A Novel Subdivision-based Deformable Model for Surface Reconstruction of Arbitrary Topology

Ye Duan and Hong Qin

Department of Computer Science
State University of New York at Stony Brook
Stony Brook, NY 11794-4400
{yduan | qin}@cs.sunysb.edu
Tel: 631-632-1312
Fax: 631-632-8334

Abstract

We propose a novel subdivision-based deformable model that is capable of recovering arbitrary, complicated shape geometry and its unknown topology simultaneously. Starting from a simple seed inside the dataset, the model will grow according to the principle of energy-based minimization. Our algorithm can adaptively subdivide the model geometry, automatically detect self-collision of the model, properly modify its topology, continuously evolve the model towards the object boundary, and reduce fitting error and improve fitting quality via global subdivision. Commonly-used mesh optimization techniques are employed to ensure the model both locally smooth and globally well-conditioned. Our model overcomes the topological limitation of traditional deformable models and provides a unified approach to handle both volumetric image dataset and range dataset.