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Automated 3D Mosaicing and Scan Trajectories for Surveillance of Bladder Cancer

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While cystoscopic surveillance, which uses a type of endoscope used by urologists to view the interior surface of patient's bladder, is regarded as the "gold standard" for bladder cancer detection, it remains imperfect. Physicians advance a rigid or flexible scope through a patient's urethra and into his/her bladder, manually manipulating the probe in order to view the entire inner surface of the bladder. Thus, the completeness of cystoscopic examinations remains completely dependent on the examining physician. We propose a few scanning trajectories, which can be potentially adopted in the mechatronics approach to minimize operator errors. An automated image mosaicing software, which would afford 3D reconstruction of the bladder for more efficient surveillance, is proposed to achieve a high resolution and comprehensive model of the bladder. The software adequately reconstructs the internal surface of the virtual model under all three scan trajectories as a proof-of-concept.

Multifunction Pericardial Drainage Catheter

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A longstanding controversy in the field of cardiac surgery is whether or not to repair the pericardium on completion of open heart surgery. The device proposed is a multilumen catheter that will allow for delivery and removal of fluids to and from the pericardial space. In more detail, the main lumen will allow for gentle suction. A second lumen will allow for targeted drug delivery if desired. Targeted drug deliver can be especially important in the case of adverse events such as infection or postoperative atrial fibrillation. A temporary pacing lead through the catheter will allow for increased rate control by means of antibradicardic pacing. The catheter can help reduce the complications involved with closing the pericardium and thus encouraging more surgeons to complete this task in more procedures in order to reduce complications among the ever-increasing number of repeat operations.

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