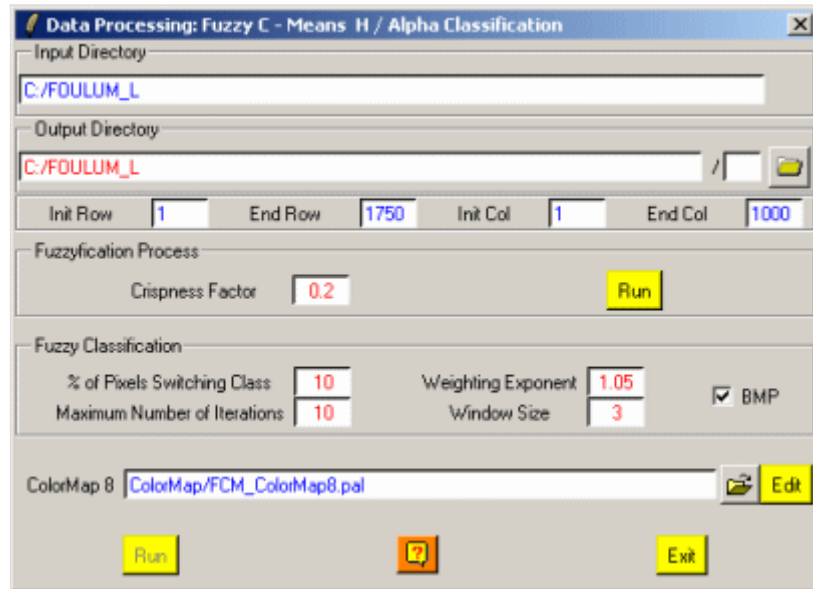


Fuzzyfication of H/Alpha and Classification



Description:

This program creates binary and bitmap image files resulting from the fuzzyfication of the H/Alpha plane following with a fuzzy-c-means segmentation of polarimetric data.

Comments:

Parameters written in Red can be modified directly by the user from the keyboard.

Input/Output Arguments:

Input Directory	Indicates the complete location of the considered Main Directory (MD) containing the Sinclair monostatic [S2] matrix data to be classified.
Output Directory	Indicates the location of the processed data output directory. The default value is set automatically to Main Directory (MD) .

Output Image Number of Rows/Columns:

The output image numbers of rows and columns are initialised to the input data set dimensions.

Users wishing to process a sub-part of the initial image can modify the **Init** and **End** values of the converted images rows and columns.

Note: init and end values have to remain within the range defined by the input image dimensions.

Fuzzyfication of the H / Alpha plane:

H-alpha plane is closely linked to physical scattering mechanisms and, thus, has been widely used for an unsupervised classification scheme for POLSAR imagery. However, since the H and alpha values are distributed continuously in the H-alpha plane, the formal zone boundaries represented by precisely defined lines have difficulties in dealing with class type mixture in a boundary position. This inherent vagueness of boundary properties can be expressed in terms of fuzzy sets. In order to fuzzify the two-dimensional H-alpha plane, the hypertrapezoidal fuzzy membership functions have been introduced [Park, 2007]. This program offers membership degrees for each zone in the two-dimensional H-alpha plane. In addition, this program offers optionally fuzzification of the anisotropy. Low or high anisotropy values represent a linguistic variable to be added to the fuzzy rule base.

Crispness factor

The crispness factor, defined in the range from 0 to 1, determines the degree of ambiguity between the partition sets. For the crispness factor of 1, no fuzziness exists in the H-alpha decision boundaries.

The default value is set to 0.2.

Output Files:

This procedure creates 8 files which are corresponding with the membership degrees for each zone in the H-alpha plane.

- Mu_Z1.bin
- ...
- Mu_Z8.bin

This procedure also creates 2 files:

- Mu_A_low.bin
- Mu_A_high.bin

for the fuzzy membership degrees for the low and high anisotropy.

Fuzzy-C-Means segmentation:

This program creates binary and bitmap image files resulting from the segmentation of polarimetric data using the Fuzzy c-means H-Alpha classification scheme. Two-dimensional fuzzy membership degrees constructed in the H-alpha plane can address the inherent vagueness of class boundaries in the H-alpha plane. They are then able to create a partition function that initializes an iterative fuzzy c-means (FCM) algorithm. The fuzzy c-means H-alpha classifier iteratively updates the membership degrees and cluster centers in the coherency matrix space. The FCM procedure terminates, when iteratively updated cluster centers move to an appropriate location within the data set.

Weighting exponent

The weighting exponent, m ($m > 1$), is the free parameters in FCM procedure. due to the fixed number of clusters. When it approximates one, the partition approaches the hard c-means algorithm. When it approaches infinity, the mass center of the data set will be the only FCM solution.

Window Size The default value is set to 1.05.
NxN sliding window used to compute the local estimate of the average matrix. Users wishing to avoid additional filtering may set N to 1.

The segmentation termination criterion consists of a logical combination of the two following conditions. The iterative fuzzy-c-mean clustering procedure is stopped if :

% of Pixels Switching Class A sufficiently low percentage of pixels switch class from one iteration to the other.

(The default value is set automatically to 10%)

Maximum Number of Iterations The number of iterations reaches a maximum value.
(The default value is set automatically to 10)

ColorMaps:

The colour coding of the bitmap output files is realized by the way of a 8 element colormap initialised with arbitrary values. Users have the possibility to modify the elements of the colormap in an interactive way.

Output Files:

This procedure creates one binary file containing the Fuzzy c-means H-Alpha classification result.

- FCM_H_alpha_class_**m**_X.bin

The variable **m** indicates the weighting exponent used in the FCM procedure
The variable **X** indicates the window size of the eventual additional filtering performed prior to data classification.
