NAME

fuzzy − fuzzy c-means spectral and spatial segmentation

SYNOPSIS

fuzzy −c *nclust* [**−m** *m*] [**−b** *b n_size*] [**−g** *gam ext_file]* [**−r** *randomseed* | −u *membership_filename* | −S *means_filename]* **[−saveS** *means_filename* [**−lump** *lumpit eps*] [**−P** *potts_merge n_size p_a p_b1 p_b2]* [**−M** *transient]* [**−E** *max_rel_error*] [**−e** *max_error*] [**−i** *maxiter*] [**−v**] [**−O1** *map_thresh]* [**−G**]

DESCRIPTION

fuzzy performs unsupervised classification by fuzzy c-means spectral and spatial clustering into maximally *nclust* clusters. An external field can be included in the clustering by specifying **−g**.

If **−b** is specified (and *b* != 0) spatial weights are used. *n_size* specifies the order of the neighbourhood to be used (1, 2 or 3 corresponding to 4, 8 or 12 neighbours). *n_size* is pr. default 1. With **−P** the spatial characteristics are included by means of a MRF. *potts_merge* is a flag which indicates whether or not to merge the spatial memberships with the spectral after each iteration. *n_size* is the order of the MRF and can be either 1 or 2. *p_a p_b1 p_b2* are parameters for the cliques in the MRF. Pr. default the spatial weight *b* is set to 1. But can be altered by means of **-b.**

If **−g** is specified (and *gam* !=0) an external field is read from file *ext_file* and used.

Pr. default cluster means are assigned equidistant in the feature space. With **-r** cluster means are assigned randomly. With **−S** the cluster centres are read column-wise from *means_filename*. If **-u** is specified the cluster centres are calculated using the memberships in the *membership_filename* as weights on the spectral observations in the image. Using **-u** or **-S** will override the number of cluster centers *nclust* .

With **-lump** then, if the cluster centres after *lumpit* iterations are closer than *eps* in feature space, they are lumped together into one cluster.

If **−M** is specified the distance measure in feature space switches from Euclidean to Mahalanobis distance after **transient** iterations.

Cluster centres can be stored by using **−saveS** *means_filename*

Iterations are stopped if either stop criteron is met (**−e**, **−E** or **−i**).

The means file must be HIPS float format. Input must be in float format. Output containing cluster membership degrees is float. With **-O1** the last frame in the output is the actual cluster number with MAP estimate > *map_thresh.*

With **-G** gnuplot is used to plot the evolution of the cluster centres as the algorithm iterates.

OPTIONS

−c *nclust*
maximum number of clusters; must be specified

−m *m* degree of spectral fuzziness which grows with *m* (*m* is power in distance measure, *m* = 3 corresponds to inverse distance); defaults to 2

−b *b n_size*
weight on spatial term; defaults to 0. *n_size* defaults to 1;

−g *gam ext_file*
weight on term from external field read from *ext_file*; defaults to 0 (no external field read)

−S *means_filename*
means in *means_filename* are specified column-wise

−saveS *means_filename*
means in *means_filename* are specified column-wise

−lump *lumpit eps*
eps is maximal distance between cluster centres, below this distance cluster centres are lumped together after *lumpit* iterations

−e *max_change*
is the maximal absolute change in the Frobenius norm of ... from iteration to iteration; defaults to 0.0

−E *max_rel_change*
is the maximal relative change in the Frobenius norm of ... from iteration to iteration; defaults to 0.001

−i *maxiter*
is the maximal number of iterations; defaults to 50

−v verbose

SEE ALSO

disc, regcovmat, carth

REFERENCES

Rafael Wiemker. "Unsupervised fuzzy classification of multispectral imagery using spatial-spectral features". In I. Balderjahn, R. Mathar and M. Schader (Eds.) *Data Highways and Information Flooding, a Challenge for Classification and Data analysis*, Springer 1997.

J.C. Bezdek. *Pattern Recognition with Fuzzy Objective Function Algorithms.* Plenum Press, 1981.

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