AN ADAPTIVE FINITE VOLUME METHOD IN PROCESSING OF COLOR IMAGES

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We propose the coarsening strategy for finite volume computational method given by Mikula and Ramarosi ([4]) for the numerical solution of the modified (in the sense of Catté, Lions, Morel and Coll) Perona–Malik nonlinear image selective smoothing equation (called *anisotropic diffusion* in the image processing).

An image can be modelled as a real function $u_0(x)$ representing values of greylevel intensity, defined in some rectangular subdomain $\Omega \subset \mathbb{R}^d$ (in practice $d = 2$ or 3). Basic tasks of image processing and computer vision like selective image smoothing, enhancement, restoration, segmentation, edge detection, shape analysis, optic flow computations etc. are recently modelled by application of evolutionary PDE to $u_0(x)$. Such approach is known as *image multiscale analysis* ([1],[2],[3]) since the initial image $u_0(x) = u(0,x)$ is associated with a sequence of images $u(t,x)$, depending on an abstract parameter $t > 0$ called scale. The well known examples are nonlinear diffusion equations of Perona-Malik type ([5], and and generalized mean curvature flow equations.

In the finite volume method, the discrete approximations are piecewise constant in control volumes corresponding to pixel structure of the discrete image, thus such approach is most natural for image processing. As the solution tends to be more flat in some regions of the image with the increasing scale, we can improve the efficiency of the method using adaptivity, i.e. choosing irregular grid with less finite volumes. Process of merging of finite volume pixels is called coarsening in numerical methods for solving PDEs.

In this paper we present a method for creating an irregular adaptive grid, adaptive finite volume method in processing of colour images, give some computational comparisons and results of numerical experiments applied to real and artificial images.

References

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