Package 'SparseVFC'

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Type Package

Title Sparse Vector Field Consensus for Vector Field Learning

Version 0.1.2

URL https://github.com/Sciurus365/SparseVFC

BugReports https://github.com/Sciurus365/SparseVFC/issues

Description The sparse vector field consensus (SparseVFC) algorithm (Ma et al., 2013 <doi:10.1016/j.patcog.2013.05.017>) for robust vector field learning. Largely translated from the Matlab functions in <https://github.com/jiayi-ma/VFC>.

License GPL (>= 3)

Encoding UTF-8

LazyData true

Imports pdist, purrr

Depends R (>= 4.1.0)

Suggests ggplot2, dplyr, tibble, rmarkdown, grid, knitr

RoxygenNote 7.2.3

VignetteBuilder knitr

NeedsCompilation no

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Repository CRAN

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Contents

church *The Church Photos*

Description

A dataset containing the vectors for the church photos.

Usage

```
church
```

Format

A list with three components:

X The position of points in the first photo.

Y The position of points in the second photo.

CorrectIndex The indices for the correct point pairs.

Source

https://github.com/jiayi-ma/VFC

References

Ma et al. (2013) doi:10.1016/j.patcog.2013.05.017; Zhao et al. (2011) doi:10.1109/CVPR.2011.5995336

norm_vecs *Normalize (a matrix of) vectors*

Description

Normalize the data so that the mean of the vectors is **0** and the variance of the vectors is 1. Here the variance of vectors is calculated by interpreting the deviation as the Euclidean distance, which means the trace of the (population) covariance matrix is 1.

Usage

```
norm_vecs(x)
```

Arguments

x	The matrix to be normalized. Each row of x represent a vector.

Value

The normalized matrix with two attributions `scale` and `mean`, which are used for normalization.

Examples

```
norm_vecs(matrix(seq(1, 100), ncol = 2))
```

`predict.VFC` *Predict method for VFC fits*

Description

Predicted values based on `VFC` objects.

Usage

```
## S3 method for class 'VFC'
predict(object, newdata, ...)
```

Arguments

`object`	A `VFC` object generated by `SparseVFC()`.
`newdata`	A vector specifying the position.
`...`	Not in use.

Value

A vector.

See Also

`SparseVFC()`

`SparseVFC` *Sparse Vector Field Consensus*

Description

The main function for the SparseVFC algorithm. See `References` for more information.

Usage

```
SparseVFC(
  X,
  Y,
  M = 16,
  MaxIter = 500,
  gamma = 0.9,
  beta = 0.1,
  lambda = 3,
  theta = 0.75,
  a = 10,
  ecr = 1e-05,
  minP = 1e-05,
  silent = TRUE
)
```

Arguments

X	The position of the vectors.
Y	The value of the vectors.
M	The number of the basis functions used for sparse approximation. Default value is 16.
MaxIter	Maximum iteration times. Default value is 500.
gamma	Percentage of inliers in the samples. This is an initial value for EM iteration, and it is not important. Default value is 0.9.
beta	Parameter of Gaussian Kernel, $k(x, y) = exp(-beta * \|\|x - y\|\|^2)$. Default value is 0.1.
lambda	Represents the trade-off between the goodness of data fit and smoothness of the field. Default value is 3.
theta	If the posterior probability of a sample being an inlier is larger than theta, then it will be regarded as an inlier. Default value is 0.75.
a	Parameter of the uniform distribution. We assume that the outliers obey a uniform distribution $1/a$. Default Value is 10.
ecr	The minimum limitation of the energy change rate in the iteration process. Default value is 1e-5.
minP	The posterior probability Matrix P may be singular for matrix inversion. We set the minimum value of P as minP. Default value is 1e-5.
silent	Should the messages be suppressed? Default value is TRUE.

Value

A VFC object, which is a list containing the following elements:

X A matrix of the positions of kernels.

Y A matrix of the input vectors.

beta The input value of `beta`.

V A matrix of the estimated vectors.

C A matrix of the coefficients of each kernel.

P A vector of the posterior probability of the input vectors (`Y`) being an inlier.

VFCIndex A vector of indices of the inliers.

sigma2 The σ^2 of the estimations weighted by `P`.

References

The algorithm is described in Ma et al. (2013) doi:10.1016/j.patcog.2013.05.017. This function is translated with permission from Jiayi Ma's Matlab function at https://github.com/jiayi-ma/VFC. Also see Zhao et al. (2011) doi:10.1109/CVPR.2011.5995336 for the earlier VFC algorithm.

Examples

```
data(church)
set.seed(1614)
VecFld <- SparseVFC(norm_vecs(church$X), norm_vecs(church$Y) - norm_vecs(church$X))
predict(VecFld, c(0, 0))
```

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