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Special issue on Signals and Images – Preface

In the early days of its existence, the research community of image processing and computer vision was populated almost entirely by electrical and computer engineers. Throughout the years however, it has increasingly been recognised that many of the problems encountered in this field require a deeper understanding of their intrinsic structure and cannot be solved solely by the design of ever more powerful hardware nor by the development of more efficient algorithms. The advent of the world wide web and the problems that it poses (for instance with respect to compression and content-based image retrieval) has even further increased this necessity.

Today, image processing is a multi-disciplinary research area with contributions from many different directions, such as electrical engineering, computer science, physics, medicine, psychology, and last but not least, mathematics.

In this special issue we wish to emphasise the important role played by mathematics. Towards that goal, we have selected some topics of interest with a strong mathematical flavour, namely: wavelet theory, stochastic modelling, random set theory, image scale-spaces and PDEs, and mathematical morphology. All of these topics are closely related to the research carried out in the 'Signals and Images' research pilot at CWI, to which both editors of this special issue belong. We are delighted that all experts we invited to write a paper on one of these topics kindly accepted and would like to seize this opportunity to express our thanks to them.

To conclude, we give a short description of the six contributions.

In the first paper, Antoine presents a review of the 2-dimensional continuous wavelet transform and discusses some of its applications.

Goutsias discusses multi-resolution image modelling by means of morphological constraints.

The third contribution by Molchanov introduces various ways of defining the concept of an average image and discusses their relative merits.

Pauwels gives a comprehensive overview of the concept of an image scale-space, the PDE's describing them, and some of their applications in computer vision.

Perez presents Markov random field models and discusses their application in image segmentation problems.

In the final paper, Ronse shows how (algebraic) concepts from mathematical morphology can be used to describe feature extraction and removal.

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