Historical Overview of Image Analysis and Mathematical Morphology¹

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Abstract—The paper consists in a survey of image analysis over the last fifty years, seen from the point of view of Mathematica Morphology.

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Firstly, the principles of this method are recalled. The morphological approach was initiated fifty years ago by the study of geological structures, considered as sets. Its deterministic aspect lies on the algebraic theory of the complete lattices. Unlike the linear operations, such as convolution, where one must not lose image information, the morphological ones usually eliminate part of this information. In particular, they never satisfy group structures, but semi-groups only.

In twentieth century, the evolution of image analysis followed the rhythm of the decades. It appeared at the beginning of the sixties, in association with the first images for land observation (USA) and with optical microscopy (Europe). The latter experienced a boom in the seventies with the introduction of video sensors, mainly in the two domains of biology (cytology and histology) and material sciences where, for the first time the structures under study were quantified in an automatic way. The next change came at the beginning

of the eighties, as a consequence of the oil crisis. Automatic control of the industrial processes became an economical issue. In parallel but independently, new sensor technologies such as tomography or ultrasound were introduced in medicine, that generated digital images to be processed. Another change commenced at the end of the eighties with the need for image and video compression, and with the boom of Internet a few years later. Finally, in our current decade, which ends this year, emphasis is put on maps. The resolution of the satellites for earth observation has been drastically reduced by a factor of 10 (from 5 m to 50 cm), which induces new problems and new products.

All these themes, although they appeared successively, are still evolving with varying degrees of rapidity depending on the domain, and on the development of methods such as mathematical morphology or wavelets.

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