Package ‘stapler’

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Version 0.7.1

Title Simultaneous Truth and Performance Level Estimation

Description An implementation of Simultaneous Truth and Performance Level Estimation (STAPLE) <doi:10.1109/TMI.2004.828354>. This method is used when there are multiple raters for an object, typically an image, and this method fuses these ratings into one rating. It uses an expectation-maximization method to estimate this rating and the individual specificity/sensitivity for each rater.

License GPL-3

Imports matrixStats, RNifti

Suggests knitr, rmarkdown, covr, testthat, spelling

Encoding UTF-8

LazyData true

Type Package

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VignetteBuilder knitr

URL https://github.com/muschellij2/stapler

BugReports https://github.com/muschellij2/stapler/issues

RoxygenNote 7.0.1

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### staple

**Generic STAPLE Algorithm**

**Description**

Tries to do the correct STAPLE algorithm (binary/multi-class) for the type of input (array/matrix/list of images/filenames of images)

**Usage**

```r
staple(x, ..., set_orient = FALSE)
```

## Default S3 method:

```r
staple(x, ..., set_orient = FALSE)
```

## S3 method for class 'list'

```r
staple(x, ..., set_orient = FALSE)
```

## S3 method for class 'character'

```r
staple(x, ..., set_orient = FALSE)
```

## S3 method for class 'array'

```r
staple(x, ..., set_orient = FALSE)
```

**Arguments**

- **x**
  
a nxr matrix where there are n raters and r elements rated, a list of images, or a character vector. Note, readNifti is used for image filenames

- **...**
  
Options for STAPLE, see staple_bin_mat and staple_multi_mat

- **set_orient**
  
Should the orientation be set to the same if x is a set of images, including niftiImages.
Run STAPLE on a set of nifti images

Usage

staple_bin_img(x, set_orient = FALSE, verbose = TRUE, ...)

staple_multi_img(x, set_orient = FALSE, verbose = TRUE, ...)

Arguments

x Character vector of filenames or list of arrays/images

set_orient Should the orientation be set to the same if the images are niftiImages

verbose print diagnostic messages

... Additional arguments to staple_bin_mat

Value

A list similar to staple_bin_mat, but has a resulting image

Examples

n = 5
r = 1000
x = lapply(seq(n), function(i) {
  x = rbinom(n = r, size = 1, prob = 0.5)
  array(x, dim = c(10,10, 10))
})
staple_out = staple_bin_img(x, set_orient = FALSE)

n = 5
r = 1000
x = lapply(seq(n), function(i) {
  x = rbinom(n = r, size = 5, prob = 0.5)
  array(x, dim = c(10,10, 10))
})
staple_out = staple_multi_img(x, set_orient = FALSE)
Description

STAPLE on binary matrix

Usage

staple_bin_mat(
  x,
  sens_init = 0.99999,
  spec_init = 0.99999,
  max_iter = 10000,
  tol = .Machine$double.eps,
  prior = "mean",
  verbose = TRUE,
  trace = 10,
  drop_all_same = FALSE
)

Arguments

x a n x r matrix where there are n raters and r elements rated
sens_init Initialize parameter for sensitivity (p)
spec_init Initialize parameter for specificity (q)
max_iter Maximum number of iterations to run
tol Tolerance for convergence
prior Either "mean" or a vector of prior probabilities,
verbose print diagnostic messages
trace Number for modulus to print out verbose iterations
drop_all_same drop all records where they are all the same. DO NOT use in practice, only for validation of past results

Value

List of output sensitivities, specificities, and vector of probabilities

Examples

n = 5
r = 1000
sens = c(0.8, 0.9, 0.8, 0.5, 0.8)
spec = c(0.9, 0.75, 0.99, 0.98, 0.92)
suppressWarnings(RNGversion("3.5.0"))
set.seed(20171120)
n_1 = 200
n_0 = r - n_1
truth = c(rep(0, n_0), rep(1, n_1))
pred_1 = rbinom(n = n, size = n_1, prob = sens)
pred_0 = rbinom(n = n, size = n_0, prob = spec)
pred_0 = sapply(pred_0, function(n) {
    sample(c(rep(0, n), rep(1, n_0 - n)))
})
pred_1 = sapply(pred_1, function(n) {
    sample(c(rep(1, n), rep(0, n_1 - n)))
})
pred = rbind(pred_0, pred_1)
true_sens = colMeans(pred[, truth == 1])
true_spec = colMeans(1 - pred[, truth == 0])
x = t(pred)

staple_out = staple_bin_mat(x)
testthat::expect_equal(staple_out$sensitivity,
    c(0.781593858553476, 0.895868301462594,
    0.760514086161722, 0.464483444340873,
    0.765239314719065))
staple_out_prior = staple_bin_mat(x, prior = rep(0.5, r))
testthat::expect_equal(staple_out_prior$sensitivity,
    c(0.683572080864211, 0.821556768891859,
    0.619166852992802, 0.389409921992467, 0.67042085955546))
**staple_multi_mat**

**STAPLE on Multi-class matrix**

**Description**

STAPLE on Multi-class matrix

**Usage**

```
staple_multi_mat(
  x,
  sens_init = 0.99999,
  spec_init = 0.99999,
  max_iter = 10000,
  tol = .Machine$double.eps,
  prior = "mean",
  verbose = TRUE,
  trace = 25,
  ties.method = c("first", "random", "last"),
  drop_all_same = FALSE
)
```

**Arguments**

- **x**: a nxr matrix where there are n raters and r elements rated
- **sens_init**: Initialize matrix for sensitivity (p)
- **spec_init**: Initialize matrix for specificity (q)
- **max_iter**: Maximum number of iterations to run
- **tol**: Tolerance for convergence
- **prior**: Either "mean" or a matrix of prior probabilities,
- **verbose**: print diagnostic messages
- **trace**: Number for modulus to print out verbose iterations
- **ties.method**: Method passed to `max.col` for hard segmentation
- **drop_all_same**: drop all records where they are all the same. DO NOT use in practice, only for validation of past results

**Value**

List of matrix output sensitivities, specificities, and matrix of probabilities
Examples

```r
rm(list = ls())
x = matrix(rbinom(5000, size = 5, prob = 0.5), ncol = 1000)
sens_init = 0.99999
spec_init = 0.99999
max_iter = 10000
tol = .Machine$double.eps
prior = "mean"
verbose = TRUE
trace = 25
ties.method = "first"

res = staple_multi_mat(x)
```
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