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

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LazyData true

ByteCompile true

Type Package

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BugReports https://github.com/muschelli2/stapler/issues

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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)
```

```r
## Default S3 method:
staple(x, ..., set_orient = FALSE)
```

```r
## S3 method for class 'list'
staple(x, ..., set_orient = FALSE)
```

```r
## S3 method for class 'character'
staple(x, ..., set_orient = FALSE)
```

```r
## S3 method for class 'array'
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**

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

```r
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**

```r
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)
```

```r
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)
```
staple_bin_mat

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 nxr 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"))
```
staple_example_data

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_example_data  STAPLE Example Data

Description

STAPLE Example Data

Usage

staple_example_data()

Value

Character vector of filenames

Examples

staple_example_data()
staple_multi_mat  

**STAPLE on Multi-class matrix**

**Description**

STAPLE on Multi-class matrix

**Usage**

```r
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 n x r 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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