



## **Pattern Recognition algorithms for an automated search for Martian dust devils**

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Dust devils are temporal and spatial variable surface features. They are recognised as bright spots accompanied by a dark shadow in Martian images. Image data from the various Mars missions are getting more and more voluminous. A Pattern Recognition algorithm is going to be developed which will help to scan and search the images for dust devils. Several questions can then be answered: How often do these phenomena occur? In which areas can you detect them? How fast are they? What is their height? How long do they last?

The principle of Pattern Recognition is as follows: after image processing, dust devil parameters are extracted by the software and put into a n-dimensional vector. The classifier analyses the vector and puts the detected objects in classes. The classes represent a probability from 0 to 100 percent that a detected object is a dust devil.

Relative brightness maxima were selected from the images because of the bright spot from the sunlight reflecting dust column of the dust devils. The selected pixels have been marked black, all others are rendered white. Detected black pixels represent quite well the bright spots of dust devils. Random noise may be spread over the resulting image or other parts of surface features like crater rims.

The Hoshen-Kopelman algorithm is used to identify each cluster of black pixels with a number. The coordinates of the pixels which belong to a cluster are known in order to determine the size and the shape of each cluster. The size is determined by the number of pixels in each cluster. A best-fit ellipse is adjusted to describe the shape of the cluster by using the minimum and maximum moments of inertia.

The same method is applied to detect the shadow of the dust devils by searching for

minima of brightness. The shadows are identified quite well. In some cases also the shape was clearly represented in the tested examples. The retrieved shadow parameters have to be checked carefully. The shadows represent the vertical structure of a dust devil and no clear line can be expected.

Quick-look plots are generated to check visually if the identified object is really a dust devil and if the calculated clusters fit the bright spot and the dark shadow.