

A novel PDE based image restoration: convection-diffusion equation for image denoising

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Abstract

In this paper we present a convection-diffusion equation for processing the image denoising, edge preservation and compression. We compare it with a popular nonlinear anisotropic diffusion model which has been widely implemented in image denoising for Gaussian white noise. Here we show that the convection-diffusion model removes noisy effectively, especially for the mixture of salt-and-pepper noise and Gaussian noise. We propose the modified streamline diffusion method for the discretization of the convection-diffusion model to prevent internal layers because of the discontinuities on the coarse grids of image for while using the coarsening algorithm for image compression. The computation cost through the coarsening processing can be reduced dramatically. Numerical experiments have shown the efficiency of our convection-diffusion filtering model for removing the mixture of Gaussian and salt-and-pepper noises, efficiently and reliably in preserving edges quite satisfactorily.

Keyword : Image smoothing, edge detection, compression, streamline diffusion method, adaptive finite element, convection-diffusion.