Package 'HandTill2001'

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Type Package

Title Multiple Class Area under ROC Curve

Version 1.0.2

Description An S4 implementation of Eq. (3) and Eq. (7) by David J. Hand and Robert J. Till (2001) <DOI:10.1023/A:1010920819831>.

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URL https://gitlab.com/fvafrcu/HandTill2001

Depends R (>= 2.14)

Imports methods, utils

Suggests caTools, devtools, knitr, MASS, mda, nnet, pkgload, rmarkdown, ROCR, rpart, rprojroot, RUnit, testthat

VignetteBuilder utils

RoxygenNote 7.3.2

NeedsCompilation no

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Contents

`HandTill2001-package` *Multiple Class Area under ROC Curve*

Description

A very lean package implementing merely M given by *Hand and Till (2001)*, Eq. (7).

Details

M given by *Hand and Till (2001)* defines a multiple class version of the area under curve of the receiver operating characteristic.

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References

David J. Hand and Robert J. Till (2001). A Simple Generalisation of the Area Under the ROC Curve for Multiple Class Classification Problems. Machine Learning ***45***(2), p. 171–186. DOI: doi:10.1023/A:1010920819831.

See Also

`help(package="HandTill2001")`, especially `?HandTill2001::auc`; various packages that calculate binary class AUC (`ROCR`) or multiple class AUC (pROC, `caTools`).

Examples

```
library(HandTill2001)
data(ht01.multipleclass)
auc(
  multcap(
    response = ht01.multipleclass$observed,
    predicted = as.matrix(ht01.multipleclass[, levels(ht01.multipleclass$observed)])
  )
)
```

auc-methods *Methods for Function* auc *in Package* **HandTill2001**

Description

Calculate area under curve of the receiver operating characteristic for two or more prediction classes.

Usage

```
## S4 method for signature 'bincap'
auc(object)

## S4 method for signature 'multcap'
auc(object)
```

Arguments

object	An object of class *bincap* or *multcap*.

Details

Depending on whether object is of class bincap or of class multcap, a binary class or multiple class AUC is calculated.

Value

An object of class "numeric".

Methods

signature(object = "bincap") calculates the AUC statistic for a binary class response following *Hand and Till (2001)*, Eq. (3).

signature(object = "multcap") calculates the AUC statistic for a multiple class response following *Hand and Till (2001)*, Eq. (7).

References

David J. Hand and Robert J. Till (2001). A Simple Generalisation of the Area Under the ROC Curve for Multiple Class Classification Problems. Machine Learning ***45***(2), *p. 171–186. DOI: doi:10.1023/A:1010920819831*.

See Also

class?bincap, class?multcap

Examples

```
data(ht01.twoclass, package = "HandTill2001")
message(" == AUC for a binary class response")
message(" == == HandTill2001 result:")
HandTill2001::auc(HandTill2001::bincap(
  response = as.factor(ht01.twoclass[["observed"]]),
  predicted = ht01.twoclass[["predicted"]],
  true = "1"
))
## Not run:
message(" == == ROCR result:")
ROCR::performance(ROCR::prediction(
  labels = ht01.twoclass[["observed"]],
  predictions = ht01.twoclass[["predicted"]]
),
measure = "auc"
)@y.values

## End(Not run)
data(ht01.multipleclass, package = "HandTill2001")
message(" == AUC for a multiple class response")
predicted <- as.matrix(ht01.multipleclass[, levels(ht01.multipleclass[["observed"]])])
HandTill2001::auc(HandTill2001::multcap(
  response = ht01.multipleclass[["observed"]],
  predicted = predicted
))
```

`bincap` *A Constructor for Objects of Class* `bincap`

Description

`bincap(...)` is an alias to `new("bincap", ...)`.

Usage

```
bincap(response, predicted, true = "1")
```

Arguments

`response`	Object of class `factor`.
`predicted`	Object of class `numeric`.
`true`	Object of class `character`.

Details

There is no casting or conversion of data. `bincap(...)` is just an alias to `new("bincap", ...)`.

Value

An object of class `bincap`.

See Also

`class?HandTill2001::bincap`

Examples

```
library(HandTill2001)
data(ht01.twoclass)
str(ht01.twoclass$observed)
message("note that ht01.twoclass$observed is not a factor; we have to convert it.")
bincap(
  response = as.factor(ht01.twoclass$observed),
  predicted = ht01.twoclass$predicted,
  true = c("1")
)
```

`bincap-class` *Binary Class and Prediction Objects*

Description

S4 class for a binary class response and corresponding (predicted) probabilities.

Objects from the Class

Objects can be created by calls of the form `new("bincap", ...)`. They are used to store a binary class response (one of the two `levels` of which is supposed to be `true`), the information which of the two `levels` of the binary class response is thought of as 'true'/'positive'/'present' (the other one would then be thought of as 'false'/'negative'/'absence') and the predicted probabilities that `response` is `true`.

Note

No defaults are set. Especially, you have to explicitly initialize `true`, there is no trying to guess it from the `levels` of `response`.

See Also

`class?HandTill2001::cap` , `class?HandTill2001::multcap` , `?HandTill2001::bincap`

Examples

```
showClass("bincap")
```

`ht01.multipleclass` *Example Data for Multiple Classes*

Description

Multiple class data and probability predictions thereof.

Format

A data frame with 214 observations on the following 7 variables.

observed a factor with levels `Con` `Head` `Tabl` `Veh` `WinF` `WinNF`

WinF a numeric vector

WinNF a numeric vector

Veh a numeric vector

Con a numeric vector

Tabl a numeric vector

Head a numeric vector

Details

Multiple class data ('observed': `MASS::fgl$type`) and probability predictions (`predict(fgl.rp4)`, cf. Venables and Ripley (2002), p. 264 and 'Source') from `rpart::rpart`.

Source

```
 ## From: Forensic glass example Venables and Ripley
(2002) pp. 261--265 library(MASS);library(rpart);data(fgl);set.seed(123)
fgl.rp4 <- rpart(type ~ ., data = fgl, cp = 0.03 , parms = list(split =
"information")) ht01.multipleclass <- data.frame(observed = fgl$type,
predict(fgl.rp4)) write.table(ht01.multipleclass, file =
"ht01.multipleclass.txt")
```

References

Venables, W. N and Ripley, B. D. (2002), *Modern Applied Statistics with S* (4th edition). Springer, ISBN 0-387-95457-0

Examples

```
library(HandTill2001)
data(ht01.multipleclass)
str(ht01.multipleclass)
```

`ht01.twoclass` *Example Data for Binary Classes*

Description

Binary class data and probability predictions thereof.

Format

A data frame with 189 observations on the following 2 variables.

observed a numeric vector

predicted a numeric vector

Details

Binary class data ('observed': `MASS::birthwt$low`) and probability predictions (`predict(birthwt.step2, type = "response")`, cf. Venables and Ripley (2002), pp. 195f and 'Source') from `stats::glm`.

Source

```
 ## From: A binary class data example Venables and
Ripley pp. 194--199 library(MASS); data("birthwt"); attach(birthwt) race <-
(factor(race, labels = c("white", "black", "other"))) ptd <- factor(ptl > 0)
ftv <- factor(ftv) levels(ftv)[-(1:2)] <- "2+" bwt <- data.frame(low =
factor(low), age, lwt, race, smoke = (smoke > 0) , ptd, ht = (ht > 0), ui =
(ui > 0), ftv) detach(birthwt) birthwt.glm <- glm(low ~ .,
family=binomial(link=logit), data=bwt) birthwt.step2 <- stepAIC(birthwt.glm,
~ .^2 + I(scale(age)^2) + I(scale(lwt)^2), trace = F ) ht01.twoclass <-
data.frame(observed = bwt$low , predicted = predict(birthwt.step2 , type =
"response")) write.table(ht01.twoclass, file = "ht01.twoclass.txt")
```

References

Venables, W. N and Ripley, B. D. (2002), *Modern Applied Statistics with S* (4th edition). Springer, ISBN 0-387-95457-0

Examples

```
library(HandTill2001)
data(ht01.twoclass)
str(ht01.twoclass)
```

multcap *A Constructor for Objects of Class* multcap

Description

multcap(...) is an alias to new("multcap", ...).

Usage

```
multcap(response, predicted)
```

Arguments

response	Object of class factor.
predicted	Object of class matrix.

Details

There is no casting or conversion of data. multcap(...) is just an alias to new("multcap", ...).

Value

An object of class multcap.

See Also

class?HandTill2001::multcap

Examples

```
library(HandTill2001)
data(ht01.multipleclass)
str(ht01.multipleclass$observed)
message("note that ht01.multipleclass$observed is a factor; we do not have to convert it.")
multcap(
  response = ht01.multipleclass$observed,
  predicted = as.matrix(ht01.multipleclass[, levels(ht01.multipleclass$observed)])
)
```

multcap-class *Multiple Class and Prediction Objects*

Description

S4 class for a multiple class response and corresponding (predicted) probabilities.

Objects from the Class

Objects can be created by calls of the form `new("multcap", ...)`. They are used to store a multiple class response and the predicted probabilities for each of the `levels(response)`.

See Also

`class?HandTill2001::cap` , `class?HandTill2001::bincap` , `?HandTill2001::multcap`

Examples

```
showClass("multcap")
```

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