Automation for 3D Volume Visualization of Medical Data

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Introduction

- **3D volume visualization** is an alternative to viewing the medical data slice by slice (Fig. 1).

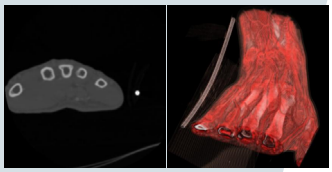


Figure 1: *Hand dataset. Slice view vs. 3D view*

It becomes more important as the modern scanners produce data volumes of thousands of slices and watching each slice separately is too difficult.

- **Transfer Functions** (TF) represent the visualization parameters which determine **what** (e.g. bone, skin) and **how** (color, opacity) is visualized. Although it is more natural to see the data in 3D, the non-intuitive and time-consuming settings of the TF prevent it from a wider use.

- The goal of our research is to develop automated methods for setting the 3D visualization parameters.

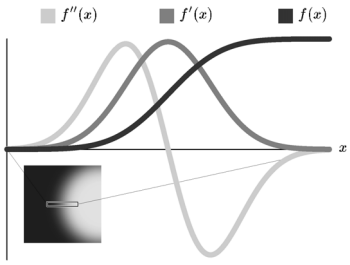
Transitions between tissues

Visualizing an object (tissue) can be done by displaying its borders. The transitions between materials in the CT data are blurred by the Gaussian shaped Point Spread Function (PSF) of the scanner (Fig. 2).

Figure 2: *Blurred edges.*

To reconstruct the edge information, we need to analyze the transition profile [1] (Fig. 3).

Figure 3:
Boundary analysis.



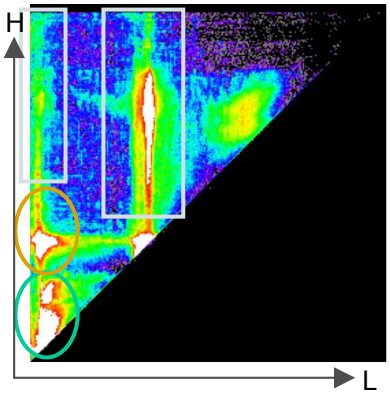
For each voxel (volume element) of the transition, the distance from the edge and intensities of both tissues (labeled L - lower and H – higher) can be obtained.

LH histogram

Having the L and H values for all voxels a histogram can be constructed [2]. Transitions between tissues appear as blobs in the histogram (Fig. 4).

Figure 4:

Selection in the LH histogram. The white rectangles select (from left to right) the bone-air and bone-skin transitions. Orange oval selects the skin-air transition.



Results

Selecting a blob in the histogram (Fig. 4) results in visualizing a transition between two tissues (Fig. 5) .

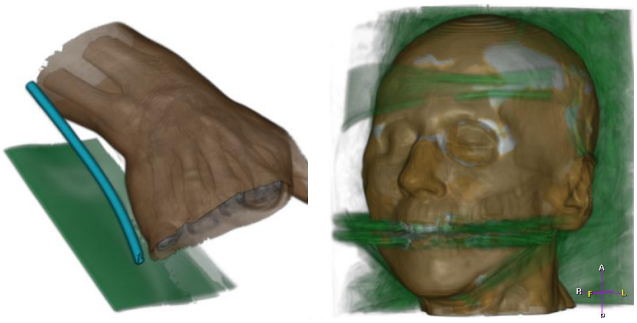


Figure 5: *Resulting 3D renderings. The right image is result of the blob selection in Fig. 4.*

Conclusions

This poster showed that the information from the boundary analysis allows a transition-based classification. Transitions can be selected and classified independently.

Our further research aims for using this and other information obtained from the data analysis to introduce more automation and improve the user interaction.

References:

[1] *Gordon Kindlmann and James W. Durkin: Semiautomatic Generation of Transfer Functions for Direct Volume Rendering, IEEE Symposium on Volume Visualization, 1998, pp. 79–86.*

[2] Iwo Serlie, Roel Truyen, Jasper Florie, Frits H. Post, Lucas J. van Vliet and Frans Vos: Computed Cleansing for Virtual Colonoscopy Using a Three-Material Transition Model. MICCAI (2) 2003, pp 175-183.