

Package ‘modeltuning’

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Title Model Selection and Tuning Utilities

Version 0.1.4

Description Provides a lightweight framework for model selection and hyperparameter tuning in R. The package offers intuitive tools for grid search, cross-validation, and combined grid search with cross-validation that work seamlessly with virtually any modeling package. Designed for flexibility and ease of use, it standardizes tuning workflows while remaining fully compatible with a wide range of model interfaces and estimation functions.

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Depends R (>= 4.1.0)

Imports future.apply, progressr, R6, rlang

Suggests Matrix, e1071, future, parallelly, paws.compute, rsample, rpart, yardstick, knitr, rmarkdown

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CV	<i>Predictive Models with Cross Validation</i>
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Description

CV allows the user to specify a cross validation scheme with complete flexibility in the model, data splitting function, and performance metrics, among other essential parameters.

Public fields

- learner Predictive modeling function.
- scorer List of performance metric functions.
- splitter Function that splits data into cross validation folds.

Methods

Public methods:

- [CV\\$fit\(\)](#)
- [CV\\$new\(\)](#)
- [CV\\$clone\(\)](#)

CV\$fit(): fit performs cross validation with user-specified parameters.

Usage:

```
CV$fit(  
  formula = NULL,  
  data = NULL,  
  x = NULL,  
  y = NULL,  
  response = NULL,  
  convert_response = NULL,  
  progress = FALSE  
)
```

Arguments:

- formula An object of class [formula](#): a symbolic description of the model to be fitted.
- data An optional data frame, or other object containing the variables in the model. If data is not provided, how formula is handled depends on \$learner.
- x Predictor data (independent variables), alternative interface to data with formula.
- y Response vector (dependent variable), alternative interface to data with formula.

`response` String; In the absence of formula or `y`, this specifies which element of `learner_args` is the response vector.

`convert_response` Function; This should be a single function that transforms the response vector. E.g. a function converting a numeric binary variable to a factor variable.

`progress` Logical; indicating whether to print progress across cross validation folds.

Details: `fit` follows standard R modeling convention by surfacing a formula modeling interface as well as an alternate matrix option. The user should use whichever interface is supported by the specified `$learner` function.

Returns: An object of class `FittedCV`.

Examples:

```
if (require(e1071) && require(rpart) && require(yardstick)) {
  iris_new <- iris[sample(1:nrow(iris), nrow(iris)), ]
  iris_new$Species <- factor(iris_new$Species == "virginica")

  ### Decision Tree Example

  iris_cv <- CV$new(
    learner = rpart::rpart,
    learner_args = list(method = "class"),
    splitter = cv_split,
    scorer = list(accuracy = yardstick::accuracy_vec),
    prediction_args = list(accuracy = list(type = "class"))
  )
  iris_cv_fitted <- iris_cv$fit(formula = Species ~ ., data = iris_new)

  ### Example with multiple metric functions

  iris_cv <- CV$new(
    learner = rpart::rpart,
    learner_args = list(method = "class"),
    splitter = cv_split,
    splitter_args = list(v = 3),
    scorer = list(
      f_meas = yardstick::f_meas_vec,
      accuracy = yardstick::accuracy_vec,
      roc_auc = yardstick::roc_auc_vec,
      pr_auc = yardstick::pr_auc_vec
    ),
    prediction_args = list(
      f_meas = list(type = "class"),
      accuracy = list(type = "class"),
      roc_auc = list(type = "prob"),
      pr_auc = list(type = "prob")
    ),
    convert_predictions = list(
      f_meas = NULL,
      accuracy = NULL,
```

```

        roc_auc = function(i) i[, "FALSE"],
        pr_auc = function(i) i[, "FALSE"]
    )
)
iris_cv_fitted <- iris_cv$fit(formula = Species ~ ., data = iris_new)

# Print the mean performance metrics across CV folds
iris_cv_fitted$mean_metrics

# Grab the final model fitted on the full dataset
iris_cv_fitted$model

### OLS Example

mtcars_cv <- CV$new(
  learner = lm,
  splitter = cv_split,
  splitter_args = list(v = 2),
  scorer = list("rmse" = yardstick::rmse_vec, "mae" = yardstick::mae_vec)
)

mtcars_cv_fitted <- mtcars_cv$fit(
  formula = mpg ~ .,
  data = mtcars
)

### Matrix interface example - SVM

mtcars_x <- model.matrix(mpg ~ . - 1, mtcars)
mtcars_y <- mtcars$mpg

mtcars_cv <- CV$new(
  learner = e1071::svm,
  learner_args = list(scale = TRUE, kernel = "polynomial", cross = 0),
  splitter = cv_split,
  splitter_args = list(v = 3),
  scorer = list(rmse = yardstick::rmse_vec, mae = yardstick::mae_vec)
)
mtcars_cv_fitted <- mtcars_cv$fit(
  x = mtcars_x,
  y = mtcars_y
)
}

```

`CV$new()`: Create a new [CV](#) object.

Usage:

```

CV$new(
  learner = NULL,

```

```

    splitter = NULL,
    scorer = NULL,
    learner_args = NULL,
    splitter_args = NULL,
    scorer_args = NULL,
    prediction_args = NULL,
    convert_predictions = NULL
)

```

Arguments:

learner Function that estimates a predictive model. It is essential that this function support either a formula interface with formula and data arguments, or an alternate matrix interface with x and y arguments.

splitter A function that computes cross validation folds from an input data set or a pre-computed list of cross validation fold indices. If **splitter** is a function, it must have a data argument for the input data, and it must return a list of cross validation fold indices. If **splitter** is a list of integers, the number of cross validation folds is `length(splitter)` and each element contains the indices of the data observations that are included in that fold.

scorer A named list of metric functions to evaluate model performance on each cross validation fold. Any provided metric function must have **truth** and **estimate** arguments for true outcome values and predicted outcome values respectively, and must return a single numeric metric value.

learner_args A named list of additional arguments to pass to **learner**.

splitter_args A named list of additional arguments to pass to **splitter**.

scorer_args A named list of additional arguments to pass to **scorer**. **scorer_args** must either be length 1 or `length(scorer)` in the case where different arguments are being passed to each scoring function.

prediction_args A named list of additional arguments to pass to **predict**. **prediction_args** must either be length 1 or `length(scorer)` in the case where different arguments are being passed to each scoring function.

convert_predictions A list of functions to convert predicted values prior to being evaluated by the metric functions supplied in **scorer**. This list should either be length 1, in which case the same function will be applied to all predicted values, or `length(scorer)` in which case each function in **convert_predictions** will correspond with each function in **scorer**.

Returns: An object of class [CV](#).

CV\$clone(): The objects of this class are cloneable with this method.

Usage:

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

Arguments:

deep Whether to make a deep clone.

Examples

```

## -----
## Method `CV$fit()`
## -----

```

```

if (require(e1071) && require(rpart) && require(yardstick)) {
  iris_new <- iris[sample(1:nrow(iris), nrow(iris)), ]
  iris_new$Species <- factor(iris_new$Species == "virginica")

  ### Decision Tree Example

  iris_cv <- CV$new(
    learner = rpart::rpart,
    learner_args = list(method = "class"),
    splitter = cv_split,
    scorer = list(accuracy = yardstick::accuracy_vec,
      prediction_args = list(accuracy = list(type = "class")))
  )
  iris_cv_fitted <- iris_cv$fit(formula = Species ~ ., data = iris_new)

  ### Example with multiple metric functions

  iris_cv <- CV$new(
    learner = rpart::rpart,
    learner_args = list(method = "class"),
    splitter = cv_split,
    splitter_args = list(v = 3),
    scorer = list(
      f_meas = yardstick::f_meas_vec,
      accuracy = yardstick::accuracy_vec,
      roc_auc = yardstick::roc_auc_vec,
      pr_auc = yardstick::pr_auc_vec
    ),
    prediction_args = list(
      f_meas = list(type = "class"),
      accuracy = list(type = "class"),
      roc_auc = list(type = "prob"),
      pr_auc = list(type = "prob")
    ),
    convert_predictions = list(
      f_meas = NULL,
      accuracy = NULL,
      roc_auc = function(i) i[, "FALSE"],
      pr_auc = function(i) i[, "FALSE"]
    )
  )
  iris_cv_fitted <- iris_cv$fit(formula = Species ~ ., data = iris_new)

  # Print the mean performance metrics across CV folds
  iris_cv_fitted$mean_metrics

  # Grab the final model fitted on the full dataset
  iris_cv_fitted$model

  ### OLS Example

  mtcars_cv <- CV$new(

```

```

    learner = lm,
    splitter = cv_split,
    splitter_args = list(v = 2),
    scorer = list("rmse" = yardstick::rmse_vec, "mae" = yardstick::mae_vec)
  )

mtcars_cv_fitted <- mtcars_cv$fit(
  formula = mpg ~ .,
  data = mtcars
)

### Matrix interface example - SVM

mtcars_x <- model.matrix(mpg ~ . - 1, mtcars)
mtcars_y <- mtcars$mpg

mtcars_cv <- CV$new(
  learner = e1071::svm,
  learner_args = list(scale = TRUE, kernel = "polynomial", cross = 0),
  splitter = cv_split,
  splitter_args = list(v = 3),
  scorer = list(rmse = yardstick::rmse_vec, mae = yardstick::mae_vec)
)
mtcars_cv_fitted <- mtcars_cv$fit(
  x = mtcars_x,
  y = mtcars_y
)
}

```

cv_split

Generate cross-validation fold indices

Description

Splits row indices of a data frame or matrix into k folds for cross-validation.

Usage

```
cv_split(data, v = 5, seed = NULL)
```

Arguments

data	A data frame or matrix.
v	Integer. Number of folds. Defaults to 5.
seed	Optional integer. Random seed for reproducibility.

Value

A list of length v, where each element is a vector of row indices for that fold.

Examples

```
folds <- cv_split(mtcars, v = 5)
str(folds)
```

FittedCV

Fitted, Cross-Validated Predictive Models

Description

FittedCV is a fitted, cross-validated predictive model object that is returned by `CV$fit()` and contains relevant model components, cross-validation metrics, validation set predicted values, etc.

Public fields

folds A list of length `$nfolds` where each element contains the indices of the observations contained in that fold.

model Predictive model fitted on the full data set.

mean_metrics Numeric list; Cross-validation performance metrics averaged across folds.

metrics Numeric list; Cross-validation performance metrics on each fold.

nfolds An integer specifying the number of cross-validation folds.

predictions A list containing the predicted hold-out values on every fold.

Methods

Public methods:

- [FittedCV\\$new\(\)](#)
- [FittedCV\\$clone\(\)](#)

FittedCV\$new(): Create a new [FittedCV](#) object.

Usage:

```
FittedCV$new(folds, model, metrics, nfolds, predictions)
```

Arguments:

folds A list of length `$nfolds` where each element contains the indices of the observations contained in that fold.

model Predictive model fitted on the full data set.

metrics Numeric list; Cross-validation performance metrics on each fold.

nfolds An integer specifying the number of cross-validation folds.

predictions A list containing the predicted hold-out values on every fold.

Returns: An object of class [FittedCV](#).

FittedCV\$clone(): The objects of this class are cloneable with this method.

Usage:

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

Arguments:

deep Whether to make a deep clone.

Description

FittedGridSearch is an object containing fitted predictive models across a tuning grid of hyper-parameters returned by `GridSearch$fit()` as well as relevant model information such as the best performing model, best hyper-parameters, etc.

Public fields

`best_idx` An integer specifying the index of `$models` that contains the best-performing model.
`best_metric` The performance metric of the best model on the validation data.
`best_model` The best performing predictive model.
`best_params` A named list of the hyper-parameters that result in the optimal predictive model.
`tune_params` Data.frame of the full hyper-parameter grid.
`models` List of predictive models at every value of `$tune_params`.
`metrics` Numeric list; Cross-validation performance metrics on each fold.
`predictions` A list containing the predicted hold-out values on every fold.

Methods**Public methods:**

- [FittedGridSearch\\$new\(\)](#)
- [FittedGridSearch\\$clone\(\)](#)

`FittedGridSearch$new()`: Create a new [FittedGridSearch](#) object.

Usage:

```
FittedGridSearch$new(tune_params, models, metrics, predictions, optimize_score)
```

Arguments:

`tune_params` Data.frame of the full hyper-parameter grid.
`models` List of predictive models at every value of `$tune_params`.
`metrics` List of performance metrics on the validation data for every model in `$models`.
`predictions` A list containing the predicted values on the validation data for every model in `$models`.
`optimize_score` Either "max" or "min" indicating whether or not the specified performance metric was maximized or minimized to find the optimal predictive model.

Returns: An object of class [FittedGridSearch](#).

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

Usage:

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

Arguments:

`deep` Whether to make a deep clone.

FittedGridSearchCV	<i>Fitted Models with Cross Validation across a Tuning Grid of Hyper-parameters</i>
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Description

FittedGridSearchCV is an object containing fitted predictive models across a tuning grid of hyper-parameters returned by GridSearchCV\$fit() as well as relevant model information such as the best performing model, best hyper-parameters, etc.

Public fields

best_idx An integer specifying the index of \$models that contains the best-performing model.

best_metric The average performance metric of the best model across cross-validation folds.

best_model The best performing predictive model.

best_params A named list of the hyper-parameters that result in the optimal predictive model.

folds A list of length \$models where each element contains a list of the cross-validation indices for each fold.

tune_params A [data.frame](#) of the full hyper-parameter grid.

models List of predictive models at every value of \$tune_params.

metrics Numeric list; Cross-validation performance metrics for every model in \$models.

predictions A list containing the cross-validation fold predictions for each model in \$models.

Methods

Public methods:

- [FittedGridSearchCV\\$new\(\)](#)
- [FittedGridSearchCV\\$clone\(\)](#)

FittedGridSearchCV\$new(): Create a new [FittedGridSearchCV](#) object.

Usage:

```
FittedGridSearchCV$new(
  tune_params,
  models,
  folds,
  metrics,
  predictions,
  optimize_score
)
```

Arguments:

tune_params Data.frame of the full hyper-parameter grid.

models List of predictive models at every value of \$tune_params.

folds List of cross-validation indices at every value of \$tune_params.

metrics List of cross-validation performance metrics for every model in `$models`.
predictions A list containing the predicted values on the cross-validation folds for every model in `$models`.
optimize_score Either "max" or "min" indicating whether or not the specified performance metric was maximized or minimized to find the optimal predictive model.
Returns: An object of class [FittedGridSearchCV](#).

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

Usage:

`FittedGridSearchCV$clone(deep = FALSE)`

Arguments:

deep Whether to make a deep clone.

GridSearch

Tune Predictive Model Hyper-parameters with Grid Search

Description

GridSearch allows the user to specify a Grid Search schema for tuning predictive model hyper-parameters with complete flexibility in the predictive model and performance metrics.

Public fields

learner Predictive modeling function.

scorer List of performance metric functions.

tune_params Data.frame of full hyper-parameter grid created from `$tune_params`

Methods

Public methods:

- [GridSearch\\$fit\(\)](#)
- [GridSearch\\$new\(\)](#)
- [GridSearch\\$clone\(\)](#)

`GridSearch$fit()`: fit tunes user-specified model hyper-parameters via Grid Search.

Usage:

```
GridSearch$fit(
  formula = NULL,
  data = NULL,
  x = NULL,
  y = NULL,
  progress = FALSE
)
```

Arguments:

formula An object of class **formula**: a symbolic description of the model to be fitted.

data An optional data frame, or other object containing the variables in the model. If data is not provided, how formula is handled depends on `$learner`.

x Predictor data (independent variables), alternative interface to data with formula.

y Response vector (dependent variable), alternative interface to data with formula.

progress Logical; indicating whether to print progress across cross validation folds.

Details: `fit` follows standard R modeling convention by surfacing a formula modeling interface as well as an alternate matrix option. The user should use whichever interface is supported by the specified `$learner` function.

Returns: An object of class **FittedGridSearch**.

Examples:

```
if (require(e1071) && require(rpart) && require(yardstick)) {
  iris_new <- iris[sample(1:nrow(iris), nrow(iris)), ]
  iris_new$Species <- factor(iris_new$Species == "virginica")
  iris_train <- iris_new[1:100, ]
  iris_validate <- iris_new[101:150, ]

  ### Decision Tree example

  iris_grid <- GridSearch$new(
    learner = rpart::rpart,
    learner_args = list(method = "class"),
    tune_params = list(
      minsplit = seq(10, 30, by = 5),
      maxdepth = seq(20, 30, by = 2)
    ),
    evaluation_data = list(x = iris_validate[, 1:4], y = iris_validate$Species),
    scorer = list(accuracy = yardstick::accuracy_vec),
    optimize_score = "max",
    prediction_args = list(accuracy = list(type = "class"))
  )
  iris_grid_fitted <- iris_grid$fit(
    formula = Species ~ .,
    data = iris_train
  )

  ### Example with multiple metric functions

  iris_grid <- GridSearch$new(
    learner = rpart::rpart,
    learner_args = list(method = "class"),
    tune_params = list(
      minsplit = seq(10, 30, by = 5),
      maxdepth = seq(20, 30, by = 2)
    ),
    evaluation_data = list(x = iris_validate, y = iris_validate$Species),
    scorer = list(
```

```

        accuracy = yardstick::accuracy_vec,
        auc = yardstick::roc_auc_vec
    ),
    optimize_score = "max",
    prediction_args = list(
        accuracy = list(type = "class"),
        auc = list(type = "prob")
    ),
    convert_predictions = list(
        accuracy = NULL,
        auc = function(i) i[, "FALSE"]
    )
)
iris_grid_fitted <- iris_grid$fit(
    formula = Species ~ .,
    data = iris_train,
)

# Grab the best model
iris_grid_fitted$best_model

# Grab the best hyper-parameters
iris_grid_fitted$best_params

# Grab the best model performance metrics
iris_grid_fitted$best_metric

### Matrix interface example - SVM

mtcars_train <- mtcars[1:25, ]
mtcars_eval <- mtcars[26:nrow(mtcars), ]

mtcars_grid <- GridSearch$new(
    learner = e1071::svm,
    tune_params = list(
        degree = 2:4,
        kernel = c("linear", "polynomial")
    ),
    evaluation_data = list(x = mtcars_eval[, -1], y = mtcars_eval$mpg),
    learner_args = list(scale = TRUE),
    scorer = list(
        rmse = yardstick::rmse_vec,
        mae = yardstick::mae_vec
    ),
    optimize_score = "min"
)
mtcars_grid_fitted <- mtcars_grid$fit(
    x = mtcars_train[, -1],

```

```

    y = mtcars_train$mpg
  )

}

```

`GridSearch$new()`: Create a new [GridSearch](#) object.

Usage:

```

GridSearch$new(
  learner = NULL,
  tune_params = NULL,
  evaluation_data = NULL,
  scorer = NULL,
  optimize_score = c("min", "max"),
  learner_args = NULL,
  scorer_args = NULL,
  prediction_args = NULL,
  convert_predictions = NULL
)

```

Arguments:

learner Function that estimates a predictive model. It is essential that this function support either a formula interface with formula and data arguments, or an alternate matrix interface with x and y arguments.

tune_params A named list specifying the arguments of \$learner to tune.

evaluation_data A two-element list containing the following elements: x, the validation data to generate predicted values with; y, the validation response values to evaluate predictive performance.

scorer A named list of metric functions to evaluate model performance on evaluation_data. Any provided metric function must have truth and estimate arguments, for true outcome values and predicted outcome values respectively, and must return a single numeric metric value. The last metric function will be the one used to identify the optimal model from the Grid Search.

optimize_score One of "max" or "min"; Whether to maximize or minimize the metric defined in scorer to find the optimal Grid Search parameters.

learner_args A named list of additional arguments to pass to learner.

scorer_args A named list of additional arguments to pass to scorer. scorer_args must either be length 1 or length(scorer) in the case where different arguments are being passed to each scoring function.

prediction_args A named list of additional arguments to pass to predict. prediction_args must either be length 1 or length(scorer) in the case where different arguments are being passed to each scoring function.

convert_predictions A list of functions to convert predicted values prior to being evaluated by the metric functions supplied in scorer. This list should either be length 1, in which case the same function will be applied to all predicted values, or length(scorer) in which case each function in convert_predictions will correspond with each function in scorer.

Returns: An object of class [GridSearch](#).

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

Usage:

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

Arguments:

deep Whether to make a deep clone.

Examples

```
## -----
## Method `GridSearch$fit()`
## -----

if (require(e1071) && require(rpart) && require(yardstick)) {
  iris_new <- iris[sample(1:nrow(iris), nrow(iris)), ]
  iris_new$Species <- factor(iris_new$Species == "virginica")
  iris_train <- iris_new[1:100, ]
  iris_validate <- iris_new[101:150, ]

  ### Decision Tree example

  iris_grid <- GridSearch$new(
    learner = rpart::rpart,
    learner_args = list(method = "class"),
    tune_params = list(
      minsplit = seq(10, 30, by = 5),
      maxdepth = seq(20, 30, by = 2)
    ),
    evaluation_data = list(x = iris_validate[, 1:4], y = iris_validate$Species),
    scorer = list(accuracy = yardstick::accuracy_vec),
    optimize_score = "max",
    prediction_args = list(accuracy = list(type = "class"))
  )
  iris_grid_fitted <- iris_grid$fit(
    formula = Species ~ .,
    data = iris_train
  )

  ### Example with multiple metric functions

  iris_grid <- GridSearch$new(
    learner = rpart::rpart,
    learner_args = list(method = "class"),
    tune_params = list(
      minsplit = seq(10, 30, by = 5),
      maxdepth = seq(20, 30, by = 2)
    ),
    evaluation_data = list(x = iris_validate, y = iris_validate$Species),
    scorer = list(
      accuracy = yardstick::accuracy_vec,
      auc = yardstick::roc_auc_vec
    ),
    optimize_score = "max",
    prediction_args = list(
```

```

        accuracy = list(type = "class"),
        auc = list(type = "prob")
    ),
    convert_predictions = list(
        accuracy = NULL,
        auc = function(i) i[, "FALSE"]
    )
)
iris_grid_fitted <- iris_grid$fit(
    formula = Species ~ .,
    data = iris_train,
)

# Grab the best model
iris_grid_fitted$best_model

# Grab the best hyper-parameters
iris_grid_fitted$best_params

# Grab the best model performance metrics
iris_grid_fitted$best_metric

### Matrix interface example - SVM

mtcars_train <- mtcars[1:25, ]
mtcars_eval <- mtcars[26:nrow(mtcars), ]

mtcars_grid <- GridSearch$new(
    learner = e1071::svm,
    tune_params = list(
        degree = 2:4,
        kernel = c("linear", "polynomial")
    ),
    evaluation_data = list(x = mtcars_eval[, -1], y = mtcars_eval$mpg),
    learner_args = list(scale = TRUE),
    scorer = list(
        rmse = yardstick::rmse_vec,
        mae = yardstick::mae_vec
    ),
    optimize_score = "min"
)
mtcars_grid_fitted <- mtcars_grid$fit(
    x = mtcars_train[, -1],
    y = mtcars_train$mpg
)
}

```

Description

GridSearchCV allows the user to specify a Grid Search schema for tuning predictive model hyper-parameters with Cross-Validation. GridSearchCV gives the user complete flexibility in the predictive model and performance metrics.

Public fields

`learner` Predictive modeling function.

`scorer` List of performance metric functions.

`splitter` Function that splits data into cross validation folds.

`tune_params` Data.frame of full hyper-parameter grid created from `$tune_params`

Methods**Public methods:**

- [GridSearchCV\\$fit\(\)](#)
- [GridSearchCV\\$new\(\)](#)
- [GridSearchCV\\$clone\(\)](#)

`GridSearchCV$fit()`: `fit` tunes user-specified model hyper-parameters via Grid Search and Cross-Validation.

Usage:

```
GridSearchCV$fit(
  formula = NULL,
  data = NULL,
  x = NULL,
  y = NULL,
  response = NULL,
  convert_response = NULL,
  progress = FALSE
)
```

Arguments:

`formula` An object of class [formula](#): a symbolic description of the model to be fitted.

`data` An optional data frame, or other object containing the variables in the model. If data is not provided, how `formula` is handled depends on `$learner`.

`x` Predictor data (independent variables), alternative interface to data with `formula`.

`y` Response vector (dependent variable), alternative interface to data with `formula`.

`response` String; In the absence of `formula` or `y`, this specifies which element of `learner_args` is the response vector.

`convert_response` Function; This should be a single function that transforms the response vector. E.g. a function converting a numeric binary variable to a factor variable.

`progress` Logical; indicating whether to print progress across the hyper-parameter grid.

Details: `fit` follows standard R modeling convention by surfacing a `formula` modeling interface as well as an alternate matrix option. The user should use whichever interface is supported by the specified `$learner` function.

Returns: An object of class `FittedGridSearchCV`.

Examples:

```
if (require(e1071) && require(rpart) && require(yardstick)) {
  iris_new <- iris[sample(1:nrow(iris), nrow(iris)), ]
  iris_new$Species <- factor(iris_new$Species == "virginica")
  iris_train <- iris_new[1:100, ]
  iris_validate <- iris_new[101:150, ]
```

Decision Tree example

```
iris_grid_cv <- GridSearchCV$new(
  learner = rpart::rpart,
  learner_args = list(method = "class"),
  tune_params = list(
    minsplit = seq(10, 30, by = 5),
    maxdepth = seq(20, 30, by = 2)
  ),
  splitter = cv_split,
  splitter_args = list(v = 3),
  scorer = list(accuracy = yardstick::accuracy_vec),
  optimize_score = "max",
  prediction_args = list(accuracy = list(type = "class"))
)
iris_grid_cv_fitted <- iris_grid_cv$fit(
  formula = Species ~ .,
  data = iris_train
)
```

Example with multiple metric functions

```
iris_grid_cv <- GridSearchCV$new(
  learner = rpart::rpart,
  learner_args = list(method = "class"),
  tune_params = list(
    minsplit = seq(10, 30, by = 5),
    maxdepth = seq(20, 30, by = 2)
  ),
  splitter = cv_split,
  splitter_args = list(v = 3),
  scorer = list(
    accuracy = yardstick::accuracy_vec,
    auc = yardstick::roc_auc_vec
  ),
  optimize_score = "max",
  prediction_args = list(
    accuracy = list(type = "class"),
    auc = list(type = "prob")
  ),
)
```

```

      convert_predictions = list(
        accuracy = NULL,
        auc = function(i) i[, "FALSE"]
      )
    )
    iris_grid_cv_fitted <- iris_grid_cv$fit(
      formula = Species ~ .,
      data = iris_train,
    )

    # Grab the best model
    iris_grid_cv_fitted$best_model

    # Grab the best hyper-parameters
    iris_grid_cv_fitted$best_params

    # Grab the best model performance metrics
    iris_grid_cv_fitted$best_metric

    ### Matrix interface example - SVM

    mtcars_train <- mtcars[1:25, ]
    mtcars_eval <- mtcars[26:nrow(mtcars), ]

    mtcars_grid_cv <- GridSearchCV$new(
      learner = e1071::svm,
      tune_params = list(
        degree = 2:4,
        kernel = c("linear", "polynomial")
      ),
      splitter = cv_split,
      splitter_args = list(v = 2),
      learner_args = list(scale = TRUE),
      scorer = list(
        rmse = yardstick::rmse_vec,
        mae = yardstick::mae_vec
      ),
      optimize_score = "min"
    )
    mtcars_grid_cv_fitted <- mtcars_grid_cv$fit(
      x = mtcars_train[, -1],
      y = mtcars_train$mpg
    )
  }

```

`GridSearchCV$new()`: Create a new [GridSearchCV](#) object.

Usage:

`GridSearchCV$new(`

```

learner = NULL,
tune_params = NULL,
splitter = NULL,
scorer = NULL,
optimize_score = c("min", "max"),
learner_args = NULL,
splitter_args = NULL,
scorer_args = NULL,
prediction_args = NULL,
convert_predictions = NULL
)

```

Arguments:

learner Function that estimates a predictive model. It is essential that this function support either a formula interface with formula and data arguments, or an alternate matrix interface with x and y arguments.

tune_params A named list specifying the arguments of \$learner to tune.

splitter A function that computes cross validation folds from an input data set or a pre-computed list of cross validation fold indices. If splitter is a function, it must have a data argument for the input data, and it must return a list of cross validation fold indices. If splitter is a list of integers, the number of cross validation folds is length(splitter) and each element contains the indices of the data observations that are included in that fold.

scorer A named list of metric functions to evaluate model performance on evaluation_data. Any provided metric function must have truth and estimate arguments, for true outcome values and predicted outcome values respectively, and must return a single numeric metric value. The last metric function will be the one used to identify the optimal model from the Grid Search.

optimize_score One of "max" or "min"; Whether to maximize or minimize the metric defined in scorer to find the optimal Grid Search parameters.

learner_args A named list of additional arguments to pass to learner.

splitter_args A named list of additional arguments to pass to splitter.

scorer_args A named list of additional arguments to pass to scorer. scorer_args must either be length 1 or length(scorer) in the case where different arguments are being passed to each scoring function.

prediction_args A named list of additional arguments to pass to predict. prediction_args must either be length 1 or length(scorer) in the case where different arguments are being passed to each scoring function.

convert_predictions A list of functions to convert predicted values prior to being evaluated by the metric functions supplied in scorer. This list should either be length 1, in which case the same function will be applied to all predicted values, or length(scorer) in which case each function in convert_predictions will correspond with each function in scorer.

Returns: An object of class [GridSearch](#).

GridSearchCV\$clone(): The objects of this class are cloneable with this method.

Usage:

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

Arguments:

deep Whether to make a deep clone.

Examples

```
## -----
## Method `GridSearchCV$fit()`
## -----

if (require(e1071) && require(rpart) && require(yardstick)) {
  iris_new <- iris[sample(1:nrow(iris), nrow(iris)), ]
  iris_new$Species <- factor(iris_new$Species == "virginica")
  iris_train <- iris_new[1:100, ]
  iris_validate <- iris_new[101:150, ]

  ### Decision Tree example

  iris_grid_cv <- GridSearchCV$new(
    learner = rpart::rpart,
    learner_args = list(method = "class"),
    tune_params = list(
      minsplit = seq(10, 30, by = 5),
      maxdepth = seq(20, 30, by = 2)
    ),
    splitter = cv_split,
    splitter_args = list(v = 3),
    scorer = list(accuracy = yardstick::accuracy_vec,
      optimize_score = "max",
      prediction_args = list(accuracy = list(type = "class"))
    )
  )
  iris_grid_cv_fitted <- iris_grid_cv$fit(
    formula = Species ~ .,
    data = iris_train
  )

  ### Example with multiple metric functions

  iris_grid_cv <- GridSearchCV$new(
    learner = rpart::rpart,
    learner_args = list(method = "class"),
    tune_params = list(
      minsplit = seq(10, 30, by = 5),
      maxdepth = seq(20, 30, by = 2)
    ),
    splitter = cv_split,
    splitter_args = list(v = 3),
    scorer = list(
      accuracy = yardstick::accuracy_vec,
      auc = yardstick::roc_auc_vec
    ),
    optimize_score = "max",
    prediction_args = list(
      accuracy = list(type = "class"),
      auc = list(type = "prob")
    ),
  )
}
```

```

    convert_predictions = list(
      accuracy = NULL,
      auc = function(i) i[, "FALSE"]
    )
  )
  iris_grid_cv_fitted <- iris_grid_cv$fit(
    formula = Species ~ .,
    data = iris_train,
  )

  # Grab the best model
  iris_grid_cv_fitted$best_model

  # Grab the best hyper-parameters
  iris_grid_cv_fitted$best_params

  # Grab the best model performance metrics
  iris_grid_cv_fitted$best_metric

  ### Matrix interface example - SVM

  mtcars_train <- mtcars[1:25, ]
  mtcars_eval <- mtcars[26:nrow(mtcars), ]

  mtcars_grid_cv <- GridSearchCV$new(
    learner = e1071::svm,
    tune_params = list(
      degree = 2:4,
      kernel = c("linear", "polynomial")
    ),
    splitter = cv_split,
    splitter_args = list(v = 2),
    learner_args = list(scale = TRUE),
    scorer = list(
      rmse = yardstick::rmse_vec,
      mae = yardstick::mae_vec
    ),
    optimize_score = "min"
  )
  mtcars_grid_cv_fitted <- mtcars_grid_cv$fit(
    x = mtcars_train[, -1],
    y = mtcars_train$mpg
  )
}

```

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