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Digital Image Processing Systems

Edited by Leonard Bolc and Zenon Kulpa



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P R E F A C E

Pictorial information, in all its varieties, constitutes the most important source of our sensory data as well as (apart from the phonetic language) the most general means of communication between people. Inevitably, use of this sort of information becomes steadily the most important means of man-computer communication.

It has started to develop almost at the beginning of computer era: in a sense, the tens of blinking lamps on the early computer panels were a means of visual communication. Apart from this primitive "visual communication", the use of true pictures to exchange information between computers and people can be divided into two main types:

- a) real-image processing and analysis
- b) computer graphics.

In image processing, the real images from the outside world (real scenes photographs, microscopic images, satellite images, fingerprints, and many others) are inputted to the computer (e.g. by TV means) and processed by it. The results of processing can be of different types: other pictures (e.g. enhanced, noise-filtered, etc.), quantitative descriptions of the picture contents (e.g. number of objects, areas of cells, positions of some features, etc.), recognition decisions (e.g. name of an alphanumeric character, fingerprint classification code, abnormal cell identification, etc.), interpretations (e.g. meaning of a scene, description of a particle-collision event in nuclear physics, etc.). The new use of image processing to store and retrieve pictures in large pictorial data bases is also emerging presently.

In computer graphics, generally not the real images, but descriptions of some, more or less "abstract" drawings are inputted by a human operator to the computer. The input has the character of expressions in some descriptive (artificial) language and/or manual "drawing" (pointing out required positions) with a light-pen on the display screen. The computer stores these picture descriptions in some internal (usually non-pictorial) form and displays them in pictorial form on the graphic display screen (or draws on the plotter) for the convenience of the human operator. It can also introduce some "corrections" to these pictures (e.g. straightening of crooked lines drawn by the light-pen), manipulate them (e.g. zooming, rotation in space) and

calculate required parameters (e.g. transmittance of the electronic circuit from the scheme drawn, strain distribution along the beam, etc.). The computer animation of cartoons also uses these techniques. Generally, in image processing the input images are processed by computer (producing eventually some descriptions or "understanding" of their meaning), whereas in computer graphics the images are generated by a computer on the basis of their input descriptions. Both areas share, nevertheless, certain common features, which arise from manipulation of common type of data (pictures) and manifest themselves in the field of picture description and manipulation (for the display).

This book is dedicated to digital systems of image processing. Several European computer systems are described here in detail: GOP and CELLO from Sweden, BIHES ("Budapest Intelligent Hand-Eye-System") from Hungary, CPO-2/K-202 from Poland and S.A.M. (called previously MODSYS) from Federal Republic of Germany.

For various reasons, some other interesting European systems have not been included here. To compensate this, a fairly representative survey of European systems has been included. It reviews and compares systematically eleven systems, including all these listed above. The survey is a somewhat extended and reworked version of an invited paper presented at the EUSIPCO-80 Conference held in Lausanne in September 1980.

In order to show the readers possible practical usefulness of such systems and to introduce them into the methods and techniques of image processing, the book has been augmented finally by the paper by Milgram and Rosenfeld, the leading specialists in the field. This paper presents on a specific example of infrared images analysis a wide range of methods and techniques of image processing, analysis and recognition.

The editors sincerely acknowledge the collaboration of all the contributors to the book and wish to express their gratitude to the European Association for Signal Processing EURASIP for their kind permission to use the survey paper from EUSIPCO-80-Conference for this book.

The authors would like to express their thanks to Springer-Verlag for publishing this volume.

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Leonard B o l c
Zenon K u l p a

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