Package ‘HandTill2001’

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Type Package

Title Multiple Class Area under ROC Curve

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Description (nothing but) an S4 implementation of Eq. (3) and Eq. (7) by 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:10.1023/A:1010920819831.

Depends R (>= 2.14), methods

Suggests MASS, rpart, mda, nnet

License GPL (>= 2)

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**auc-methods**

**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.

**References**


**See Also**

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

**Examples**

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

---

**Description**

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

**Details**

Depending on whether *object* is of class "bincap" or of class "multcap", a two class or multiple class AUC is calculated.
Value

An object of class "numeric".

Methods

signature(object = "bincap") calculates the AUC statistic for a two 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


See Also

"class?bincap","class?multcap"

Examples

library(HandTill2001)
data(ht01.twoclass)
data(ht01.multipleclass)
message(" == AUC for a two class response")
# Not run:
message(" == ROCR result:")
library(ROCR)
performance(prediction(labels=ht01.twoclass$observed , predictions=ht01.twoclass$predicted )
 , measure = "auc")

# Not run
message(" == HandTill2001 result:")

auc(bincap(
    response = as.factor(ht01.twoclass$observed)
 , predicted = ht01.twoclass$predicted
 , true = "1"
))
message(" == AUC for a multiple class response")

auc(multcap(
    response = ht01.multipleclass$observed
 , predicted = as.matrix(ht01.multipleclass[, levels(ht01.multipleclass$observed)])
))
bincap

a ui-constructor for Class "bincap" in Package HandTill2001

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"

Author(s)

Andreas Dominik Cullmann

See Also

"class?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")
)
Description

S4 class for a two 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 two class response (one of the two levels of which is supposed to be true), the information which of the two levels of the two 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.

Slots

predicted: Object of class "numeric", probabilities for response. Of length n
true: Object of class "character", indicating which of the two levels of response is to be treated as 'true'/’positive'/’presence' (the other one would then accordingly be called 'false'/’negative'/’absence'). Of length 1.
response: Object of class "factor", two class observations. Of length n.

Extends

Class "cap", directly.

Methods

auc signature(object = "bincap"): ...

Note

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

Author(s)

Andreas Dominik Cullmann

See Also

"class?cap","class?multcap","?bincap"

Examples

showClass("bincap")
cap-class

Class "cap" in Package HandTill2001

Description

A virtual class for "bincap" and "multcap".

Objects from the Class

A virtual Class: No objects may be created from it.

Slots

response: Object of class "factor", typically two class or multiple class observations.

Methods

No methods defined with class "cap" in the signature.

Author(s)

Andreas Dominik Cullmann

See Also

"class?bincap", "class?multcap"

ht01.multipleclass

ht01.multipleclass data in Package HandTill2001

Description

multiple class data and probability predictions thereof.

Usage

data(ht01.multipleclass)
**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**

```r
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**


**Examples**

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

---

**Description**

two class data and probability predictions thereof.

**Usage**

data(ht01.twoclass)
Format

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

observed a numeric vector
predicted a numeric vector

Details

two 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

```r
## From: A two 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

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Examples

```r
library(HandTill2001)
data(ht01.twoclass)
str(ht01.twoclass)
```
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 "bincap"

Author(s)

Andreas Dominik Cullmann

See Also

"class?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

Class "multcap" in Package HandTill2001

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).

Slots

  predicted: Object of class "matrix", probabilities for response. Of dimension (n, length(unique(response))).
  The columns (dimnames()[[2]]) of the prediction matrix have to be named with the values of unique(response). This is the default for example with predict.rpart(type="prob", ...).
  response: Object of class "factor", multiple class observations. Of length n.

Extends

  Class "cap", directly.

Methods

  auc signature(object = "multcap"): ...

Author(s)

  Andreas Dominik Cullmann

See Also

  "class?cap", "class?bincap", "?multcap"

Examples

  showClass("multcap")
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