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Image analysis and mathematical morphology. English version rev. by Noel Cressie. (English)

Zbl 0565.92001

London - Orlando etc.: Academic Press, Inc. (Harcourt Brace Jovanovich, Publishers). XVIII, 610 p. $ 90.00 (1982).

From the preface: The notion of a geometrical structure, or texture, is not purely objective. It does not exist in the phenomenon itself, nor in the observer, but somewhere in between the two. Mathematical morphology quantifies this intuition by introducing the concept of structuring elements. Chosen by the morphologist, they interact with the object under study, modifying its shape and reducing it to a sort of caricature which is more expressive than the actual initial phenomenon. The power of the approach, but also its difficulty, lies in this structural sorting. Indeed, the need for a general theory for the rules of deformations appeared soon. The method progressed as a result of an interchange between intellectual intuitions and practical demands coming from the applications. This finally leads to the content of this book.

Mathematical morphology deals with sets in Euclidean or digital spaces, and considers the functions defined in an n-dimensional space as particular sets of dimension $n + 1$. Basically, the objects under study are considered as being embedded in the usual Euclidean space; afterwards they are digitalized (in contrast to this, picture processing is essentially digital). Suitable topologies then allow the robustness of the morphological operations to be studied.

The main objective of morphology is to reveal the structure of the objects by transforming the sets which model them (such a purpose generalizes that of integral geometry and of stereology, which consists of transforming bounded sets into significant numbers). However, all set transformations are not at the same level. Algorithms are governed by more general criteria, which in turn satisfy a few universal constraints.

Anyone wishing to master mathematical morphology must assimilate this vertical hierarchy. As a consequence, we did not design the book according to various problems such as image enhancement, filtering, or segmentation, but on a classification based on criteria and related questions. Every morphological criterion may help to segment an image, depending upon the type of image and the initial knowledge of it that we possess. It is precisely this information which orients us towards one or another type of criteria.

A strong counterpoint interlaces criteria to models. It generally brings set models into play, but the introduction of probabilistic notions opens the door to the more specific class of random set models. This gives rise to the four main parts of the book: theoretical tools, partial knowledge, criteria, random models.

This book is directed to the triple audience of the users of the method (biologists, metallographers, geologists,...), the specialists of picture processing and the theoreticians (probabilists, statisticians). I have set the level of the book at the interface of applications and theory, and have emphasized the links between modes of operation and general underlying concepts.

Reviewer: J.Křivý

MSC:

92-02	Research exposition (monographs, survey articles) pertaining to biology
92B05	General biology and biomathematics
60D05	Geometric probability and stochastic geometry
60-02	Research exposition (monographs, survey articles) pertaining to probability theory

Cited in **5** Reviews
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