Real-Time Localization Pipeline in Bladder for Tele-Cystoscopy

This technology offers a real-time camera localization method for mapping a featureless bladder surface. This method uses video recordings from a prior cystoscopy and 3D bladder reconstruction to estimate cystoscope pose within the bladder during follow-up telecystoscopy.

What is the Problem?

Tele-cystoscopy can lower the barrier to access of critical urologic diagnostics for patients around the world. A challenge to robotic control of flexible cystoscopes and intuitive teleoperation is estimation of the location of the scope tip. Because of the often featureless bladder surface and/or the low image quality of bladder frames including low resolution, blurring and distortion, most 3D localization and mapping algorithms based on feature extraction are not applicable or robust.

What is the Solution?

The solution is a novel real-time camera localization method using video recordings from a prior cystoscopy and 3D bladder reconstruction to estimate cystoscope pose within the bladder during follow-up telecystoscopy. It reconstructs the 3D surface of the bladder in the beginning and maps the used frames into a low dimensional space as a dictionary. New frames can be located on the bladder surface by searching the nearest neighbors in the low dimensional space and registering two images. The corresponding 3D camera pose of the new frame then can be efficiently computed based on the camera pose of the dictionary frame. This pipeline is proposed for the first time and the localization is performed in 2D instead of 3D for real-time purposes. This pipeline is originally developed for bladder, but it can be used within other organs such as stomach, uterus, GI tract, nasal and lung, and more general non-medical environments without distinctive features.

What is the Competitive Advantage?

Existing solutions have low image quality and deal with the issue of a featureless bladder surface, leading to poor 3D localization and mapping algorithms that are based on feature extraction. This algorithm will be able to perform better than existing methods and could help make telecystoscopy a compelling option for urologists and their patients.

Patent Information:

Technology ID

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Category

Device/Imaging

Selection of Available Technologies

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References

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