MIBlob: A Tool for Medical Visualization and Modelling using Sketches

Bruno de Araújo   Joaquim Jorge   Mario Costa Sousa   Faramarz Samavati   Brian Wyvill

brar@immi.inesc.pt   jorgej@acm.org
Technical University of Lisbon

{mario,samavati,blob}@cpsc.ucalgary.ca
University of Calgary

1 Introduction

The MIBlob application is designed to support the visualization of medical images (X-rays, MRI). The aim of the system is to provide a simple interface to allow manual 3D reconstruction from the 2D data presented in the image in order to help users to explain concepts to clinical staff such as medical students or even other doctor colleagues. Our system aims not to be an automatic tool but rather provides interactive assistance. Modelling tasks are accessible through a calligraphic interface without requiring specific design or modeler skills since shapes are inflated from freehand contours.

We present an application that combines modelling ability with advanced visualization techniques based on non-photo realistic rendering (NPR). The rendering options are based on [Sousa et al. 2004] which are both more adequate than traditional Gouraud shading for the understanding of shape's curvature and more similar to traditional techniques used in medical illustration. However, Gouraud-based rendering is still possible, allowing the user to apply color to 3D objects. In both rendering modes, it is possible to control lighting characteristics taking advantage of all conventional models such as spotlight, directional and point light primitives.

2 System Overview

The system is to be used with advanced pointing devices such as a TabletPC or stylus based tablet since most of user interaction is based on sketches both to create and edit 3D shapes. TabletPCs are more appealing for the target user since this enable ready communicating with other users while offering mobility and a familiar interaction similar to the pencil-paper metaphor.

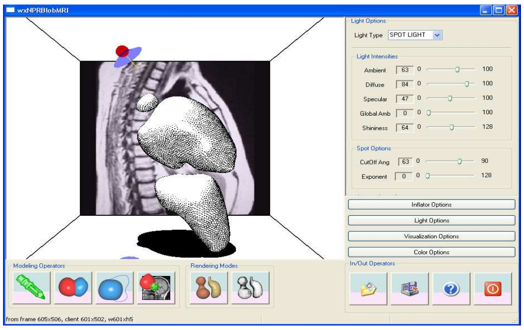

Figure 1: System overview.

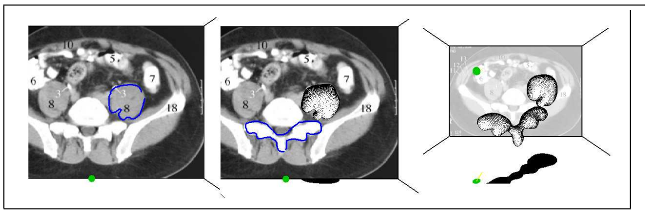

Figure 2: 3D shape creation examples

The interface is divided in three areas as depicted by Figure 1. At center is a workspace where the user can create, edit and visualize 2D images and 3D shapes. On the bottom, a toolbar contains button for main operators of our system such as open an image, save 3D scene, create new form, edit 3D shapes and choose visualization mode. Finally, on the left, specific options for each functionality are proposed such as visualization controls, 3D inflation parameters, as well as light and color features.

The workspace presents a 3D perspective view of a "virtual cave" where the user can find on the front wall plane a medical image previously imported to the system. This provides a virtual plane on which users draw contours to create new forms. Sketches are inflated to generate 3D shapes following the approach presented by [de Araújo and Jorge 2003]. These inflated blob can be edited through two free-form operators: a) merge blends two shapes in order to create a more complex one; b) oversketch allows to redefine object silhouettes or create new features using an extrusion paradigm. Surfaces are internally represented using an implicit model. Users can pick a blob and translate or rotate it to a new given position. Alternatively, selecting the shadow of blobs, depth wise translation is possible. Additionally, users can put the blob back on the image plane at its original position using the snap operator. Each manipulation operator can be applied to one or more blobs depending of the current selection. We use the same approach to control lights.

For rendering blobs, the program makes different options available. These control stroke thickness, length and curvature information. We will extend these with different NPR options including surface measures and additional lighting effects. With more usability tests, more sketching refinements to polish the inflated model by selected sketching/modeling operations will be available. Computer Vision algorithms extracting geometric information from image's grey-scale will be used to improve the approximation to the anatomical part being designed.

References

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