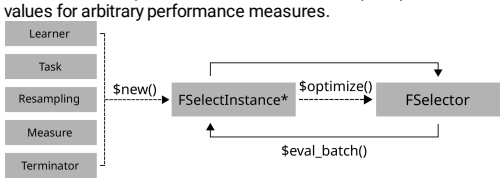
Feature Selection with mlr3fselect::CHEAT SHEET

Class Overview

The package provides a set of R6 classes which allow to (a) define generalfeature selection instances and (b) run algorithms which optimize on these. (a) is called a FSelectInstanceSingleCrit or FSelectInstaneMultiCrit, which define a blackbox optimization function that maps feature subsets to resampled performance values for arbitrary performance measures.



Terminators - When to stop

Construction: `trm(.key, ...)`

- `evals` (`n_evals`)
  After a given amount of iterations.
- `clock_time` (`secs`, `stop_time`)
  After a given absolute time.
- `model_time` (`secs`)
  After a given training time.
- `perf_reached` (`level`)
  After a specific performance was reached.
- `stagnation` (`iters`, `threshold`)
  After the performance stagnated for given iterations.
- `stagnation_batch` (n, `threshold`)
  After the performance stagnated for given batches.

```
as.data.table(mlr_terminators)
```

Lists all available terminators.

FSelectInstance* - Search Scenario

Evaluator and container for resampled performances of feature subsets. The main (internal) function `eval_batch(xdt)` calls `benchmark()` to evaluate a table of feature subsets. Also stores archive of all evaluated feature subsets and the final result.

```
instance = FSelectInstanceSingleCrit$new(
  task, learner, resampling, measure,
  terminator)
```

Set `store_benchmark_result = TRUE` to store resamplings of evaluations and `store_models = TRUE` to store associated models.

Example

```
instance = FSelectInstanceSingleCrit$new(
    tsk("iris"), lrn("classif.rpart"), rsmp("cv"), msr("classif.ce"),
    trm("evals", n_evals = 10))
fselector = fs("random_search")
fselector$optimize(instance)
```

Use `FSelectInstanceMultiCrit` for multi-criteria tuning.

FSelector - Search Strategy

Feature Selection strategy. Generates feature subsets and passes these to `FSelectInstance*` for evaluation until termination.
Creation: `fs(.key, ...)`

- `random_search` (`batch_size`)
  Random search.
- `exhaustive_search` (`max_features`)
  Exhaustive Search.
- `sequential` (`strategy`)
  Sequential Selection.
- `rfe` (`feature_fraction`, `recursive`)
  Recursive Feature Elimination.
- `design_points` (`batch_size`, `design`)
  User supplied feature subsets.

```
as.data.table(mlr_fselectors)
```

Lists all available feature selection algorithms.

Executing the Feature Selection

```
fselector$optimize(instance)
```

Starts the feature selection. `FSelector` generates feature subsets and passes these to the `$eval_batch()` method of the `FSelectInstance*` until the budget of the `Terminator` is exhausted.

```
instance$archive$data()
```

Returns all evaluated feature subsets and their resampling results.

Example

```
instance$archive$data()
## >    Petal.Length Petal.Width Sepal.Length Sepal.Width classif.ce
## > 1:        FALSE       FALSE         TRUE       FALSE 0.26000000
## > 2:         TRUE       FALSE         TRUE       FALSE 0.08000000
```

`uhash` refers to `instance$archive$benchmark_result`.

```
instance$result
```

Returns data.table with optimal feature subset and estimated performance.

```
task$select(instance$result_feature_set)
```

Set optimized feature subset in `Task`.

AutoFSelect - Select before Train

Wraps learner and performs integrated feature selection.

```
at = AutoFSelect$new(
  learner, resampling, measure, terminator,
  fselector)
```

Inherits from class `Learner`. Training starts feature selection on the training set. After completion the learner is trained with the "optimal" feature subset on the given task.

```
at$train(task)
at$predict(task, row_ids)
```

Nested Resampling

Resampling the `AutoFSelect` results in nested resampling with an inner and outer loop.

Example

```
resampling_inner = rsmp("holdout")
evals20 = trm("evals", n_evals = 20)

at = AutoFSelect$new(learner, resampling_inner, measure, evals20, fselector)
at$store_fselect_instance = TRUE

resampling_outer = rsmp("cv", folds = 2)
rr = resample(task, at, resampling_outer, store_models = TRUE)

as.data.table(rr)
## >             learner         resampling iteration              prediction
## > 1: <AutoFSelect[38]> <ResamplingCV[19]>         1 <PredictionClassif[19]>
## > 2: <AutoFSelect[38]> <ResamplingCV[19]>         2 <PredictionClassif[19]>
```

```
rr$aggregate()
```

Aggregates performances of outer folds.

```
as.data.table(rr)$learner[[1]]$fselect_result
```

Retrieves inner feature selection results.

Logging and Parallelization

```
lgr::get_logger("bbotk")$set_threshold("<level>")
```

Change log-level only for mlr3fselect.

```
future::plan(strategy)
```

Sets the parallelization backend. Speeds up feature selection by running iterations in parallel.