Automatic 3D Model Creation during Minimally Invasive Surgery

Personal Space Technologies

Personal Space Technologies (PS-tech) is a high-tech spin off company from the Center for Mathematics and Computer Science in Amsterdam, based on expertise in the field of Virtual Reality (VR). PS-tech focuses on making this VR technology, consisting of 3D visualization and 3D interaction technology, available to the medical market. This has resulted in the development of 3D workstations for the visualization and analysis of complex volumetric medical data sets, such as MRI, CT and Ultrasound data. Supported by intuitive 3D interaction technology, these 3D workstations facilitate faster and more accurate data analysis.

Project Description

Minimally Invasive Surgery (MIS) is a common surgical technique whereby patients are treated for their illness while inflicting minimal trauma. One of the procedures that is often performed using MIS is the removal of malignant tumors from the bladder. With this type of procedure the operator enters the bladder of the patient using an endoscope, locates and then removes one or more tumors using a small knife attached to the tip of the endoscope.

A particularly difficult situation can occur when multiple tumors are present. In this case the removal of one tumor can cause blood to flow and create a murky endoscope image. This makes it more difficult for a surgeon to find the remaining tumors and it raises the chance that tumors may be overlooked.

To assist the surgeon during this kind of procedure PS-Tech has developed an augmented reality in-patient navigation system. With this system the endoscope is tracked using an optical tracking system; at any time the exact location of the endoscope is known. This allows operators to locate and mark 3D positions within the bladder and find them back based on navigational instructions given by the system.

During the procedure the system collects a lot of interesting video and spatial data. Much of this data is currently not used to its full potential. The main focus of this research is to develop a system that automatically constructs a model of the bladder from the endoscope images. This would allow the operator to not only see the current view from the endoscope but an instantaneous view of the entire bladder. Moreover, it would provide a logging capability, which enabled a surgeon to compare the bladder of a patient during a follow-up procedure to that of a previous procedure. To achieve this, a first step could be to stitch the images collected from the endoscope together to create a full panoramic view of the bladder. This basic functionality could be extended in a subsequent step to automatically reconstruct a textured 3D model of the bladder.

Your Competencies

The work will be practical and requires the following skills:
- Microsoft Windows operating system.
- C/C++ experience.
- Interest in 3D computer graphics and image analysis.
- Good communication skills.

**Contact Information**

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