Okock, Omondi Polycarp; Urbán, Jozef; Mikula, Karol
Improvement and handling of the segmentation model with an inflation term. (English)
Zbl 07460171

Summary: The use of balloon models to address the problems of “snakes” based models was introduced by Laurent D. Cohen. This paper presents a geodesic active contours model with a modified external force term that includes a balloon model. This balloon model makes the segmentation surface to behave like a balloon inflated by the external forces. In this paper, we show an automatic way to control the behaviour of the external force with respect to the segmentation evolution. The external forces, comprised of edge and inflation terms, push the segmentation surface to edges, while curvature regularizes the evolution. As segmentation evolves, the influence of the applied inflation force is determined by how close we are to the edges. With this setup, the initial segmentation does not need to be close to the object’s edges, instead it is inflated by the balloon model towards the edges. Closer to the edges, the influence of the inflation force is adjusted accordingly. The force’s influence is completely turned off when the evolution is stable (reached the edges), then only the curvature and edge information is used to evolve the segmentation. This approach solves the issues associated with inclusion of balloon model. These issues are that the inflation force can overpower forces from weak edges, or they can cause the contour to be slightly larger than the actual minima. We present examples of the improved model for segmentation of human bladder images. Weak edges are more prevalent in medical images, and the automated handling of the inflation forces gives promising results for this kind of images.

MSC:
65Mxx Numerical methods for partial differential equations, initial value and time-dependent initial-boundary value problems
65K10 Numerical optimization and variational techniques
35Q68 PDEs in connection with computer science
65Y05 Parallel numerical computation
65Y20 Complexity and performance of numerical algorithms

Keywords:
geodesic active contours; balloon model; estimation; curve fitting; curve smoothing

Full Text: DOI

References:


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