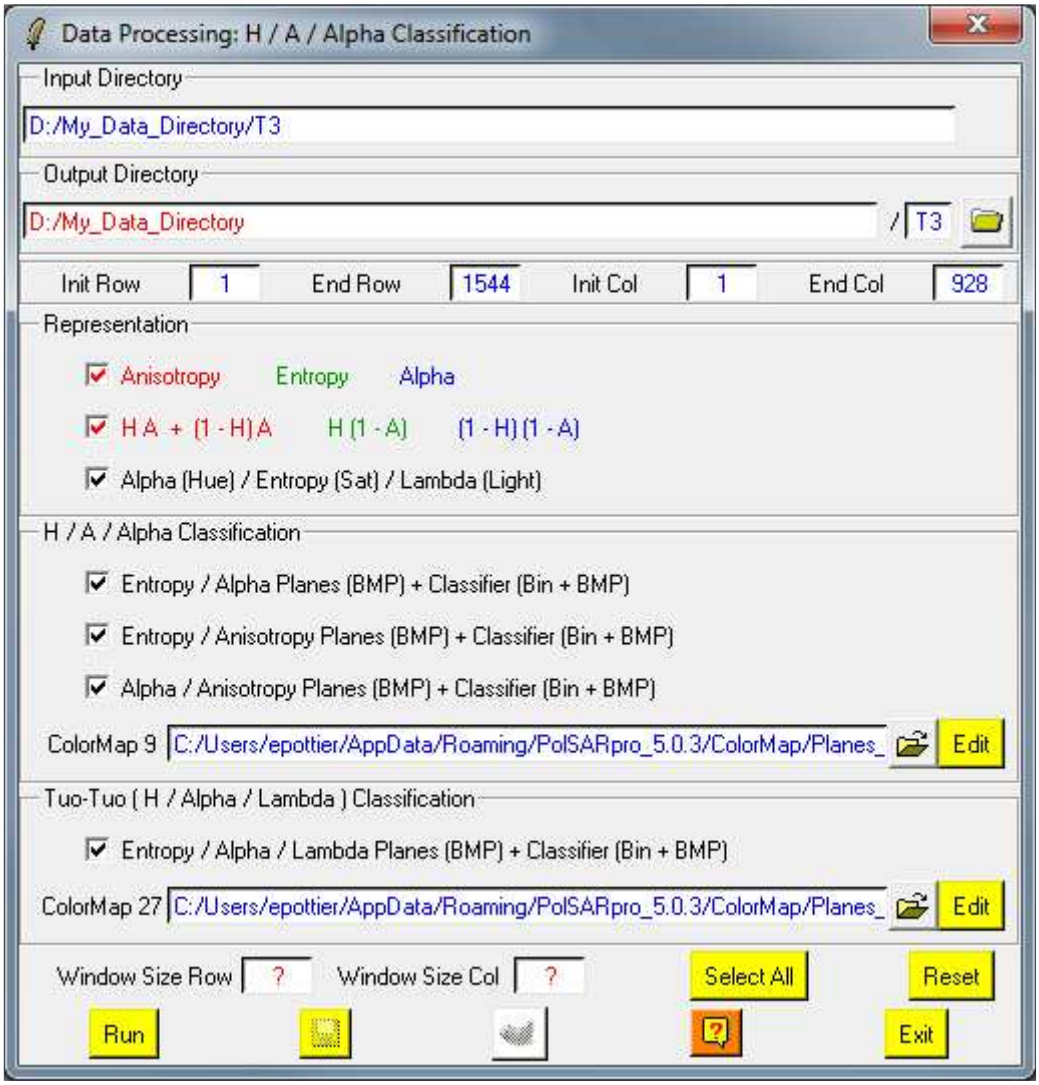
H/A/Alpha Classification



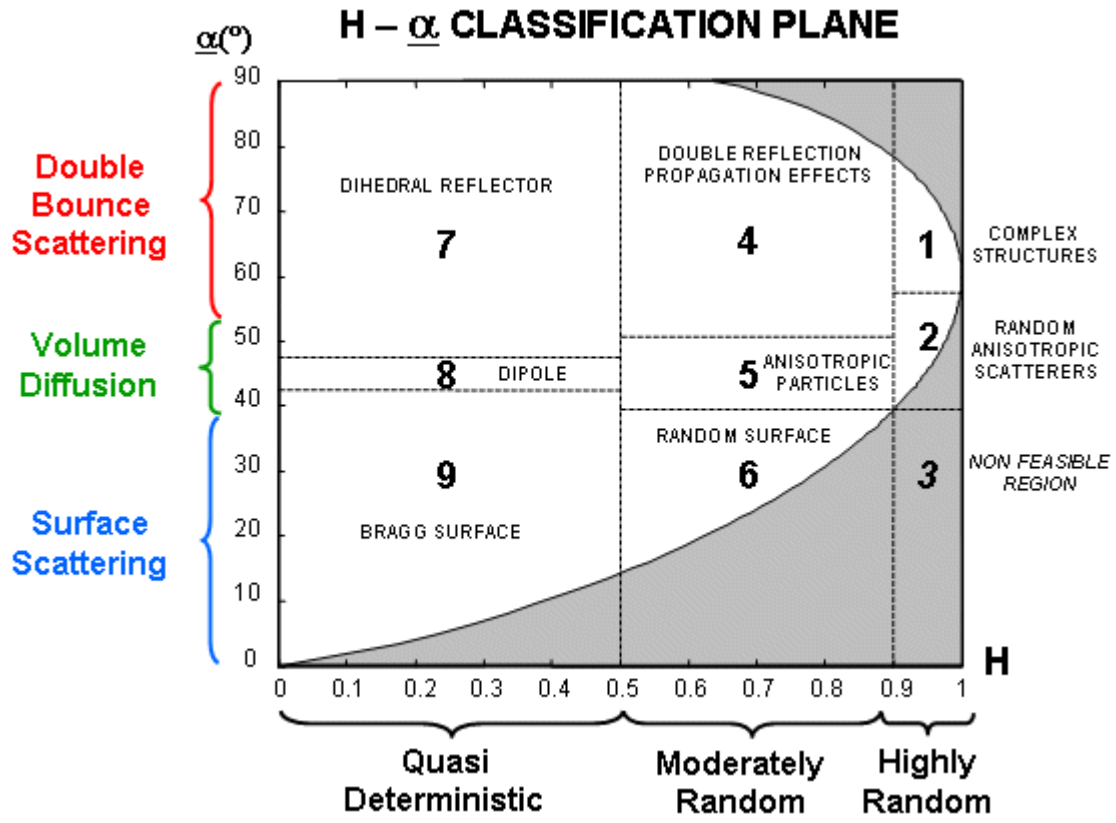
This program creates binary and bitmap image files resulting from the classification of polarimetric data in the H-Alpha, H-A and Alpha-A planes obtained from the H/A/Alpha decomposition of polarimetric raw binary data.
This program offers also the possibility to create color coded bitmap image files. The color coding is realised by assigning input files (results of the H/A/Alpha decomposition) either to the Red Green Blue channels or to the Hue Saturation Lightness channels of a 24 bit colormap.

Description:

Polarimetric descriptors of scattering mechanisms, such as H, A and Alpha are known to be tightly related to observed media physical properties. Such relevant parameters may be used to classify in an unsupervised way polarimetric data, using linear decision boundaries in the (H-Alpha), (H-A) or (Alpha-A) planes. The different decision

boundaries are set in an arbitrary way so as to isolate different canonical scattering properties usually encountered in polarimetric data sets.

H-Alpha Classification



The H/Alpha classification aims to discriminate different types of canonical scattering mechanisms, using Alpha, with different degrees of randomness from the entropy H. Pixels are assigned to one of the 8 classes delimited in the H-Alpha plane using linear boundaries.
Gray areas correspond to unreachable regions.

H-A Classification

The joint use of H and A allows to fully describing the pseudo-probability spectrum of a distributed coherency matrix. H may be used to discriminate random scattering from deterministic polarimetric patterns, while the anisotropy is useful to estimate the pseudo probability distribution in the case of intermediate entropy values.

A-Alpha Classification

The last combination of the H-A-Alpha parameters leads to the definition of a classification scheme relying on a segmentation of the Alpha-A plane. The coordinates of the linear decision boundaries remain similar to those stipulated for the H-Alpha and H-A classification procedures.

H-Alpha Lambda (Tuo-Tuo) Classification

This classification, proposed by Cao Fang and Hong Wen from IECAS (see IGARSS 05), is based on the classical H-Alpha unsupervised classification where the H-Alpha plane is split into three independent H-Alpha planes according to the Lambda value

(averaged Intensity). The Lambda boundaries (lambda1 and lambda2) are automatically determined from the Lambda values distribution using a median approach, according to the following procedure:
Lambda_median = median value of the range [lambda_min, lambda_max] corresponding to the maximum and minimum values of the averaged intensity.
Lambda1 = median value of the range [lambda_min, lambda_median]
Lambda2 = median value of the range [lambda_median, lambda_max]
Pixels are then assigned to one of the 3x9 = 27 classes delimited in the three H-Alpha plane using linear boundaries.

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 **[S2]** matrix data to be processed.
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.

Processing parameters:

Representation

The different H-/ A-/ Alpha / Lambda combination schemes require the polarimetric parameters binary to be created prior to the different representation and classification script execution. The creation of the corresponding 24 bit color coded bitmap image files may be selected by ticking the corresponding option.
The different output files are

- HAAlpha_RGB.bmp
- Hacombinations_RGB.bmp
- HalphaLambda_RGB.bmp

H-A-Alpha Classification

Each classification procedures creates three output files

- A classified data binary file containing the class index of each pixel of the input image.
- The corresponding bitmap image file.
- A bitmap image file indicating the pixels occurrence (density) in the selected classification plane.
- A bitmap image file indicating the location of classified data in the selected classification plane.

The different classification procedures may be simultaneously selected. The different output files are

- H_alpha_class.bin; H_alpha_class.bmp;
- H_alpha_occurence_plane.bmp; H_alpha_segmented_plane.bmp;
- H_A_class.bin; H_A_class.bmp;
- H_A_occurence_plane.bmp; H_A_segmented_plane.bmp;
- A_alpha_class.bin; A_alpha_class.bmp;
- A_alpha_occurence_plane.bmp; A_alpha_segmented_plane.bmp;

Color Map: The color coding of the bitmap output files is realized by the way of a 9 element colormap initialised with arbitrary values. Users have the possibility to modify the elements of the colormap in an interactive way.

H-Alpha-Lambda Classification

This classification procedure creates the following output files

- A classified data binary file containing the class index of each pixel of the input image (27 classes).
- The corresponding bitmap image file.
- 3 classified data binary files containing the class index of pixels of the input image for each of the 3 different classification planes (9 classes).
- The corresponding bitmap image files.
- 3 bitmap image files indicating the pixels occurrence (density) in the 3 selected classification planes.
- 3 bitmap image files indicating the location of classified data in the 3 selected classification planes.

The different output files are

- H_alpha_lambda_class.bin (27 classes),
- H_alpha_lambda_class.bmp (27 classes)

1st Classification plane: range [lambda_min, lambda1]

- H_alpha_lambda_class1.bin (9 classes),
- H_alpha_lambda_class1.bmp (9 classes),
- H_alpha_lambda_occurence_plane1.bmp, H_alpha_lambda_segmented_plane1.bmp

2nd Classification plane: range [lambda1, lambda2]

- H_alpha_lambda_class2.bin (9 classes),
- H_alpha_lambda_class2.bmp (9 classes),
- H_alpha_lambda_occurence_plane2.bmp, H_alpha_lambda_segmented_plane2.bmp

3rd Classification plane: range [lambda2, lambda_max]

- H_alpha_lambda_class3.bin (9 classes),
- H_alpha_lambda_class3.bmp (9 classes),
- H_alpha_lambda_occurence_plane3.bmp, H_alpha_lambda_segmented_plane3.bmp

Color Map: The color coding of the bitmap output files is realized by the way of a 27 element colormap initialised with arbitrary values. Users have the possibility to modify the elements of the

colormap in an interactive way (Black colour corresponds to unreachable regions).

Window Size:

Data to be decomposed may be processed through an additional filtering procedure consisting of a boxcar filter. Users have then to set the size of the (N*N) sliding window used to compute the local estimate of the average matrix. The default value of N is set to **0**. Users wishing to avoid additional filtering may set N to **1**.
