UV image processing to detect diffuse clouds

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September 8, 2014

Abstract

The presence of diffuse clouds along the Galaxy is under consideration as far as they are related to stellar formation and their physical properties are not well understood.
The signal received from most of these structures in the UV images is minimal compared to the point sources. The presence of noise in these images makes hard the analysis because the Signal-to-Noise ratio is proportionally much higher in these areas.
However, the digital processing of the images shows that it is possible to enhance and target these clouds. Typically, this kind of treatment is done on purpose for specific research areas and the Astrophysicist's work depends on the computer tools and its possibilities for enhancing a particular area based on a prior knowledge.
Automating this step is the goal of our work to make easier the study of these structures in UV images. In particular we have used the GALEX survey images in the aim of learning to automatically detect such clouds and be able of unsupervised detection and graphic enhancement to log them.
Our experiments show the existence of some evidences in the UV images that allow the systematic computing and open the chance to generalize the algorithm to find these structures in universe areas where they have not been recorded yet.

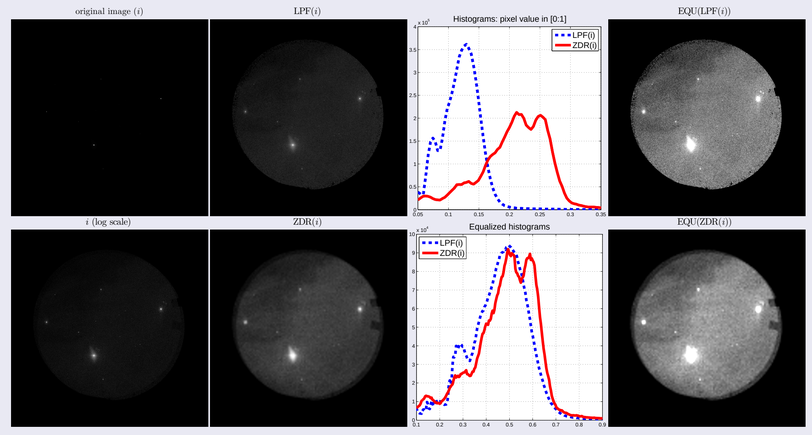
Preprocessing procedures (1/2)

Two image processing basic techniques have been tested:

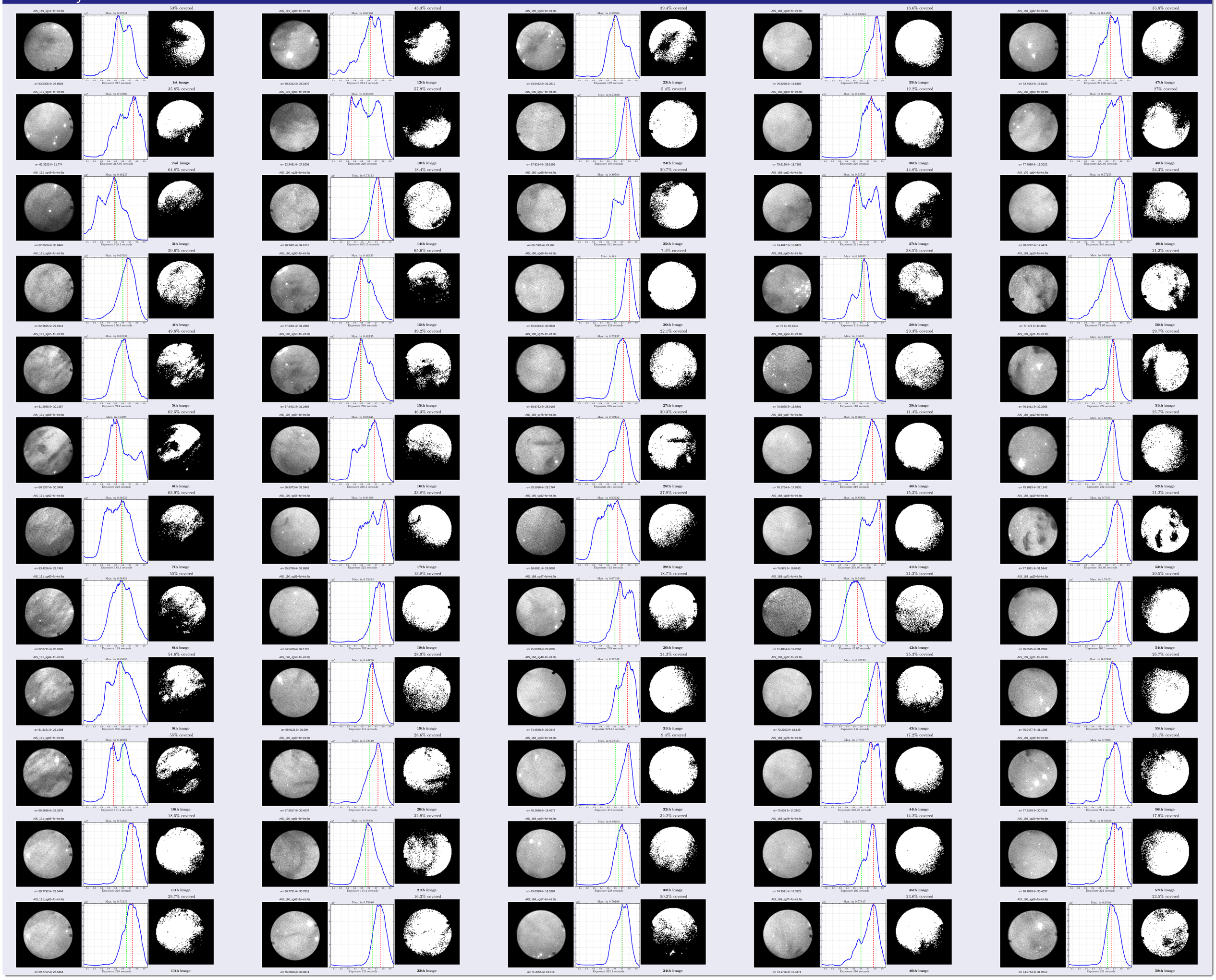
(1) **Low Pass Filtering** (LPF): The original image is filtered in the Fourier domain. This kind of smoothing allow the enhancing of cloud structures.

(2) **Zero Density Rate** (ZDR): The original image $(\mathbf{3840 \times 3840})$ is subdivided in $\mathbf{30 \times 30}$ boxes where the number of *zeros* is divided by the area. Each pixel of the resulting $\mathbf{128 \times 128}$ map shows the density of zeroes in the corresponding box of the original image.

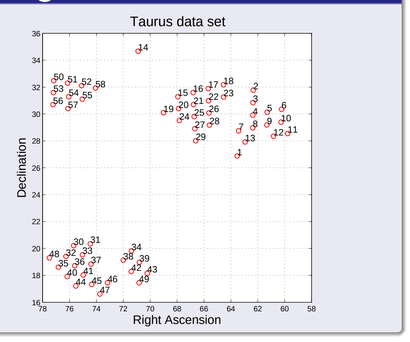
Preprocessing procedures (2/2)



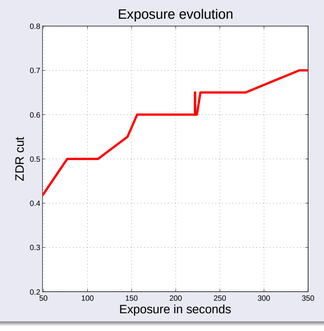
Preliminary results



Training data set



ZDR vs Exposure



Some conclussions and future

- To automate the detection of structures from the ISM is posible with image processing.
- The ZDR measure shows to be a fast method for discovering these clouds in the UV images.
- Once the ZDR(i) image is equalized, the value for discrimination is the most important step.
- The relationship between this value and the exposure time of the image and (may be) other considerations must be set up correctly depending on the purpose of study.
- The complete generalization of this algorithm is the aim of this work.
- The method opens the chance for completing a global data base from the Galex images to make the study of the ISM more easy.