

Package ‘h2otools’

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Type Package

Title Machine Learning Model Evaluation for 'h2o' Package

Version 0.4

Depends R (>= 3.5.0)

Description Enhances the H2O platform by providing tools for detailed evaluation of machine learning models. It includes functions for bootstrapped performance evaluation, extended F-score calculations, and various other metrics, aimed at improving model assessment.

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Encoding UTF-8

Imports h2o (>= 3.34.0.0), curl, boot

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URL <https://github.com/haghigh/h2otools>,
<https://www.sv.uio.no/psi/english/people/academic/haghigh/>

BugReports <https://github.com/haghigh/h2otools/issues>

NeedsCompilation no

Author E. F. Haghigh [aut, cre, cph]

Maintainer E. F. Haghigh <haghigh@hotmail.com>

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| | |
|------------------|--|
| automlModelParam | <i>AutoML Models' Parameters Summary</i> |
|------------------|--|

Description

Extracts models' parameters from AutoML grid

Usage

```
automlModelParam(model)
```

Arguments

model a h2o AutoML object

Value

a dataframe of models' parameters

Author(s)

E. F. Haghish

Examples

```
## Not run:
if(requireNamespace("h2o")) {
  library(h2o)
  h2o.init(ignore_config = TRUE, nthreads = 2, bind_to_localhost = FALSE, insecure = TRUE)
  prostate_path <- system.file("extdata", "prostate.csv", package = "h2o")
  prostate <- h2o.importFile(path = prostate_path, header = TRUE)
  y <- "CAPSULE"
  prostate[,y] <- as.factor(prostate[,y]) #convert to factor for classification
  aml <- h2o.automl(y = y,
                  training_frame = prostate,
                  include_algos = "GLM",
                  max_models = 1,
                  max_runtime_secs = 60)

  # extract the model parameters
  model.param <- automlModelParam(aml@leader)
}

## End(Not run)
```

| | |
|----------------|--|
| bootImportance | <i>Bootstrap Variable Importance And Averaged Grid Variable Importance</i> |
|----------------|--|

Description

Evaluates variable importance as well as bootstrapped variable importance for a single model or a grid of models

Usage

```
bootImportance(model, df, metric, n = 100)
```

Arguments

| | |
|--------|---|
| model | a model or a model grid of models trained by h2o machine learning software |
| df | dataset for testing the model. if "n" is bigger than 1, this dataset will be used for drawing bootstrap samples. otherwise (default), the entire dataset will be used for evaluating the model |
| metric | character. model evaluation metric to be passed to boot R package. this could be, for example "AUC", "AUCPR", "RMSE", etc., depending of the model you have trained. all evaluation metrics provided for your H2O models can be specified here. |
| n | number of bootstraps |

Value

list of mean performance of the specified metric and other bootstrap results

Author(s)

E. F. Haghish

Examples

```
## Not run:
library(h2o)
h2o.init(ignore_config = TRUE, nthreads = 2, bind_to_localhost = FALSE, insecure = TRUE)
prostate_path <- system.file("extdata", "prostate.csv", package = "h2o")
df <- read.csv(prostate_path)

# prepare the dataset for analysis before converting it to h2o frame.
df$CAPSULE <- as.factor(df$CAPSULE)

# convert the dataframe to H2OFrame and run the analysis
prostate.hex <- as.h2o(df)
aml <- h2o.automl(y = "CAPSULE", training_frame = prostate.hex, max_runtime_secs = 30)
```

```
# evaluate the model performance
perf <- h2o.performance(aml@leader, xval = TRUE)

# evaluate bootstrap performance for the training dataset
# NOTE that the raw data is given not the 'H2OFrame'
perf <- bootPerformance(model = aml@leader, df = df, metric = "RMSE", n = 500)

## End(Not run)
```

| | |
|-----------------|------------------------|
| bootPerformance | <i>bootPerformance</i> |
|-----------------|------------------------|

Description

Evaluate model performance by bootstrapping from training dataset

Usage

```
bootPerformance(model, df, metric, n = 100)
```

Arguments

| | |
|--------|---|
| model | a model trained by h2o machine learning software |
| df | training, validation, or testing dataset to bootstrap from |
| metric | character. model evaluation metric to be passed to boot R package. this could be, for example "AUC", "AUCPR", "RMSE", etc., depending of the model you have trained. all evaluation metrics provided for your H2O models can be specified here. |
| n | number of bootstraps |

Value

list of mean performance of the specified metric and other bootstrap results

Author(s)

E. F. Haghish

Examples

```
## Not run:
library(h2o)
h2o.init(ignore_config = TRUE, nthreads = 2, bind_to_localhost = FALSE, insecure = TRUE)
prostate_path <- system.file("extdata", "prostate.csv", package = "h2o")
df <- read.csv(prostate_path)

# prepare the dataset for analysis before converting it to h2o frame.
df$CAPSULE <- as.factor(df$CAPSULE)
```

```
# convert the dataframe to H2OFrame and run the analysis
prostate.hex <- as.h2o(df)
aml <- h2o.automl(y = "CAPSULE", training_frame = prostate.hex, max_runtime_secs = 30)

# evaluate the model performance
perf <- h2o.performance(aml@leader, xval = TRUE)

# evaluate bootstrap performance for the training dataset
# NOTE that the raw data is given not the 'H2OFrame'
perf <- bootPerformance(model = aml@leader, df = df, metric = "RMSE", n = 500)

## End(Not run)
```

capture

Capture Evaluation Side Effects

Description

This function evaluates an R expression while capturing its printed output, messages, warnings, and errors. It returns a list containing the result of the evaluation along with all the captured texts.

Usage

```
capture(expr)
```

Arguments

expr An R expression to evaluate. The expression is captured using `substitute()` to retain its code form before evaluation.

Details

The function uses `withCallingHandlers()` and `tryCatch()` to capture side effects of evaluating the expression. Printed output is captured using `capture.output()`. Warnings and messages are intercepted and their default display is suppressed using `invokeRestart("muffleWarning")` and `invokeRestart("muffleMessage")`, respectively. If an error occurs, its message is stored and `NULL` is returned as the value.

Value

A list with the following components:

value The result of evaluating `expr`.

output A character vector with the printed output produced during evaluation.

messages A character vector with any messages generated during evaluation.

warnings A character vector with any warnings produced during evaluation.

error A character string with the error message if an error occurred; otherwise `NULL`.

Examples

```
## Not run:
# Example: Capturing output, messages, warnings, and errors
captured <- capture({
  print("Hello, world!")
  message("This is a message.")
  warning("This is a warning.")
  42 # Final value returned
})

# Display the captured components
print(captured$output) # Printed output
print(captured$messages) # Messages
print(captured$warnings) # Warnings
print(captured$error) # Error message (if any)
print(captured$value) # The evaluated result (42 in this example)

## End(Not run)
```

 checkFrame

check input data.frame

Description

checks the class of the input data.frame, makes sure that the specified 'df' is indeed a data.frame and more over, there is no column with class 'character' or 'ordered' in the data.frame. this function helps you ensure that your data is compatible with h2o R package.

Usage

```
checkFrame(df, ignore = NULL, is.df = TRUE, no.char = TRUE, no.ordered = TRUE)
```

Arguments

| | |
|------------|--|
| df | data.frame object to evaluate |
| ignore | character vector of column names that should be ignored, if any. |
| is.df | logical. if TRUE, it examines if the 'df' is 'data.frame' |
| no.char | logical. if TRUE, it examines if the 'df' has any columns of class 'character' |
| no.ordered | logical. if TRUE, it examines if the 'df' has any columns of class 'ordered' factors |

Value

nothing

Author(s)

E. F. Haghish

Examples

```
data(cars)

# no error is expected because 'cars' dataset does not
# have 'ordered' or 'character' columns
checkFrame(cars)
```

Fmeasure

*F-Measure***Description**

Calculates F-Measure for any given value of Beta

Usage

```
Fmeasure(perf, beta = 1, max = FALSE)
```

Arguments

| | |
|------|---|
| perf | a h2o object of class "H2OBinomialMetrics" which is provided by 'h2o.performance' function. |
| beta | numeric, specifying beta value, which must be higher than zero |
| max | logical. default is FALSE. if TRUE, instead of providing the F-Measure for all the thresholds, the highest F-Measure is reported. |

Value

a matrix of F-Measures for different thresholds or the highest F-Measure value

Author(s)

E. F. Haghish

Examples

```
## Not run:
library(h2o)
h2o.init(ignite_config = TRUE, nthreads = 2, bind_to_localhost = FALSE, insecure = TRUE)
prostate_path <- system.file("extdata", "prostate.csv", package = "h2o")
prostate <- h2o.importFile(path = prostate_path, header = TRUE)
y <- "CAPSULE"
prostate[,y] <- as.factor(prostate[,y]) #convert to factor for classification
aml <- h2o.automl(y = y, training_frame = prostate, max_runtime_secs = 30)
```

```

# evaluate the model performance
perf <- h2o.performance(aml@leader, xval = TRUE)

# evaluate F-Measure for a Beta = 3
Fmeasure(perf, beta = 3, max = TRUE)

# evaluate F-Measure for a Beta = 1.5
Fmeasure(perf, beta = 1.5, max = TRUE)

# evaluate F-Measure for a Beta = 4
Fmeasure(perf, beta = 4, max = TRUE)

## End(Not run)

```

getPerfMatrix

getPerfMatrix

Description

retrieve performance matrix for all thresholds

Usage

```
getPerfMatrix(perf)
```

Arguments

perf a h2o object of class "H2OBinomialMetrics" which is provided by 'h2o.performance' function.

Value

a matrix of F-Measures for different thresholds or the highest F-Measure value

Author(s)

E. F. Haghish

Examples

```

## Not run:
library(h2o)
h2o.init(ignore_config = TRUE, nthreads = 2, bind_to_localhost = FALSE, insecure = TRUE)
prostate_path <- system.file("extdata", "prostate.csv", package = "h2o")
prostate <- h2o.importFile(path = prostate_path, header = TRUE)
y <- "CAPSULE"
prostate[,y] <- as.factor(prostate[,y]) #convert to factor for classification
aml <- h2o.automl(y = y, training_frame = prostate, max_runtime_secs = 30)

```



```
# evaluate the model performance
perf <- h2o.performance(aml@leader, xval = TRUE)

# get the performance matrix for all thresholds
getPerfMatrix(perf)

## End(Not run)
```

h2o.get_ids

h2o.get_ids

Description

extracts the model IDs from H2O AutoML object or H2O grid

Usage

```
h2o.get_ids(automl)
```

Arguments

automl a h2o "AutoML" grid object

Value

a character vector of trained models' names (IDs)

Author(s)

E. F. Haghish

Examples

```
## Not run:
library(h2o)
h2o.init(ignore_config = TRUE, nthreads = 2, bind_to_localhost = FALSE, insecure = TRUE)
prostate_path <- system.file("extdata", "prostate.csv", package = "h2o")
prostate <- h2o.importFile(path = prostate_path, header = TRUE)
y <- "CAPSULE"
prostate[,y] <- as.factor(prostate[,y]) #convert to factor for classification
aml <- h2o.automl(y = y, training_frame = prostate, max_runtime_secs = 30)

# get the model IDs
ids <- h2o.ids(aml)

## End(Not run)
```

| | |
|-------|--------------|
| kappa | <i>kappa</i> |
|-------|--------------|

Description

Calculates kappa for all thresholds

Usage

```
kappa(perf, max = FALSE)
```

Arguments

| | |
|------|---|
| perf | a h2o object of class "H2OBinomialMetrics" which is provided by 'h2o.performance' function. |
| max | logical. default is FALSE. if TRUE, instead of providing the F-Measure for all the thresholds, the highest F-Measure is reported. |

Value

a matrix of F-Measures for different thresholds or the highest F-Measure value

Author(s)

E. F. Haghish

Examples

```
## Not run:
library(h2o)
h2o.init(ignore_config = TRUE, nthreads = 2, bind_to_localhost = FALSE, insecure = TRUE)
prostate_path <- system.file("extdata", "prostate.csv", package = "h2o")
prostate <- h2o.importFile(path = prostate_path, header = TRUE)
y <- "CAPSULE"
prostate[,y] <- as.factor(prostate[,y]) #convert to factor for classification
aml <- h2o.automl(y = y, training_frame = prostate, max_runtime_secs = 30)

# evaluate the model performance
perf <- h2o.performance(aml@leader, xval = TRUE)

# evaluate F-Measure for a Beta = 3
kappa(perf, max = TRUE)

## End(Not run)
```

| | |
|-------------|---|
| performance | <i>provides performance measures using objects from h2o</i> |
|-------------|---|

Description

takes h2o performance object of class "H2OBinomialMetrics" alongside caret confusion matrix and provides different model performance measures supported by h2o and caret

Usage

```
performance(perf)
```

Arguments

perf h2o performance object of class "H2OBinomialMetrics"

Value

numeric vector

Author(s)

E. F. Haghish

Examples

```
## Not run:
library(h2o)
h2o.init(ignore_config = TRUE, nthreads = 2, bind_to_localhost = FALSE, insecure = TRUE)
prostate_path <- system.file("extdata", "prostate.csv", package = "h2o")
prostate <- h2o.importFile(path = prostate_path, header = TRUE)
y <- "CAPSULE"
prostate[,y] <- as.factor(prostate[,y]) #convert to factor for classification
aml <- h2o.automl(y = y, training_frame = prostate, max_runtime_secs = 30)

# evaluate the model performance
perf <- h2o.performance(aml@leader, xval = TRUE)

# compute more performance measures
performance(perf)

## End(Not run)
```

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