Abstract

This research explores a potentially useful segmentation algorithm, known as the level set method. It is suitable for images obtained from the Magnetic Resonance Imaging (MRI) modality, despite the fact that MR images have low contrast between bone and tissue. The level set method is a numerical technique designed to track the evolution of an interface. The fast marching version of the method is implemented for two-dimensional (2-D) and three-dimensional (3-D) segmentation in this research. Femur segmentation is the main thrust of this thesis, however brain and heart images are also presented.

Pre-processing steps are first performed for the 2-D images. The 2-D segmentation method begins when the user selects the seed point by clicking on the region of interest, on the image. An interface starts propagating outwards, towards the boundary of the region being segmented. An energy-based function controls the evolving interface by using image gradient information and a control parameter defined by the user. The user is able to visually control accuracy.

The 3-D volume is built by concatenating and interpolating the 2-D slices. The 3-D method is an extension of the 2-D method, with differences in implementation. 3-D segmentation begins when a slice chosen by the user is displayed, and the seed point is selected. The current slice being segmented within the volume is displayed to allow the user to view the segmentation process. The segmented 3-D volume is then isosurface rendered and displayed as a 3-D model