

Tutorial on Mathematical Image Processing

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ABSTRACT

We are living in a digital world. The collection, distribution, integration, manipulation and interpretation of data have become an important part of our society. Digital images are of no doubt one of the most important type of data. This is not only because image is a powerful and widely used medium of communication, but also because it is an easy, compact, and widespread data type to represent the physical world. Advances in computer technology have made it possible to apply some of the most sophisticated mathematics to the design and implementation of fast algorithms. As a result, image processing and analysis techniques are now widely applied to natural sciences, technical disciplines and social medias; and digital images have come into everyone's life.

This tutorial is most suitable for graduate students majoring in applied mathematics, engineering, computer science, operation research, etc. The topics that will be covered include, variational models (e.g. total variation, Mumford-Shah), PDE models (anisotropic diffusion, Perona-Malik equation, shock-filters), wavelet and wavelet frame based models in various problems in imaging science, such as image denoising, deblurring, inpainting, segmentation, medical imaging and image analysis, etc.