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MORPHOLOGICAL FILTERING OF ASTRONOMICAL IMAGES IN MATLAB

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This paper presents a method to perform the galaxies recognition from stars in astronomical images. This is because many images show a distribution of stellar bodies as a background where deep sky galaxies are also visible.

The process used was through morphological filtering algorithms, which employ non-linear operations on small neighborhoods of pixels in an image, this with the purpose of selectively highlighting or removing structures or objects in it (Han 1995). The filters are based on two basic operations called dilation and erosion, which are based on the union and intersection of groups of figures respectively. The code designed in MATLAB works using these basic morphological operations. The tests were performed for 6 images in gray scale of 256 tones of different sizes ($405\times1620, 525\times1800, 433\times1824, 426\times1920, :::$ pixels) using a disk-type structural element of 4×4, 8×8 pixels. In these, the dilatation operation obtains a growth of image forms; however, the erosion operation shrinks the forms. Both operations are accomplished using the Structural Element, previously mentioned, whose shape determines the neighborhood of pixels that is modified on Morphological Filter (Serra 1984). The results show high reliability and good processing speed.

The erosion and dilation are used in pairs, erosion followed by dilation. The operators were applied iteratively where we obtain the elimination of specific details without a global geometric distortion of the features is not deleted. For example, making an opening (erosion-dilation) by a structuring element with a disk, smooths, isthmus narrow breaks, eliminates small islands and sharpens peaks. In astronomical imaging it is performed by threshold segmentation after converting to gray scale (Karttunen et al. 2007).

Dilation and erosion are performed iteratively, so as to eliminate as many unwanted bodies (Pierre 1999). This is done by regulating the structuring factor which is what controls the number of pixels with the morphology filter works. At the end, only the objects of interest are left. The program lists, features and locate in the image so that these can be located in the original image helping the user to quickly identify the presence of galaxies in astronomical images densely populated by stars.

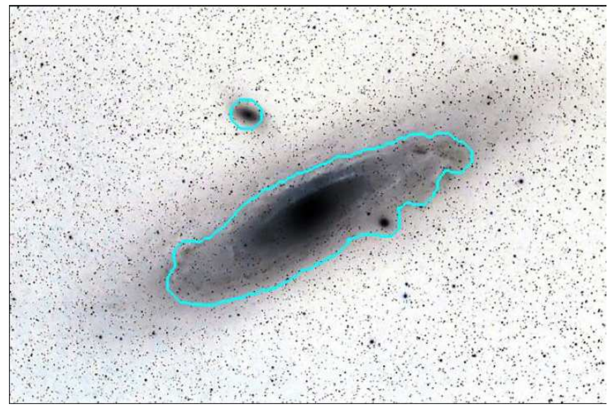

Fig. 1. M81 image showing the edges of galaxies.

The mathematical morphology method used for this project is based on the fact that in many applications it is natural and easier to think in terms of shapes in algorithm design. Mathematical morphology facilitates thinking in terms of shapes and icons. The fundamental unit of pictorial information on the morphological method is the binary image; although, these methods are also extended to gray scale images and color (Sonka 1998).

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