

Robust Real-Time Image-Guided Endoscopy: A New Discriminative Structural Similarity Measure for Video to Volume Registration**Xiongbiao Luo - Nagoya University****Hirotsugu Takabatake - Sapporo MinamiSanjo Hospital****Hiroshi Natori - Keiwakai Nishioka Hospital****Kensaku Mori - Nagoya University**

This paper proposes a fully automatic real-time robust image-guided endoscopy method that uses a new discriminative structural similarity measure for pre- and intra-operative registration. Current approaches are limited to clinical applications due to two major bottlenecks: (1) weak continuity, i.e., endoscopic guidance may be blocked since a similarity measure might incorrectly characterize video images and virtual renderings generated from pre-operative volume data, resulting in a registration failure; (2) slow computation, since volume rendering is a time-consuming step in the registration. To address the first drawback, we introduce a robust similarity measure, which uses the degradation of structural information and considers image correlation or structure, luminance, and contrast to characterize images. Moreover, we utilize graphics processing unit techniques to accelerate the volume rendering step. We evaluated our method on patient datasets. The experimental results demonstrated that we provide a promising method, which is possibly applied in the operating room, to accurately and robustly guide endoscopy in real time, particularly the average accuracy of position and orientation was improved from (14.6, 51.2) to (4.45 mm, 12.3 degrees) and the runtime was about 32 frames per second compared to current image-guided methods.

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