids = ids$test)

# Score the predictions
predictions$score()
}
```

---

mlr_learners_classif.svm

Support Vector Machine

Description

Support vector machine for classification. Calls `e1071::svm()` from package **e1071**.

Dictionary

This Learner can be instantiated via the dictionary mlr_learners or with the associated sugar function `lrn()`:

```
mlr_learners$get("classif.svm")
lrn("classif.svm")
```

Meta Information

- Task type: "classif"
- Predict Types: "response", "prob"
- Feature Types: "logical", "integer", "numeric"
- Required Packages: **mlr3**, **mlr3learners**, **e1071**

Parameters

Id	Type	Default	Levels	Range
cachesize	numeric	40		$(-\infty, \infty)$
class.weights	untyped			-
coef0	numeric	0		$(-\infty, \infty)$
cost	numeric	1		$[0, \infty)$
cross	integer	0		$[0, \infty)$
decision.values	logical	FALSE	TRUE, FALSE	-
degree	integer	3		$[1, \infty)$
epsilon	numeric	0.1		$[0, \infty)$
fitted	logical	TRUE	TRUE, FALSE	-
gamma	numeric	-		$[0, \infty)$
kernel	character	radial	linear, polynomial, radial, sigmoid	-
nu	numeric	0.5		$(-\infty, \infty)$
scale	untyped	TRUE		-
shrinking	logical	TRUE	TRUE, FALSE	-
tolerance	numeric	0.001		$[0, \infty)$
type	character	C-classification	C-classification, nu-classification	-

Super classes

`mlr3::Learner` -> `mlr3::LearnerClassif` -> `LearnerClassifSVM`

Methods

Public methods:

- `LearnerClassifSVM$new()`
- `LearnerClassifSVM$clone()`

Method `new()`**:** Creates a new instance of this R6 class.

Usage:

```
LearnerClassifSVM$new()
```

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

Usage:

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

Arguments:

`deep` Whether to make a deep clone.

References

Cortes, Corinna, Vapnik, Vladimir (1995). "Support-vector networks." *Machine Learning*, **20**(3), 273–297. doi:10.1007/BF00994018.

See Also

- Chapter in the mlr3book: https://mlr3book.mlr-org.com/chapters/chapter2/data_and_basic_modeling.html#sec-learners
- Package mlr3extralearners for more learners.
- Dictionary of Learners: mlr_learners
- `as.data.table(mlr_learners)` for a table of available Learners in the running session (depending on the loaded packages).
- **mlr3pipelines** to combine learners with pre- and postprocessing steps.
- Extension packages for additional task types:
  - **mlr3proba** for probabilistic supervised regression and survival analysis.
  - **mlr3cluster** for unsupervised clustering.
- **mlr3tuning** for tuning of hyperparameters, **mlr3tuningspaces** for established default tuning spaces.

Other Learner: `mlr_learners_classif.cv_glmnet`, `mlr_learners_classif.glmnet`, `mlr_learners_classif.kknn`, `mlr_learners_classif.lda`, `mlr_learners_classif.log_reg`, `mlr_learners_classif.multinom`, `mlr_learners_classif.naive_bayes`, `mlr_learners_classif.nnet`, `mlr_learners_classif.qda`, `mlr_learners_classif.ranger`, `mlr_learners_classif.xgboost`, `mlr_learners_regr.cv_glmnet`, `mlr_learners_regr.glmnet`, `mlr_learners_regr.kknn`, `mlr_learners_regr.km`, `mlr_learners_regr.lm`, `mlr_learners_regr.nnet`, `mlr_learners_regr.ranger`, `mlr_learners_regr.svm`, `mlr_learners_regr.xgboost`

Examples

```
if (requireNamespace("e1071", quietly = TRUE)) {
# Define the Learner and set parameter values
learner = lrn("classif.svm")
print(learner)

# Define a Task
task = tsk("sonar")

# Create train and test set
ids = partition(task)

# Train the learner on the training ids
learner$train(task, row_ids = ids$train)

# print the model
print(learner$model)

# importance method
if("importance" %in% learner$properties) print(learner$importance)

# Make predictions for the test rows
predictions = learner$predict(task, row_ids = ids$test)

# Score the predictions
predictions$score()
}
```

`mlr_learners_classif.xgboost` *Extreme Gradient Boosting Classification Learner*

Description

eXtreme Gradient Boosting classification. Calls `xgboost::xgb.train()` from package **xgboost**.

If not specified otherwise, the evaluation metric is set to the default `"logloss"` for binary classification problems and set to `"mlogloss"` for multiclass problems. This was necessary to silence a deprecation warning.

Note that using the `watchlist` parameter directly will lead to problems when wrapping this `Learner` in a `mlr3pipelines` `GraphLearner` as the preprocessing steps will not be applied to the data in the watchlist.

Initial parameter values

- `nrounds`:
  - Actual default: no default.
  - Adjusted default: 1.
  - Reason for change: Without a default construction of the learner would error. Just setting a nonsense default to workaround this. `nrounds` needs to be tuned by the user.
- `nthread`:
  - Actual value: Undefined, triggering auto-detection of the number of CPUs.
  - Adjusted value: 1.
  - Reason for change: Conflicting with parallelization via **future**.
- `verbose`:
  - Actual default: 1.
  - Adjusted default: 0.
  - Reason for change: Reduce verbosity.

Early stopping

Early stopping can be used to find the optimal number of boosting rounds. The `early_stopping_set` parameter controls which set is used to monitor the performance. Set `early_stopping_set = "test"` to monitor the performance of the model on the test set while training. The test set for early stopping can be set with the `"test"` row role in the mlr3::Task. Additionally, the range must be set in which the performance must increase with `early_stopping_rounds` and the maximum number of boosting rounds with `nrounds`. While resampling, the test set is automatically applied from the mlr3::Resampling. Not that using the test set for early stopping can potentially bias the performance scores. See the section on early stopping in the examples.

Dictionary

This Learner can be instantiated via the dictionary mlr_learners or with the associated sugar function `lrn()`:

```
mlr_learners$get("classif.xgboost")
lrn("classif.xgboost")
```

Meta Information

- Task type: "classif"
- Predict Types: "response", "prob"
- Feature Types: "logical", "integer", "numeric"
- Required Packages: **mlr3**, **mlr3learners**, **xgboost**

Parameters

Id	Type	Default	Levels	Range
alpha	numeric	0		$[0, \infty)$
approxcontrib	logical	FALSE	TRUE, FALSE	-
base_score	numeric	0.5		$(-\infty, \infty)$
booster	character	gbtree	gbtree, gblinear, dart	-
callbacks	untyped	list		-
colsample_bylevel	numeric	1		$[0, 1]$
colsample_bynode	numeric	1		$[0, 1]$
colsample_bytree	numeric	1		$[0, 1]$
device	untyped	cpu		-
disable_default_eval_metric	logical	FALSE	TRUE, FALSE	-
early_stopping_rounds	integer	NULL		$[1, \infty)$
early_stopping_set	character	none	none, train, test	-
eta	numeric	0.3		$[0, 1]$
eval_metric	untyped	-		-
feature_selector	character	cyclic	cyclic, shuffle, random, greedy, thrifty	-
feval	untyped			-
gamma	numeric	0		$[0, \infty)$
grow_policy	character	depthwise	depthwise, lossguide	-
interaction_constraints	untyped	-		-
iterationrange	untyped	-		-
lambda	numeric	1		$[0, \infty)$
lambda_bias	numeric	0		$[0, \infty)$
max_bin	integer	256		$[2, \infty)$
max_delta_step	numeric	0		$[0, \infty)$
max_depth	integer	6		$[0, \infty)$
max_leaves	integer	0		$[0, \infty)$
maximize	logical	NULL	TRUE, FALSE	-
min_child_weight	numeric	1		$[0, \infty)$
missing	numeric	NA		$(-\infty, \infty)$
monotone_constraints	untyped	0		-

normalize_type	character	tree	tree, forest	-
nrounds	integer	-		$[1, \infty)$
nthread	integer	1		$[1, \infty)$
ntreelimit	integer	NULL		$[1, \infty)$
num_parallel_tree	integer	1		$[1, \infty)$
objective	untyped	binary:logistic		-
one_drop	logical	FALSE	TRUE, FALSE	-
outputmargin	logical	FALSE	TRUE, FALSE	-
predcontrib	logical	FALSE	TRUE, FALSE	-
predinteraction	logical	FALSE	TRUE, FALSE	-
predleaf	logical	FALSE	TRUE, FALSE	-
print_every_n	integer	1		$[1, \infty)$
process_type	character	default	default, update	-
rate_drop	numeric	0		$[0, 1]$
refresh_leaf	logical	TRUE	TRUE, FALSE	-
reshape	logical	FALSE	TRUE, FALSE	-
seed_per_iteration	logical	FALSE	TRUE, FALSE	-
sampling_method	character	uniform	uniform, gradient_based	-
sample_type	character	uniform	uniform, weighted	-
save_name	untyped			-
save_period	integer	NULL		$[0, \infty)$
scale_pos_weight	numeric	1		$(-\infty, \infty)$
skip_drop	numeric	0		$[0, 1]$
strict_shape	logical	FALSE	TRUE, FALSE	-
subsample	numeric	1		$[0, 1]$
top_k	integer	0		$[0, \infty)$
training	logical	FALSE	TRUE, FALSE	-
tree_method	character	auto	auto, exact, approx, hist, gpu_hist	-
tweedie_variance_power	numeric	1.5		$[1, 2]$
updater	untyped	-		-
verbose	integer	1		$[0, 2]$
watchlist	untyped			-
xgb_model	untyped			-

Super classes

`mlr3::Learner` -> `mlr3::LearnerClassif` -> `LearnerClassifXgboost`

Methods

Public methods:

- `LearnerClassifXgboost$new()`
- `LearnerClassifXgboost$importance()`
- `LearnerClassifXgboost$clone()`

Method `new()`**:** Creates a new instance of this R6 class.

Usage:

```
LearnerClassifXgboost$new()
```

Method `importance()`**:** The importance scores are calculated with `xgboost::xgb.importance()`.

Usage:

```
LearnerClassifXgboost$importance()
```

Returns: Named `numeric()`.

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

Usage:

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

Arguments:

`deep` Whether to make a deep clone.

Note

To compute on GPUs, you first need to compile **xgboost** yourself and link against CUDA. See `https://xgboost.readthedocs.io/en/stable/build.html#building-with-gpu-support`.

References

Chen, Tianqi, Guestrin, Carlos (2016). "Xgboost: A scalable tree boosting system." In *Proceedings of the 22nd ACM SIGKDD Conference on Knowledge Discovery and Data Mining*, 785–794. ACM. doi:10.1145/2939672.2939785.

See Also

- Chapter in the mlr3book: `https://mlr3book.mlr-org.com/chapters/chapter2/data_and_basic_modeling.html#sec-learners`
- Package mlr3extralearners for more learners.
- Dictionary of Learners: mlr_learners
- `as.data.table(mlr_learners)` for a table of available Learners in the running session (depending on the loaded packages).
- **mlr3pipelines** to combine learners with pre- and postprocessing steps.
- Extension packages for additional task types:
  - **mlr3proba** for probabilistic supervised regression and survival analysis.
  - **mlr3cluster** for unsupervised clustering.
- **mlr3tuning** for tuning of hyperparameters, **mlr3tuningspaces** for established default tuning spaces.

Other Learner: `mlr_learners_classif.cv_glmnet`, `mlr_learners_classif.glmnet`, `mlr_learners_classif.kknn`, `mlr_learners_classif.lda`, `mlr_learners_classif.log_reg`, `mlr_learners_classif.multinom`, `mlr_learners_classif.naive_bayes`, `mlr_learners_classif.nnet`, `mlr_learners_classif.qda`, `mlr_learners_classif.ranger`, `mlr_learners_classif.svm`, `mlr_learners_regr.cv_glmnet`, `mlr_learners_regr.glmnet`, `mlr_learners_regr.kknn`, `mlr_learners_regr.km`, `mlr_learners_regr.lm`, `mlr_learners_regr.nnet`, `mlr_learners_regr.ranger`, `mlr_learners_regr.svm`, `mlr_learners_regr.xgboost`

Examples

```
## Not run:
if (requireNamespace("xgboost", quietly = TRUE)) {
# Define the Learner and set parameter values
learner = lrn("classif.xgboost")
print(learner)

# Define a Task
task = tsk("sonar")

# Create train and test set
ids = partition(task)

# Train the learner on the training ids
learner$train(task, row_ids = ids$train)

# print the model
print(learner$model)

# importance method
if("importance" %in% learner$properties) print(learner$importance)

# Make predictions for the test rows
predictions = learner$predict(task, row_ids = ids$test)

# Score the predictions
predictions$score()
}

## End(Not run)

## Not run:
# Train learner with early stopping on spam data set
task = tsk("spam")

# Split task into training and test set
split = partition(task, ratio = 0.8)
task$set_row_roles(split$test, "test")

# Set early stopping parameter
learner = lrn("classif.xgboost",
  nrounds = 100,
  early_stopping_rounds = 10,
  early_stopping_set = "test"
)

# Train learner with early stopping
learner$train(task)

## End(Not run)
```

`mlr_learners_regr.cv_glmnet`

GLM with Elastic Net Regularization Regression Learner

Description

Generalized linear models with elastic net regularization. Calls `glmnet::cv.glmnet()` from package **glmnet**.

The default for hyperparameter `family` is set to `"gaussian"`.

Dictionary

This Learner can be instantiated via the dictionary mlr_learners or with the associated sugar function `lrn()`:

```
mlr_learners$get("regr.cv_glmnet")
lrn("regr.cv_glmnet")
```

Meta Information

- Task type: "regr"
- Predict Types: "response"
- Feature Types: "logical", "integer", "numeric"
- Required Packages: **mlr3**, **mlr3learners**, **glmnet**

Parameters

Id	Type	Default	Levels	Range
alignment	character	lambda	lambda, fraction	-
alpha	numeric	1		$[0, 1]$
big	numeric	9.9e+35		$(-\infty, \infty)$
devmax	numeric	0.999		$[0, 1]$
dfmax	integer	-		$[0, \infty)$
eps	numeric	1e-06		$[0, 1]$
epsnr	numeric	1e-08		$[0, 1]$
exclude	integer	-		$[1, \infty)$
exmx	numeric	250		$(-\infty, \infty)$
family	character	gaussian	gaussian, poisson	-
fdev	numeric	1e-05		$[0, 1]$
foldid	untyped			-
gamma	untyped	-		-
grouped	logical	TRUE	TRUE, FALSE	-
intercept	logical	TRUE	TRUE, FALSE	-
keep	logical	FALSE	TRUE, FALSE	-
lambda	untyped	-		-

lambda.min.ratio	numeric	-		$[0, 1]$
lower.limits	untyped	-		-
maxit	integer	100000		$[1, \infty)$
mnlam	integer	5		$[1, \infty)$
mxit	integer	100		$[1, \infty)$
mxitnr	integer	25		$[1, \infty)$
nfolds	integer	10		$[3, \infty)$
nlambda	integer	100		$[1, \infty)$
offset	untyped			-
parallel	logical	FALSE	TRUE, FALSE	-
penalty.factor	untyped	-		-
pmax	integer	-		$[0, \infty)$
pmin	numeric	1e-09		$[0, 1]$
prec	numeric	1e-10		$(-\infty, \infty)$
predict.gamma	numeric	gamma.1se		$(-\infty, \infty)$
relax	logical	FALSE	TRUE, FALSE	-
s	numeric	lambda.1se		$[0, \infty)$
standardize	logical	TRUE	TRUE, FALSE	-
standardize.response	logical	FALSE	TRUE, FALSE	-
thresh	numeric	1e-07		$[0, \infty)$
trace.it	integer	0		$[0, 1]$
type.gaussian	character	-	covariance, naive	-
type.logistic	character	-	Newton, modified.Newton	-
type.measure	character	deviance	deviance, class, auc, mse, mae	-
type.multinomial	character	-	ungrouped, grouped	-
upper.limits	untyped	-		-

Super classes

`mlr3::Learner` -> `mlr3::LearnerRegr` -> `LearnerRegrCVGlmnet`

Methods

Public methods:

- `LearnerRegrCVGlmnet$new()`
- `LearnerRegrCVGlmnet$selected_features()`
- `LearnerRegrCVGlmnet$clone()`

Method `new()`**:** Creates a new instance of this R6 class.

Usage:

```
LearnerRegrCVGlmnet$new()
```

Method `selected_features()`**:** Returns the set of selected features as reported by `glmnet::predict.glmnet()` with `type` set to `"nonzero"`.

Usage:

```
LearnerRegrCVGlmnet$selected_features(lambda = NULL)
```

Arguments:

`lambda (numeric(1))`
Custom `lambda`, defaults to the active lambda depending on parameter set.

Returns: (`character()`) of feature names.

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

Usage:

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

Arguments:

`deep` Whether to make a deep clone.

References

Friedman J, Hastie T, Tibshirani R (2010). "Regularization Paths for Generalized Linear Models via Coordinate Descent." *Journal of Statistical Software*, **33**(1), 1–22. doi:10.18637/jss.v033.i01.

See Also

- Chapter in the mlr3book: https://mlr3book.mlr-org.com/chapters/chapter2/data_and_basic_modeling.html#sec-learners
- Package mlr3extralearners for more learners.
- Dictionary of Learners: mlr_learners
- `as.data.table(mlr_learners)` for a table of available Learners in the running session (depending on the loaded packages).
- **mlr3pipelines** to combine learners with pre- and postprocessing steps.
- Extension packages for additional task types:
  - **mlr3proba** for probabilistic supervised regression and survival analysis.
  - **mlr3cluster** for unsupervised clustering.
- **mlr3tuning** for tuning of hyperparameters, **mlr3tuningspaces** for established default tuning spaces.

Other Learner: `mlr_learners_classif.cv_glmnet`, `mlr_learners_classif.glmnet`, `mlr_learners_classif.kknn`, `mlr_learners_classif.lda`, `mlr_learners_classif.log_reg`, `mlr_learners_classif.multinom`, `mlr_learners_classif.naive_bayes`, `mlr_learners_classif.nnet`, `mlr_learners_classif.qda`, `mlr_learners_classif.ranger`, `mlr_learners_classif.svm`, `mlr_learners_classif.xgboost`, `mlr_learners_regr.glmnet`, `mlr_learners_regr.kknn`, `mlr_learners_regr.km`, `mlr_learners_regr.lm`, `mlr_learners_regr.nnet`, `mlr_learners_regr.ranger`, `mlr_learners_regr.svm`, `mlr_learners_regr.xgboost`

Examples

```
if (requireNamespace("glmnet", quietly = TRUE)) {
# Define the Learner and set parameter values
learner = lrn("regr.cv_glmnet")
print(learner)
```

```
# Define a Task
task = tsk("mtcars")

# Create train and test set
ids = partition(task)

# Train the learner on the training ids
learner$train(task, row_ids = ids$train)

# print the model
print(learner$model)

# importance method
if("importance" %in% learner$properties) print(learner$importance)

# Make predictions for the test rows
predictions = learner$predict(task, row_ids = ids$test)

# Score the predictions
predictions$score()
}
```

`mlr_learners_regr.glmnet` *GLM with Elastic Net Regularization Regression Learner*

Description

Generalized linear models with elastic net regularization. Calls `glmnet::glmnet()` from package **glmnet**.

The default for hyperparameter `family` is set to `"gaussian"`.

Details

Caution: This learner is different to learners calling `glmnet::cv.glmnet()` in that it does not use the internal optimization of parameter `lambda`. Instead, `lambda` needs to be tuned by the user (e.g., via **mlr3tuning**). When `lambda` is tuned, the `glmnet` will be trained for each tuning iteration. While fitting the whole path of `lambda`s would be more efficient, as is done by default in `glmnet::glmnet()`, tuning/selecting the parameter at prediction time (using parameter `s`) is currently not supported in **mlr3** (at least not in efficient manner). Tuning the `s` parameter is, therefore, currently discouraged.

When the data are i.i.d. and efficiency is key, we recommend using the respective auto-tuning counterparts in `mlr_learners_classif.cv_glmnet()` or `mlr_learners_regr.cv_glmnet()`. However, in some situations this is not applicable, usually when data are imbalanced or not i.i.d. (longitudinal, time-series) and tuning requires custom resampling strategies (blocked design, stratification).

Dictionary

This Learner can be instantiated via the dictionary mlr_learners or with the associated sugar function `lrn()`:

```
mlr_learners$get("regr.glmnet")
lrn("regr.glmnet")
```

Meta Information

- Task type: "regr"
- Predict Types: "response"
- Feature Types: "logical", "integer", "numeric"
- Required Packages: **mlr3**, **mlr3learners**, **glmnet**

Parameters

Id	Type	Default	Levels	Range
alignment	character	lambda	lambda, fraction	-
alpha	numeric	1		$[0, 1]$
big	numeric	9.9e+35		$(-\infty, \infty)$
devmax	numeric	0.999		$[0, 1]$
dfmax	integer	-		$[0, \infty)$
eps	numeric	1e-06		$[0, 1]$
epsnr	numeric	1e-08		$[0, 1]$
exact	logical	FALSE	TRUE, FALSE	-
exclude	integer	-		$[1, \infty)$
exmx	numeric	250		$(-\infty, \infty)$
family	character	gaussian	gaussian, poisson	-
fdev	numeric	1e-05		$[0, 1]$
gamma	numeric	1		$(-\infty, \infty)$
grouped	logical	TRUE	TRUE, FALSE	-
intercept	logical	TRUE	TRUE, FALSE	-
keep	logical	FALSE	TRUE, FALSE	-
lambda	untyped	-		-
lambda.min.ratio	numeric	-		$[0, 1]$
lower.limits	untyped	-		-
maxit	integer	100000		$[1, \infty)$
mnlam	integer	5		$[1, \infty)$
mxit	integer	100		$[1, \infty)$
mxitnr	integer	25		$[1, \infty)$
newoffset	untyped	-		-
nlambda	integer	100		$[1, \infty)$
offset	untyped			-
parallel	logical	FALSE	TRUE, FALSE	-
penalty.factor	untyped	-		-
pmax	integer	-		$[0, \infty)$
pmin	numeric	1e-09		$[0, 1]$

prec	numeric	1e-10		$(-\infty, \infty)$
relax	logical	FALSE	TRUE, FALSE	-
s	numeric	0.01		$[0, \infty)$
standardize	logical	TRUE	TRUE, FALSE	-
standardize.response	logical	FALSE	TRUE, FALSE	-
thresh	numeric	1e-07		$[0, \infty)$
trace.it	integer	0		$[0, 1]$
type.gaussian	character	-	covariance, naive	-
type.logistic	character	-	Newton, modified.Newton	-
type.multinomial	character	-	ungrouped, grouped	-
upper.limits	untyped	-		-

Super classes

`mlr3::Learner` -> `mlr3::LearnerRegr` -> `LearnerRegrGlmnet`

Methods

Public methods:

- `LearnerRegrGlmnet$new()`
- `LearnerRegrGlmnet$selected_features()`
- `LearnerRegrGlmnet$clone()`

Method `new()`**:** Creates a new instance of this R6 class.

Usage:

```
LearnerRegrGlmnet$new()
```

Method `selected_features()`**:** Returns the set of selected features as reported by `glmnet::predict.glmnet()` with `type` set to `"nonzero"`.

Usage:

```
LearnerRegrGlmnet$selected_features(lambda = NULL)
```

Arguments:

`lambda (numeric(1))`
Custom `lambda`, defaults to the active lambda depending on parameter set.

Returns: (`character()`) of feature names.

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

Usage:

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

Arguments:

`deep` Whether to make a deep clone.

References

Friedman J, Hastie T, Tibshirani R (2010). "Regularization Paths for Generalized Linear Models via Coordinate Descent." *Journal of Statistical Software*, **33**(1), 1–22. doi:10.18637/jss.v033.i01.

See Also

- Chapter in the mlr3book: https://mlr3book.mlr-org.com/chapters/chapter2/data_and_basic_modeling.html#sec-learners
- Package mlr3extralearners for more learners.
- Dictionary of Learners: mlr_learners
- `as.data.table(mlr_learners)` for a table of available Learners in the running session (depending on the loaded packages).
- **mlr3pipelines** to combine learners with pre- and postprocessing steps.
- Extension packages for additional task types:
  - **mlr3proba** for probabilistic supervised regression and survival analysis.
  - **mlr3cluster** for unsupervised clustering.
- **mlr3tuning** for tuning of hyperparameters, **mlr3tuningspaces** for established default tuning spaces.

Other Learner: `mlr_learners_classif.cv_glmnet`, `mlr_learners_classif.glmnet`, `mlr_learners_classif.kknn`, `mlr_learners_classif.lda`, `mlr_learners_classif.log_reg`, `mlr_learners_classif.multinom`, `mlr_learners_classif.naive_bayes`, `mlr_learners_classif.nnet`, `mlr_learners_classif.qda`, `mlr_learners_classif.ranger`, `mlr_learners_classif.svm`, `mlr_learners_classif.xgboost`, `mlr_learners_regr.cv_glmnet`, `mlr_learners_regr.kknn`, `mlr_learners_regr.km`, `mlr_learners_regr.lm`, `mlr_learners_regr.nnet`, `mlr_learners_regr.ranger`, `mlr_learners_regr.svm`, `mlr_learners_regr.xgboost`

Examples

```
if (requireNamespace("glmnet", quietly = TRUE)) {
# Define the Learner and set parameter values
learner = lrn("regr.glmnet")
print(learner)

# Define a Task
task = tsk("mtcars")

# Create train and test set
ids = partition(task)

# Train the learner on the training ids
learner$train(task, row_ids = ids$train)

# print the model
print(learner$model)

# importance method
if("importance" %in% learner$properties) print(learner$importance)

# Make predictions for the test rows
```

```
predictions = learner$predict(task, row_ids = ids$test)

# Score the predictions
predictions$score()
}
```

`mlr_learners_regr.kknn`

k-Nearest-Neighbor Regression Learner

Description

k-Nearest-Neighbor regression. Calls `kknn::kknn()` from package **kknn**.

Initial parameter values

- `store_model`:
  - See note.

Dictionary

This Learner can be instantiated via the dictionary mlr_learners or with the associated sugar function `lrn()`:

```
mlr_learners$get("regr.kknn")
lrn("regr.kknn")
```

Meta Information

- Task type: "regr"
- Predict Types: "response"
- Feature Types: "logical", "integer", "numeric", "factor", "ordered"
- Required Packages: **mlr3**, **mlr3learners**, **kknn**

Parameters

Id	Type	Default	Levels
k	integer	7	
distance	numeric	2	
kernel	character	optimal	rectangular, triangular, epanechnikov, biweight, triweight, cos, inv, gaussian, rank, optim
scale	logical	TRUE	TRUE, FALSE
ykernel	untyped		
store_model	logical	FALSE	TRUE, FALSE

Super classes

`mlr3::Learner` -> `mlr3::LearnerRegr` -> `LearnerRegrKKNN`

Methods

Public methods:

- `LearnerRegrKKNN$new()`
- `LearnerRegrKKNN$clone()`

Method `new()`**:** Creates a new instance of this R6 class.

Usage:

```
LearnerRegrKKNN$new()
```

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

Usage:

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

Arguments:

`deep` Whether to make a deep clone.

Note

There is no training step for k-NN models, just storing the training data to process it during the predict step. Therefore, `$model` returns a list with the following elements:

- `formula`: Formula for calling `kknn::kknn()` during `$predict()`.
- `data`: Training data for calling `kknn::kknn()` during `$predict()`.
- `pv`: Training parameters for calling `kknn::kknn()` during `$predict()`.
- `kknn`: Model as returned by `kknn::kknn()`, only available **after** `$predict()` has been called. This is not stored by default, you must set hyperparameter `store_model` to `TRUE`.

References

Hechenbichler, Klaus, Schliep, Klaus (2004). "Weighted k-nearest-neighbor techniques and ordinal classification." Technical Report Discussion Paper 399, SFB 386, Ludwig-Maximilians University Munich. doi:10.5282/ubm/epub.1769.

Samworth, J R (2012). "Optimal weighted nearest neighbour classifiers." *The Annals of Statistics*, **40**(5), 2733–2763. doi:10.1214/12AOS1049.

Cover, Thomas, Hart, Peter (1967). "Nearest neighbor pattern classification." *IEEE transactions on information theory*, **13**(1), 21–27. doi:10.1109/TIT.1967.1053964.

See Also

- Chapter in the mlr3book: https://mlr3book.mlr-org.com/chapters/chapter2/data_and_basic_modeling.html#sec-learners
- Package mlr3extralearners for more learners.
- Dictionary of Learners: mlr_learners
- `as.data.table(mlr_learners)` for a table of available Learners in the running session (depending on the loaded packages).
- **mlr3pipelines** to combine learners with pre- and postprocessing steps.
- Extension packages for additional task types:
  - **mlr3proba** for probabilistic supervised regression and survival analysis.
  - **mlr3cluster** for unsupervised clustering.
- **mlr3tuning** for tuning of hyperparameters, **mlr3tuningspaces** for established default tuning spaces.

Other Learner: `mlr_learners_classif.cv_glmnet`, `mlr_learners_classif.glmnet`, `mlr_learners_classif.kknn`, `mlr_learners_classif.lda`, `mlr_learners_classif.log_reg`, `mlr_learners_classif.multinom`, `mlr_learners_classif.naive_bayes`, `mlr_learners_classif.nnet`, `mlr_learners_classif.qda`, `mlr_learners_classif.ranger`, `mlr_learners_classif.svm`, `mlr_learners_classif.xgboost`, `mlr_learners_regr.cv_glmnet`, `mlr_learners_regr.glmnet`, `mlr_learners_regr.km`, `mlr_learners_regr.lm`, `mlr_learners_regr.nnet`, `mlr_learners_regr.ranger`, `mlr_learners_regr.svm`, `mlr_learners_regr.xgboost`

Examples

```
if (requireNamespace("kknn", quietly = TRUE)) {
# Define the Learner and set parameter values
learner = lrn("regr.kknn")
print(learner)

# Define a Task
task = tsk("mtcars")

# Create train and test set
ids = partition(task)

# Train the learner on the training ids
learner$train(task, row_ids = ids$train)

# print the model
print(learner$model)

# importance method
if("importance" %in% learner$properties) print(learner$importance)

# Make predictions for the test rows
predictions = learner$predict(task, row_ids = ids$test)

# Score the predictions
predictions$score()
}
```

`mlr_learners_regr.km` *Kriging Regression Learner*

Description

Kriging regression. Calls `DiceKriging::km()` from package **DiceKriging**.

- The predict type hyperparameter "type" defaults to "sk" (simple kriging).
- The additional hyperparameter `nugget.stability` is used to overwrite the hyperparameter `nugget` with `nugget.stability * var(y)` before training to improve the numerical stability. We recommend a value of `1e-8`.
- The additional hyperparameter `jitter` can be set to add `N(0, [jitter])`-distributed noise to the data before prediction to avoid perfect interpolation. We recommend a value of `1e-12`.

Dictionary

This Learner can be instantiated via the dictionary mlr_learners or with the associated sugar function `lrn()`:

```
mlr_learners$get("regr.km")
lrn("regr.km")
```

Meta Information

- Task type: “regr”
- Predict Types: “response”, “se”
- Feature Types: “logical”, “integer”, “numeric”
- Required Packages: **mlr3**, **mlr3learners**, **DiceKriging**

Parameters

Id	Type	Default	Levels	Range
bias.correct	logical	FALSE	TRUE, FALSE	-
checkNames	logical	TRUE	TRUE, FALSE	-
coef.cov	untyped			-
coef.trend	untyped			-
coef.var	untyped			-
control	untyped			-
cov.compute	logical	TRUE	TRUE, FALSE	-
covtype	character	matern5_2	gauss, matern5_2, matern3_2, exp, powexp	-
estim.method	character	MLE	MLE, LOO	-
gr	logical	TRUE	TRUE, FALSE	-
iso	logical	FALSE	TRUE, FALSE	-
jitter	numeric	0		$[0, \infty)$
kernel	untyped			-

knots	untyped			-
light.return	logical	FALSE	TRUE, FALSE	-
lower	untyped			-
multistart	integer	1		$(-\infty, \infty)$
noise.var	untyped			-
nugget	numeric	-		$(-\infty, \infty)$
nugget.estim	logical	FALSE	TRUE, FALSE	-
nugget.stability	numeric	0		$[0, \infty)$
optim.method	character	BFGS	BFGS, gen	-
parinit	untyped			-
penalty	untyped			-
scaling	logical	FALSE	TRUE, FALSE	-
se.compute	logical	TRUE	TRUE, FALSE	-
type	character	SK	SK, UK	-
upper	untyped			-

Super classes

`mlr3::Learner` -> `mlr3::LearnerRegr` -> `LearnerRegrKM`

Methods

Public methods:

- `LearnerRegrKM$new()`
- `LearnerRegrKM$clone()`

Method `new()`**:** Creates a new instance of this R6 class.

Usage:

```
LearnerRegrKM$new()
```

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

Usage:

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

Arguments:

`deep` Whether to make a deep clone.

References

Roustant O, Ginsbourger D, Deville Y (2012). "DiceKriging, DiceOptim: Two R Packages for the Analysis of Computer Experiments by Kriging-Based Metamodeling and Optimization." *Journal of Statistical Software*, **51**(1), 1–55. doi:10.18637/jss.v051.i01.

See Also

- Chapter in the mlr3book: https://mlr3book.mlr-org.com/chapters/chapter2/data_and_basic_modeling.html#sec-learners
- Package mlr3extralearners for more learners.
- Dictionary of Learners: mlr_learners
- `as.data.table(mlr_learners)` for a table of available Learners in the running session (depending on the loaded packages).
- **mlr3pipelines** to combine learners with pre- and postprocessing steps.
- Extension packages for additional task types:
  - **mlr3proba** for probabilistic supervised regression and survival analysis.
  - **mlr3cluster** for unsupervised clustering.
- **mlr3tuning** for tuning of hyperparameters, **mlr3tuningspaces** for established default tuning spaces.

Other Learner: `mlr_learners_classif.cv_glmnet`, `mlr_learners_classif.glmnet`, `mlr_learners_classif.kknn`, `mlr_learners_classif.lda`, `mlr_learners_classif.log_reg`, `mlr_learners_classif.multinom`, `mlr_learners_classif.naive_bayes`, `mlr_learners_classif.nnet`, `mlr_learners_classif.qda`, `mlr_learners_classif.ranger`, `mlr_learners_classif.svm`, `mlr_learners_classif.xgboost`, `mlr_learners_regr.cv_glmnet`, `mlr_learners_regr.glmnet`, `mlr_learners_regr.kknn`, `mlr_learners_regr.lm`, `mlr_learners_regr.nnet`, `mlr_learners_regr.ranger`, `mlr_learners_regr.svm`, `mlr_learners_regr.xgboost`

Examples

```
if (requireNamespace("DiceKriging", quietly = TRUE)) {
# Define the Learner and set parameter values
learner = lrn("regr.km")
print(learner)

# Define a Task
task = tsk("mtcars")

# Create train and test set
ids = partition(task)

# Train the learner on the training ids
learner$train(task, row_ids = ids$train)

# print the model
print(learner$model)

# importance method
if("importance" %in% learner$properties) print(learner$importance)

# Make predictions for the test rows
predictions = learner$predict(task, row_ids = ids$test)

# Score the predictions
predictions$score()
}
```

`mlr_learners_regr.lm` *Linear Model Regression Learner*

Description

Ordinary linear regression. Calls `stats::lm()`.

Dictionary

This Learner can be instantiated via the dictionary mlr_learners or with the associated sugar function `lrn()`:

```
mlr_learners$get("regr.lm")
lrn("regr.lm")
```

Meta Information

- Task type: “regr”
- Predict Types: “response”, “se”
- Feature Types: “logical”, “integer”, “numeric”, “character”, “factor”
- Required Packages: **mlr3**, **mlr3learners**, ’stats’

Parameters

Id	Type	Default	Levels	Range
df	numeric	Inf		$(-\infty, \infty)$
interval	character	-	none, confidence, prediction	-
level	numeric	0.95		$(-\infty, \infty)$
model	logical	TRUE	TRUE, FALSE	-
offset	logical	-	TRUE, FALSE	-
pred.var	untyped	-		-
qr	logical	TRUE	TRUE, FALSE	-
scale	numeric	NULL		$(-\infty, \infty)$
singular.ok	logical	TRUE	TRUE, FALSE	-
x	logical	FALSE	TRUE, FALSE	-
y	logical	FALSE	TRUE, FALSE	-
rankdeficient	character	-	warnif, simple, non-estim, NA, NAwarn	-
tol	numeric	1e-07		$(-\infty, \infty)$
verbose	logical	FALSE	TRUE, FALSE	-

Contrasts

To ensure reproducibility, this learner always uses the default contrasts:

- `contr.treatment()` for unordered factors, and
- `contr.poly()` for ordered factors.

Setting the option `"contrasts"` does not have any effect. Instead, set the respective hyperparameter or use **mlr3pipelines** to create dummy features.

Super classes

`mlr3::Learner` -> `mlr3::LearnerRegr` -> `LearnerRegrLM`

Methods

Public methods:

- `LearnerRegrLM$new()`
- `LearnerRegrLM$loglik()`
- `LearnerRegrLM$clone()`

Method `new()`**:** Creates a new instance of this R6 class.

Usage:

```
LearnerRegrLM$new()
```

Method `loglik()`**:** Extract the log-likelihood (e.g., via `stats::logLik()` from the fitted model.

Usage:

```
LearnerRegrLM$loglik()
```

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

Usage:

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

Arguments:

`deep` Whether to make a deep clone.

See Also

- Chapter in the mlr3book: `https://mlr3book.mlr-org.com/chapters/chapter2/data_and_basic_modeling.html#sec-learners`
- Package mlr3extralearners for more learners.
- Dictionary of Learners: mlr_learners
- `as.data.table(mlr_learners)` for a table of available Learners in the running session (depending on the loaded packages).
- **mlr3pipelines** to combine learners with pre- and postprocessing steps.
- Extension packages for additional task types:
  - **mlr3proba** for probabilistic supervised regression and survival analysis.

  - **mlr3cluster** for unsupervised clustering.
- **mlr3tuning** for tuning of hyperparameters, **mlr3tuningspaces** for established default tuning spaces.

Other Learner: mlr_learners_classif.cv_glmnet, mlr_learners_classif.glmnet, mlr_learners_classif.kknn, mlr_learners_classif.lda, mlr_learners_classif.log_reg, mlr_learners_classif.multinom, mlr_learners_classif.naive_bayes, mlr_learners_classif.nnet, mlr_learners_classif.qda, mlr_learners_classif.ranger, mlr_learners_classif.svm, mlr_learners_classif.xgboost, mlr_learners_regr.cv_glmnet, mlr_learners_regr.glmnet, mlr_learners_regr.kknn, mlr_learners_regr.km, mlr_learners_regr.nnet, mlr_learners_regr.ranger, mlr_learners_regr.svm, mlr_learners_regr.xgboost

Examples

```
if (requireNamespace("stats", quietly = TRUE)) {
# Define the Learner and set parameter values
learner = lrn("regr.lm")
print(learner)

# Define a Task
task = tsk("mtcars")

# Create train and test set
ids = partition(task)

# Train the learner on the training ids
learner$train(task, row_ids = ids$train)

# print the model
print(learner$model)

# importance method
if("importance" %in% learner$properties) print(learner$importance)

# Make predictions for the test rows
predictions = learner$predict(task, row_ids = ids$test)

# Score the predictions
predictions$score()
}
```

---

mlr_learners_regr.nnet

Neural Network Regression Learner

Description

Single Layer Neural Network. Calls nnet::nnet.formula() from package **nnet**.

Note that modern neural networks with multiple layers are connected via package mlr3torch.

Dictionary

This Learner can be instantiated via the dictionary mlr_learners or with the associated sugar function `lrn()`:

```
mlr_learners$get("regr.nnet")
lrn("regr.nnet")
```

Meta Information

- Task type: "regr"
- Predict Types: "response"
- Feature Types: "integer", "numeric", "factor", "ordered"
- Required Packages: **mlr3**, **mlr3learners**, **nnet**

Parameters

Id	Type	Default	Levels	Range
Hess	logical	FALSE	TRUE, FALSE	-
MaxNWts	integer	1000		$[1, \infty)$
Wts	untyped	-		-
abstol	numeric	1e-04		$(-\infty, \infty)$
censored	logical	FALSE	TRUE, FALSE	-
contrasts	untyped			-
decay	numeric	0		$(-\infty, \infty)$
mask	untyped	-		-
maxit	integer	100		$[1, \infty)$
na.action	untyped	-		-
rang	numeric	0.7		$(-\infty, \infty)$
reltol	numeric	1e-08		$(-\infty, \infty)$
size	integer	3		$[0, \infty)$
skip	logical	FALSE	TRUE, FALSE	-
subset	untyped	-		-
trace	logical	TRUE	TRUE, FALSE	-
formula	untyped	-		-

Initial parameter values

- `size`:
  - Adjusted default: 3L.
  - Reason for change: no default in `nnet()`.

Custom mlr3 parameters

- `formula`: if not provided, the formula is set to `task$formula()`.

Super classes

`mlr3::Learner` -> `mlr3::LearnerRegr` -> `LearnerRegrNnet`

Methods

Public methods:

- `LearnerRegrNnet$new()`
- `LearnerRegrNnet$clone()`

Method `new()`**:** Creates a new instance of this R6 class.

Usage:

```
LearnerRegrNnet$new()
```

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

Usage:

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

Arguments:

`deep` Whether to make a deep clone.

References

Ripley BD (1996). *Pattern Recognition and Neural Networks*. Cambridge University Press. doi:10.1017/cbo9780511812651.

See Also

- Chapter in the mlr3book: `https://mlr3book.mlr-org.com/chapters/chapter2/data_and_basic_modeling.html#sec-learners`
- Package mlr3extralearners for more learners.
- Dictionary of Learners: mlr_learners
- `as.data.table(mlr_learners)` for a table of available Learners in the running session (depending on the loaded packages).
- **mlr3pipelines** to combine learners with pre- and postprocessing steps.
- Extension packages for additional task types:
  - **mlr3proba** for probabilistic supervised regression and survival analysis.
  - **mlr3cluster** for unsupervised clustering.
- **mlr3tuning** for tuning of hyperparameters, **mlr3tuningspaces** for established default tuning spaces.

Other Learner: `mlr_learners_classif.cv_glmnet`, `mlr_learners_classif.glmnet`, `mlr_learners_classif.kknn`, `mlr_learners_classif.lda`, `mlr_learners_classif.log_reg`, `mlr_learners_classif.multinom`, `mlr_learners_classif.naive_bayes`, `mlr_learners_classif.nnet`, `mlr_learners_classif.qda`, `mlr_learners_classif.ranger`, `mlr_learners_classif.svm`, `mlr_learners_classif.xgboost`, `mlr_learners_regr.cv_glmnet`, `mlr_learners_regr.glmnet`, `mlr_learners_regr.kknn`, `mlr_learners_regr.km`, `mlr_learners_regr.lm`, `mlr_learners_regr.ranger`, `mlr_learners_regr.svm`, `mlr_learners_regr.xgboost`

Examples

```
if (requireNamespace("nnet", quietly = TRUE)) {
# Define the Learner and set parameter values
learner = lrn("regr.nnet")
print(learner)

# Define a Task
task = tsk("mtcars")

# Create train and test set
ids = partition(task)

# Train the learner on the training ids
learner$train(task, row_ids = ids$train)

# print the model
print(learner$model)

# importance method
if("importance" %in% learner$properties) print(learner$importance)

# Make predictions for the test rows
predictions = learner$predict(task, row_ids = ids$test)

# Score the predictions
predictions$score()
}
```

---

mlr_learners_regr.ranger

Ranger Regression Learner

Description

Random regression forest. Calls `ranger::ranger()` from package **ranger**.

Dictionary

This Learner can be instantiated via the dictionary mlr_learners or with the associated sugar function `lrn()`:

```
mlr_learners$get("regr.ranger")
lrn("regr.ranger")
```

Meta Information

- Task type: "regr"
- Predict Types: "response", "se"
- Feature Types: "logical", "integer", "numeric", "character", "factor", "ordered"
- Required Packages: **mlr3**, **mlr3learners**, **ranger**

Parameters

Id	Type	Default	Levels	Range
alpha	numeric	0.5		$(-\infty, \infty)$
always.split.variables	untyped	-		-
holdout	logical	FALSE	TRUE, FALSE	-
importance	character	-	none, impurity, impurity_corrected, permutation	-
keep.inbag	logical	FALSE	TRUE, FALSE	-
max.depth	integer	NULL		$[0, \infty)$
min.bucket	integer	1		$[1, \infty)$
min.node.size	integer	5		$[1, \infty)$
minprop	numeric	0.1		$(-\infty, \infty)$
mtry	integer	-		$[1, \infty)$
mtry.ratio	numeric	-		$[0, 1]$
node.stats	logical	FALSE	TRUE, FALSE	-
num.random.splits	integer	1		$[1, \infty)$
num.threads	integer	1		$[1, \infty)$
num.trees	integer	500		$[1, \infty)$
oob.error	logical	TRUE	TRUE, FALSE	-
quantreg	logical	FALSE	TRUE, FALSE	-
regularization.factor	untyped	1		-
regularization.usedepth	logical	FALSE	TRUE, FALSE	-
replace	logical	TRUE	TRUE, FALSE	-
respect.unordered.factors	character	ignore	ignore, order, partition	-
sample.fraction	numeric	-		$[0, 1]$
save.memory	logical	FALSE	TRUE, FALSE	-
scale.permutation.importance	logical	FALSE	TRUE, FALSE	-
se.method	character	infjack	jack, infjack	-
seed	integer	NULL		$(-\infty, \infty)$
split.select.weights	untyped			-
splitrule	character	variance	variance, extratrees, maxstat	-
verbose	logical	TRUE	TRUE, FALSE	-
write.forest	logical	TRUE	TRUE, FALSE	-

Custom mlr3 parameters

- `mtry`:
  - This hyperparameter can alternatively be set via our hyperparameter `mtry.ratio` as `mtry = max(ceiling(mtry.ratio * n_features), 1)`. Note that `mtry` and `mtry.ratio` are mutually exclusive.

Initial parameter values

- `num.threads`:
  - Actual default: `NULL`, triggering auto-detection of the number of CPUs.

- Adjusted value: 1.
- Reason for change: Conflicting with parallelization via **future**.

Super classes

`mlr3::Learner` -> `mlr3::LearnerRegr` -> `LearnerRegrRanger`

Methods

Public methods:

- `LearnerRegrRanger$new()`
- `LearnerRegrRanger$importance()`
- `LearnerRegrRanger$oob_error()`
- `LearnerRegrRanger$clone()`

Method `new()`**:** Creates a new instance of this R6 class.

Usage:

```
LearnerRegrRanger$new()
```

Method `importance()`**:** The importance scores are extracted from the model slot `variable.importance`. Parameter `importance.mode` must be set to `"impurity"`, `"impurity_corrected"`, or `"permutation"`

Usage:

```
LearnerRegrRanger$importance()
```

Returns: Named `numeric()`.

Method `oob_error()`**:** The out-of-bag error, extracted from model slot `prediction.error`.

Usage:

```
LearnerRegrRanger$oob_error()
```

Returns: `numeric(1)`.

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

Usage:

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

Arguments:

`deep` Whether to make a deep clone.

References

Wright, N. M, Ziegler, Andreas (2017). "ranger: A Fast Implementation of Random Forests for High Dimensional Data in C++ and R." *Journal of Statistical Software*, **77**(1), 1–17. doi:10.18637/jss.v077.i01.

Breiman, Leo (2001). "Random Forests." *Machine Learning*, **45**(1), 5–32. ISSN 1573-0565, doi:10.1023/A:1010933404324.

See Also

- Chapter in the mlr3book: https://mlr3book.mlr-org.com/chapters/chapter2/data_and_basic_modeling.html#sec-learners
- Package mlr3extralearners for more learners.
- Dictionary of Learners: mlr_learners
- `as.data.table(mlr_learners)` for a table of available Learners in the running session (depending on the loaded packages).
- **mlr3pipelines** to combine learners with pre- and postprocessing steps.
- Extension packages for additional task types:
  - **mlr3proba** for probabilistic supervised regression and survival analysis.
  - **mlr3cluster** for unsupervised clustering.
- **mlr3tuning** for tuning of hyperparameters, **mlr3tuningspaces** for established default tuning spaces.

Other Learner: `mlr_learners_classif.cv_glmnet`, `mlr_learners_classif.glmnet`, `mlr_learners_classif.kknn`, `mlr_learners_classif.lda`, `mlr_learners_classif.log_reg`, `mlr_learners_classif.multinom`, `mlr_learners_classif.naive_bayes`, `mlr_learners_classif.nnet`, `mlr_learners_classif.qda`, `mlr_learners_classif.ranger`, `mlr_learners_classif.svm`, `mlr_learners_classif.xgboost`, `mlr_learners_regr.cv_glmnet`, `mlr_learners_regr.glmnet`, `mlr_learners_regr.kknn`, `mlr_learners_regr.km`, `mlr_learners_regr.lm`, `mlr_learners_regr.nnet`, `mlr_learners_regr.svm`, `mlr_learners_regr.xgboost`

Examples

```
if (requireNamespace("ranger", quietly = TRUE)) {
# Define the Learner and set parameter values
learner = lrn("regr.ranger")
print(learner)

# Define a Task
task = tsk("mtcars")

# Create train and test set
ids = partition(task)

# Train the learner on the training ids
learner$train(task, row_ids = ids$train)

# print the model
print(learner$model)

# importance method
if("importance" %in% learner$properties) print(learner$importance)

# Make predictions for the test rows
predictions = learner$predict(task, row_ids = ids$test)

# Score the predictions
predictions$score()
}
```

`mlr_learners_regr.svm` *Support Vector Machine*

Description

Support vector machine for regression. Calls `e1071::svm()` from package **e1071**.

Dictionary

This Learner can be instantiated via the dictionary mlr_learners or with the associated sugar function `lrn()`:

```
mlr_learners$get("regr.svm")
lrn("regr.svm")
```

Meta Information

- Task type: "regr"
- Predict Types: "response"
- Feature Types: "logical", "integer", "numeric"
- Required Packages: **mlr3**, **mlr3learners**, **e1071**

Parameters

Id	Type	Default	Levels	Range
cachesize	numeric	40		$(-\infty, \infty)$
coef0	numeric	0		$(-\infty, \infty)$
cost	numeric	1		$[0, \infty)$
cross	integer	0		$[0, \infty)$
degree	integer	3		$[1, \infty)$
epsilon	numeric	0.1		$[0, \infty)$
fitted	logical	TRUE	TRUE, FALSE	-
gamma	numeric	-		$[0, \infty)$
kernel	character	radial	linear, polynomial, radial, sigmoid	-
nu	numeric	0.5		$(-\infty, \infty)$
scale	untyped	TRUE		-
shrinking	logical	TRUE	TRUE, FALSE	-
tolerance	numeric	0.001		$[0, \infty)$
type	character	eps-regression	eps-regression, nu-regression	-

Super classes

`mlr3::Learner` -> `mlr3::LearnerRegr` -> `LearnerRegrSVM`

Methods

Public methods:

- `LearnerRegrSVM$new()`
- `LearnerRegrSVM$clone()`

Method `new()`**:** Creates a new instance of this R6 class.

Usage:

```
LearnerRegrSVM$new()
```

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

Usage:

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

Arguments:

`deep` Whether to make a deep clone.

References

Cortes, Corinna, Vapnik, Vladimir (1995). "Support-vector networks." *Machine Learning*, **20**(3), 273–297. doi:10.1007/BF00994018.

See Also

- Chapter in the mlr3book: `https://mlr3book.mlr-org.com/chapters/chapter2/data_and_basic_modeling.html#sec-learners`
- Package mlr3extralearners for more learners.
- Dictionary of Learners: mlr_learners
- `as.data.table(mlr_learners)` for a table of available Learners in the running session (depending on the loaded packages).
- **mlr3pipelines** to combine learners with pre- and postprocessing steps.
- Extension packages for additional task types:
  - **mlr3proba** for probabilistic supervised regression and survival analysis.
  - **mlr3cluster** for unsupervised clustering.
- **mlr3tuning** for tuning of hyperparameters, **mlr3tuningspaces** for established default tuning spaces.

Other Learner: `mlr_learners_classif.cv_glmnet`, `mlr_learners_classif.glmnet`, `mlr_learners_classif.kknn`, `mlr_learners_classif.lda`, `mlr_learners_classif.log_reg`, `mlr_learners_classif.multinom`, `mlr_learners_classif.naive_bayes`, `mlr_learners_classif.nnet`, `mlr_learners_classif.qda`, `mlr_learners_classif.ranger`, `mlr_learners_classif.svm`, `mlr_learners_classif.xgboost`, `mlr_learners_regr.cv_glmnet`, `mlr_learners_regr.glmnet`, `mlr_learners_regr.kknn`, `mlr_learners_regr.km`, `mlr_learners_regr.lm`, `mlr_learners_regr.nnet`, `mlr_learners_regr.ranger`, `mlr_learners_regr.xgboost`

Examples

```
if (requireNamespace("e1071", quietly = TRUE)) {
# Define the Learner and set parameter values
learner = lrn("regr.svm")
print(learner)

# Define a Task
task = tsk("mtcars")

# Create train and test set
ids = partition(task)

# Train the learner on the training ids
learner$train(task, row_ids = ids$train)

# print the model
print(learner$model)

# importance method
if("importance" %in% learner$properties) print(learner$importance)

# Make predictions for the test rows
predictions = learner$predict(task, row_ids = ids$test)

# Score the predictions
predictions$score()
}
```

---

mlr_learners_regr.xgboost

Extreme Gradient Boosting Regression Learner

Description

eXtreme Gradient Boosting regression. Calls `xgboost::xgb.train()` from package **xgboost**.

To compute on GPUs, you first need to compile **xgboost** yourself and link against CUDA. See https://xgboost.readthedocs.io/en/stable/build.html#building-with-gpu-support.

Note that using the `watchlist` parameter directly will lead to problems when wrapping this `Learner` in a `mlr3pipelines` `GraphLearner` as the preprocessing steps will not be applied to the data in the watchlist.

Dictionary

This Learner can be instantiated via the dictionary mlr_learners or with the associated sugar function `lrn()`:

```
mlr_learners$get("regr.xgboost")
lrn("regr.xgboost")
```

Meta Information

- Task type: "regr"
- Predict Types: "response"
- Feature Types: "logical", "integer", "numeric"
- Required Packages: **mlr3**, **mlr3learners**, **xgboost**

Parameters

Id	Type	Default	Levels	Range
alpha	numeric	0		$[0, \infty)$
approxcontrib	logical	FALSE	TRUE, FALSE	-
base_score	numeric	0.5		$(-\infty, \infty)$
booster	character	gbtree	gbtree, gblinear, dart	-
callbacks	untyped	list		-
colsample_bylevel	numeric	1		$[0, 1]$
colsample_bynode	numeric	1		$[0, 1]$
colsample_bytree	numeric	1		$[0, 1]$
device	untyped	cpu		-
disable_default_eval_metric	logical	FALSE	TRUE, FALSE	-
early_stopping_rounds	integer	NULL		$[1, \infty)$
early_stopping_set	character	none	none, train, test	-
eta	numeric	0.3		$[0, 1]$
eval_metric	untyped	rmse		-
feature_selector	character	cyclic	cyclic, shuffle, random, greedy, thrifty	-
feval	untyped			-
gamma	numeric	0		$[0, \infty)$
grow_policy	character	depthwise	depthwise, lossguide	-
interaction_constraints	untyped	-		-
iterationrange	untyped	-		-
lambda	numeric	1		$[0, \infty)$
lambda_bias	numeric	0		$[0, \infty)$
max_bin	integer	256		$[2, \infty)$
max_delta_step	numeric	0		$[0, \infty)$
max_depth	integer	6		$[0, \infty)$
max_leaves	integer	0		$[0, \infty)$
maximize	logical	NULL	TRUE, FALSE	-
min_child_weight	numeric	1		$[0, \infty)$
missing	numeric	NA		$(-\infty, \infty)$
monotone_constraints	untyped	0		-
normalize_type	character	tree	tree, forest	-
nrounds	integer	-		$[1, \infty)$
nthread	integer	1		$[1, \infty)$
ntreelimit	integer	NULL		$[1, \infty)$
num_parallel_tree	integer	1		$[1, \infty)$
objective	untyped	reg:squarederror		-
one_drop	logical	FALSE	TRUE, FALSE	-
outputmargin	logical	FALSE	TRUE, FALSE	-

predcontrib	logical	FALSE	TRUE, FALSE	-
predinteraction	logical	FALSE	TRUE, FALSE	-
predleaf	logical	FALSE	TRUE, FALSE	-
print_every_n	integer	1		$[1, \infty)$
process_type	character	default	default, update	-
rate_drop	numeric	0		$[0, 1]$
refresh_leaf	logical	TRUE	TRUE, FALSE	-
reshape	logical	FALSE	TRUE, FALSE	-
sampling_method	character	uniform	uniform, gradient_based	-
sample_type	character	uniform	uniform, weighted	-
save_name	untyped			-
save_period	integer	NULL		$[0, \infty)$
scale_pos_weight	numeric	1		$(-\infty, \infty)$
seed_per_iteration	logical	FALSE	TRUE, FALSE	-
skip_drop	numeric	0		$[0, 1]$
strict_shape	logical	FALSE	TRUE, FALSE	-
subsample	numeric	1		$[0, 1]$
top_k	integer	0		$[0, \infty)$
training	logical	FALSE	TRUE, FALSE	-
tree_method	character	auto	auto, exact, approx, hist, gpu_hist	-
tweedie_variance_power	numeric	1.5		$[1, 2]$
updater	untyped	-		-
verbose	integer	1		$[0, 2]$
watchlist	untyped			-
xgb_model	untyped			-

Early stopping

Early stopping can be used to find the optimal number of boosting rounds. The `early_stopping_set` parameter controls which set is used to monitor the performance. Set `early_stopping_set = "test"` to monitor the performance of the model on the test set while training. The test set for early stopping can be set with the `"test"` row role in the mlr3::Task. Additionally, the range must be set in which the performance must increase with `early_stopping_rounds` and the maximum number of boosting rounds with `nrounds`. While resampling, the test set is automatically applied from the mlr3::Resampling. Not that using the test set for early stopping can potentially bias the performance scores. See the section on early stopping in the examples.

Initial parameter values

- `nrounds`:
  - Actual default: no default.
  - Adjusted default: 1.
  - Reason for change: Without a default construction of the learner would error. Just setting a nonsense default to workaround this. `nrounds` needs to be tuned by the user.
- `nthread`:

  - Actual value: Undefined, triggering auto-detection of the number of CPUs.
  - Adjusted value: 1.
  - Reason for change: Conflicting with parallelization via **future**.
- `verbose`:
  - Actual default: 1.
  - Adjusted default: 0.
  - Reason for change: Reduce verbosity.

Super classes

`mlr3::Learner` -> `mlr3::LearnerRegr` -> `LearnerRegrXgboost`

Methods

Public methods:

- `LearnerRegrXgboost$new()`
- `LearnerRegrXgboost$importance()`
- `LearnerRegrXgboost$clone()`

Method `new()`**:** Creates a new instance of this R6 class.

Usage:

```
LearnerRegrXgboost$new()
```

Method `importance()`**:** The importance scores are calculated with `xgboost::xgb.importance()`.

Usage:

```
LearnerRegrXgboost$importance()
```

Returns: Named `numeric()`.

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

Usage:

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

Arguments:

`deep` Whether to make a deep clone.

Note

To compute on GPUs, you first need to compile **xgboost** yourself and link against CUDA. See https://xgboost.readthedocs.io/en/stable/build.html#building-with-gpu-support.

References

Chen, Tianqi, Guestrin, Carlos (2016). "Xgboost: A scalable tree boosting system." In *Proceedings of the 22nd ACM SIGKDD Conference on Knowledge Discovery and Data Mining*, 785–794. ACM. doi:10.1145/2939672.2939785.

See Also

- Chapter in the mlr3book: https://mlr3book.mlr-org.com/chapters/chapter2/data_and_basic_modeling.html#sec-learners
- Package mlr3extralearners for more learners.
- Dictionary of Learners: mlr_learners
- `as.data.table(mlr_learners)` for a table of available Learners in the running session (depending on the loaded packages).
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  - **mlr3proba** for probabilistic supervised regression and survival analysis.
  - **mlr3cluster** for unsupervised clustering.
- **mlr3tuning** for tuning of hyperparameters, **mlr3tuningspaces** for established default tuning spaces.

Other Learner: `mlr_learners_classif.cv_glmnet`, `mlr_learners_classif.glmnet`, `mlr_learners_classif.kknn`, `mlr_learners_classif.lda`, `mlr_learners_classif.log_reg`, `mlr_learners_classif.multinom`, `mlr_learners_classif.naive_bayes`, `mlr_learners_classif.nnet`, `mlr_learners_classif.qda`, `mlr_learners_classif.ranger`, `mlr_learners_classif.svm`, `mlr_learners_classif.xgboost`, `mlr_learners_regr.cv_glmnet`, `mlr_learners_regr.glmnet`, `mlr_learners_regr.kknn`, `mlr_learners_regr.km`, `mlr_learners_regr.lm`, `mlr_learners_regr.nnet`, `mlr_learners_regr.ranger`, `mlr_learners_regr.svm`

Examples

```
## Not run:
if (requireNamespace("xgboost", quietly = TRUE)) {
# Define the Learner and set parameter values
learner = lrn("regr.xgboost")
print(learner)

# Define a Task
task = tsk("mtcars")

# Create train and test set
ids = partition(task)

# Train the learner on the training ids
learner$train(task, row_ids = ids$train)

# print the model
print(learner$model)

# importance method
if("importance" %in% learner$properties) print(learner$importance)

# Make predictions for the test rows
predictions = learner$predict(task, row_ids = ids$test)

# Score the predictions
predictions$score()
```

```
}

## End(Not run)

## Not run:
# Train learner with early stopping on spam data set
task = tsk("mtcars")

# Split task into training and test set
split = partition(task, ratio = 0.8)
task$set_row_roles(split$test, "test")

# Set early stopping parameter
learner = lrn("regr.xgboost",
  nrounds = 100,
  early_stopping_rounds = 10,
  early_stopping_set = "test"
)

# Train learner with early stopping
learner$train(task)

## End(Not run)
```

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