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Introduction

The special issue of *Mathematical Imaging and Vision* on nonlinear image processing springs from two factors: (1) the great expansion of nonlinear methods applied to problems in imaging and vision, and (2) the degree to which nonlinear approaches are both using and fostering new developments in diverse areas of mathematics.

Strictly speaking, digital image processing only involves nonlinear methods since the computer processing does not take place in a linear space; nevertheless, practical image modeling has often assumed a linear-space structure. This modeling has facilitated application of fundamental linear theory such as spectral representation and projection theory. Given the success of linear methods in classical signal processing, the adaptation of such methods to image processing, especially at the outset, is a natural way to proceed.

Yet linear-space theory represents only a corner of mathematics. Semantically, at least, *nonlinear image processing* encompasses all the rest of image processing and it is defined by theory and methods that utilize all areas of mathematics besides linear mathematics. And to a great extent this is true, since its domain includes probability, statistics, logic, topology, set theory, algebra, measure theory, geometry, and analysis. Indeed, one of the most active areas of nonlinear image processing is mathematical morphology, and it alone crosses all of the aforementioned areas.

As practiced, however, the thrust of nonlinear image processing, as it is usually understood, is more directed. One thinks more of morphological, neural, and nonlinear statistical methods. These three areas are not exhaustive: consider fuzzy logic. Nor are they mutually exclusive: consider the roles of neural and statistical methods in the design of morphological filters. Nevertheless there tends to be a current emphasis of interest.

There also tends to be an application focus. Nonlinear methods are widely employed to solve all the basic problems of image processing, including segmentation, restoration, recognition, compression, and analysis. Nonetheless, when the term "nonlinear" is employed, one often sees an emphasis on filtering. Perhaps the term is emphasized when nonlinear methods are used for filtering to point out the distinction with linear filtering, perhaps because so much research has focused on nonlinear filtering methods. In any event, the emphasis on filtering is reflected in the papers composing this special issue.

We hope the papers in this issue prove beneficial to people working in the area and also to those looking for new avenues of approach to solving their problems. We offer our appreciation to all who submitted papers and also to the referees, who returned their reviews within a very short time frame.

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