"The Exact Solution of the Active Convex Hull Model and Its Application to Image Segmentation"

Friday, March 6, 2:30 pm
Pickard Hall, Room 304

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Abstract:

In the past decades mathematics brought great contributions to the fields of Image Processing and Computer Vision through the development of level set calculus and deformable models based on partial differential equations, minimization of functional, and variational methods. Some of the fundamental works in the field are reported by Osher, Sethian, Sapiro, Chan, Prince and Xu. A number of basic deformable models used for image segmentation are based on partial differential equations in particular the geometric heat differential equation. An approximate solution of this equation and its application to image segmentation was presented, by this speaker at the same seminar in February 2007. The present speech is a continuation of the previous one providing an exact solution of a specific form of the geometric heat equation, called active convex hull model. The author will discuss the level set presentation of the equation, a family of curves, defined by its complex solution, the curves' shape and periodicity. A Java implementation of the theoretical achievements will be employed to underline the effectiveness of the algorithms, in terms of calculation complexity and speed. The experiments will demonstrate automatic image segmentation.

This talk is a continuation of the one given on the same seminar in the beginning of 2007, when the speaker presented an approximate solution to the active convex hull model (ACHM). The model is a modification of the geometric heat differential equation. The latter has significant applications to Computer Vision in the form of the so called deformable models introduced by J. A. Sethian,(1985,1989) and Sapiro (G. Sapiro, 2001. Geometric Partial Differential Equation and Image Processing, Cambridge University Press, 2001).

The present talk will focus on the exact solution of the ACHM and its level sets presentation. Properties of the complex function solution will be discussed in a relation to effective image segmentation. An implementation of the theoretical results in Java will be shown. Experimental results with real life images from medicine will demonstrate the advantages and the drawbacks of the algorithm.

The Math Department will provide refreshments 30 min. prior to the presentation.