Package ‘cpt’

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Title Classification Permutation Test

Description Non-parametric test for equality of multivariate distributions. Trains a classifier to classify (multivariate) observations as coming from one of several distributions. If the classifier is able to classify the observations better than would be expected by chance (using permutation inference), then the null hypothesis that the distributions are equal is rejected.

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Imports MASS, nnet, randomForest, glmnet

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Description

Description: Non-parametric test for equality of multivariate distributions. Trains a classifier to classify (multivariate) observations as coming from one of several distributions. If the classifier is able to classify the observations better than would be expected by chance (using permutation inference), then the null hypothesis that the distributions are equal is rejected.

Details

Package: cpt
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Author(s)

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References


See Also

cpt

desc
Usage

cpt(Z, T, leaveout = 0, class.methods = "forest",
metric = "probability", ensemble.metric="mean.prob",
paired=FALSE, perm.N = 1000, leaveout.N=100,
comb.methods=c(class.methods, "ensemble"),
comb.method="fisher")

Arguments

Z The data. An n by p matrix, where n is the number of observations, and p is the
number of covariates.

T The treatment variable. Is converted to a factor.

leaveout The number of observations from each treatment group to include in the test
set. If 0, no data is left out and the in-sample test statistic is used. (See note
below.) If an integer greater than or equal to 1, the number of observations from
each treatment group to leave out. Values between 0 and 1 are converted to
ceiling(min(table(T))*leaveout).

class.methods A character vector of the different classification methods to use. Can be "lda",
"logistic", "logistic2", "glmnet", "glmnet2", or "forest". The "logistic2" and
"glmnet2" classifiers include all two-way interactions in the model.

metric Which test statistic to use. Can be "rate" (classification accuracy rate), "mse",
or "probability". The default value ("probability") is recommended.

ensemble.metric Which test statistic to use for an ensemble classifier composed of all of the
individual classifiers. Can be "vote", "mean.mse", or "mean.prob". The default
value ("mean.prob") is recommended.

paired Do a paired permutation test. The data Z must be ordered such that the first ob-
servation with T==1 is paired with the first observation with T==2, the second
observation with T==1 is paired with the second observation with T==2, etc.
This can be accomplished by either letting the first n/2 rows be the treatment
observations, and last n/2 rows being the control observations (in the same or-
der), or by using the first two rows for the first pair, the second two rows for the
second pair, etc.

perm.N The number of permutations.

leaveout.N The number of training set / test set iterations. In each iteration, a random test
set is generated. Thus, test sets will typically overlap somewhat. There is one
exception: If leaveout = 1 and leaveout.N = n, then a traditional leave-one-out
procedure is used (each observation is left out exactly once).

comb.methods Which of the classifiers to include in the combined, overall p-value. Can be any
subset of the classifiers specified in class.methods in addition to "ensemble"
for the ensemble classifier.

comb.method The method for combining p-values from the individual classifiers in order to
produce an overall p-value. The default ("fisher") is recommended. The other
possible option is "min" which uses the minimum p-value. Note that in both
cases, the combined p-value itself is not returned; rather, the combined p-value
is treated as a test statistic, which is itself then subject to permutation analysis;
what is returned is the resulting p-value from this analysis.
Value

A list containing

- `pval` The overall p-value, after combining results from the individual classifiers.
- `teststat` The observed test statistics of the individual classifiers.
- `nulldist` The permutation distributions of the individual classifiers.
- `pvals` The p-values of the individual classifiers.

Note

In the special case that the classifier is "forest", the metric is "rate", and "leaveout" is 0, the out-of-bag classification accuracy rate is used rather than the true in-sample classification accuracy rate.

Author(s)

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References


Examples

```r
## Create some simulated data
n = 50  # 50 observations
p = 5   # 5 covariates
T = rep(c(0,1),each=25)  # Two groups, 25 observations each
Z = matrix(rnorm(n*p),n,p)  # Random data (null is true)

## Run CPT
cpt.results = cpt(Z, T, class.methods="lda")
print(cpt.results$pval)

## False Null
Z[1:25, 1] = Z[1:25, 1] + 1  # Now the null is false
cpt.results = cpt(Z, T, class.methods="lda")
print(cpt.results$pval)
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