Application of the mean curvature flow in the image segmentation

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In our lecture we will give an overview to the method based on the principle of the mean curvature and the application in the process of image segmentation and missing boundaries completing.

From the mathematical perspective the problem is to find an approximate solution to the equation

$$u_t - f(|\nabla u|)\nabla \cdot \left(g(|\nabla G_S * I^0|)\frac{\nabla u}{f(|\nabla u|)} \right) = r, \quad \text{a.e.} \quad (x,t) \in \Omega \times (0,T),$$

where $u(x,t)$ is an unknown (segmentation) function and I^0 is a given image.

We consider zero Dirichlet boundary condition and the initial condition. The assumptions on the data are as in [1].

We generalize the approach presented in [2] - the semi-implicit finite volume scheme for studied equation is introduced. We mention the obtained theoretical results - stability estimates with the uniqueness of the numerical solution and the convergence of the numerical scheme to the discrete solution as it was proven in [3], but here we more focus on the numerical results.

We present segmentation of the object with incomplete border and noisy object as the examples of the robustness of our scheme to the missing borders and noise as errors in the initial data. Then we show segmentation of the real medicine data and the time dependent segmentation.

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References

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