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1002-35-13 **Hemant D Tagare*** (hemant.tagare@yale.edu), BML-320, Dept. of Diag. Radiology, 333 Cedar St., Yale University, New Haven, CT 06520, and **Zhong Tao** (zhong.tao@yale.edu), BMl-322, Dept. of Diag. Radiol., 333 Cedar St., Yale University, New Haven, CT 06520.

Maximum Likelihood Ultrasound Image Segmentation with Level Sets.

Ultrasound image segmentation is difficult in the presence of speckle, which is a spatial stochastic process caused by the scattering of the ultrasound wave in the acoustic medium. The problem is that speckle creates spurious local minima in the objective function of segmentation algorithms. Algorithms that evolve by gradient descent get trapped in the minima giving incorrect segmentations. This is especially true of algorithms that use a likelihood function based on the probability distribution of gray levels in ultrasound images.

To overcome the problem of trapping in local minima, we proposed to replace gradient descent by a new minimization technique. It has two parts: a deterministic evolution strategy called tunneling descent and a stopping rule to terminate the evolution. The combination gives an algorithm that escapes from spurious local minima, and gives good segmentations.

In this paper, we present a level set version of ultrasound segmentation with tunneling descent. The algorithm is used to segment the endocardium in short axis ultrasound cardiac images. The level set can get out of many spurious local minima that would have trapped the active contour/level set evolving under gradient descent. (Received May 24, 2004)