A Virtual Endoscopic System for Non-invasive Bronchoscopy

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Abstract. This paper describes a Virtual Endoscopic system designed for non-invasive bronchoscopy. This system uses computer graphics techniques to navigate inside the bronchial tree. Using these techniques we can avoid invasive procedures such as conventional bronchoscopy in cases where biopsy is not required.

1 Introduction

Conventional bronchoscopy is an endoscopic technique to visualize the bronchial tree. Using a flexible or rigid bronchoscope, the physician can access the respiratory tract getting to the bronchial tree. With this procedure he/she can examine the interior structure of the bronchius and in some cases extract material for biopsy.

This procedure has some risks: as it is an invasive procedure, the bronchial structures could be injured or infected if the bronchoscope is not properly clean. Another main risk is with the anesthesia procedure. Using the rigid bronchoscope one should perform general anesthesia and using the flexible bronchoscope one should perform sedation and morphine-like analgesia. Both procedures present some risk.

Virtual Endoscopy, according to Ahlquist [1], is a technique for visualizing interior cavities using computer graphics techniques. This technique is non-invasive.

In cases in which biopsy is not required, a system that can navigate through the bronchius in a non-invasive form could be a great alternative for conventional bronchoscopy.

Another major advantage of the virtual endoscopic system is its ability to pass through obstructions and stenosis.

2 Techniques

With Helicoidal Computed Tomography (CT) one can obtain high-resolution datasets from the entire lung. These datasets are suitable for visualization using volume rendering techniques.

We have chosen the ray casting technique for the virtual endoscopy system because ray casting is better suitable for changing illumination while navigating (Oliveira [2]).

However, conventional ray casting is not suitable for this application because it takes a long time to render a frame and this system requires a higher frame-rate (at least 7 frames/second). Therefore we have implemented an accelerated ray casting algorithm using a hierarchical oracle [2].

3 Example case

This is the case of a patient who performed a tracheal tomography. To test our technique, we have inserted into the acquired dataset a small tumoral lesion. In figure 1 we can see the view of the trachea and the lesion indicated by the arrows.

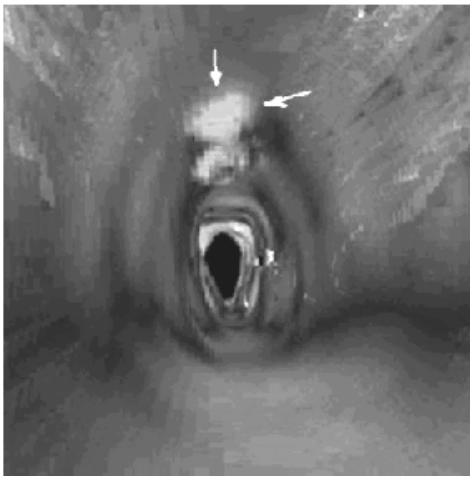

Figure 1 A typical figure.

4 References

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