

Interactive, GPU-Based Level
Sets for 3D Brain Tumor
Segmentation

<i>Aaron Lefohn</i>	<i>Joshua Cates</i>	<i>Ross Whitaker</i>
<i>School of Computing</i>	<i>School of Computing</i>	<i>School of Computing</i>
<i>Univ. of Utah</i>	<i>Univ. of Utah</i>	<i>Univ. of Utah</i>
<i>lefohnae@cs.utah.edu</i>	<i>cates@cs.utah.edu</i>	<i>whitaker@cs.utah.edu</i>

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School of Computing
University of Utah
Salt Lake City, UT 84112 USA

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Abstract

While level sets have demonstrated a great potential for 3D medical image segmentation, their usefulness has been limited by two problems. First, 3D level sets are relatively slow to compute. Second, their formulation usually entails several free parameters which can be very difficult to correctly tune for specific applications. The second problem is compounded by the first. This paper presents a tool for 3D segmentation that relies on level-set surface models computed at interactive rates on commodity graphics cards (GPUs). The mapping of a level-set solver to a GPU relies on a novel mechanism for GPU memory management. The interactive rates for solving the level-set PDE give the user immediate feedback on the parameter settings, and thus users can tune three separate parameters and control the shape of the model in real time. We have found that this interactivity enables users to produce good, reliable segmentations. To support this observation, this paper presents qualitative and quantitative results from a study of brain tumor segmentation.