

# Package ‘SparseVFC’

February 15, 2023

**Type** Package

**Title** Sparse Vector Field Consensus for Vector Field Learning

**Version** 0.1.1

**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](https://doi.org/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 (>= 2.10)

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

**RoxygenNote** 7.2.2

**VignetteBuilder** knitr

**NeedsCompilation** no

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**Repository** CRAN

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church	<i>The Church Photos</i>
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**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](https://doi.org/10.1016/j.patcog.2013.05.017); Zhao et al. (2011) [doi:10.1109/CVPR.2011.5995336](https://doi.org/10.1109/CVPR.2011.5995336)

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norm_vecs	<i>Normalize (a matrix of) vectors</i>
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**Description**

Normalize the data so that the mean of the vectors is  $\mathbf{0}$  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))
```

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predict.VFC	<i>Predict method for VFC fits</i>
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**Description**

Predicted values based on VFC objects.

**Usage**

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

**Arguments**

object	A VFC object generated by <a href="#">SparseVFC()</a> .
newdata	A vector specifying the position.
...	Not in use.

**Value**

A vector.

**See Also**

[SparseVFC\(\)](#)

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SparseVFC	<i>Sparse Vector Field Consensus</i>
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**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  $\sigma^2$  of the estimations weighted by P.

## References

The algorithm is described in Ma et al. (2013) [doi:10.1016/j.patcog.2013.05.017](https://doi.org/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](https://doi.org/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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