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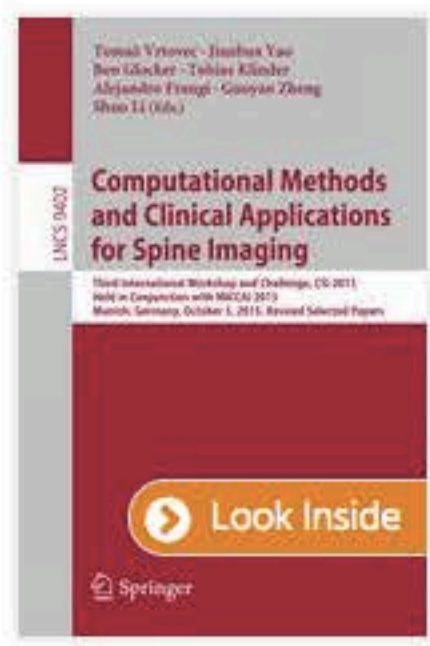
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Robust CT to US 3D-3D Registration by Using Principal Component Analysis and Kalman Filtering

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Abstract



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Robust CT to US 3D-3D Registration by Using Principal Component Analysis and Kalman Filtering

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Abstract

Algorithms based on the unscented Kalman filter (UKF) have been proposed as an alternative for registration of point clouds obtained from vertebral ultrasound (US) and computerised tomography (CT) scans, effectively handling the US limited depth and low signal-to-noise ratio. Previously proposed methods are accurate, but their convergence rate is considerably reduced with initial misalignments of the datasets greater than 30° or 30 mm. We propose a novel method which increases robustness by adding a coarse alignment of the datasets' principal components and batch-based point inclusions for the UKF. Experiments with simulated scans with full coverage of a single vertebra show the method's capability and accuracy to correct misalignments as large as 180° and 90 mm. Furthermore, the method registers datasets with varying degrees of missing data and datasets with outlier points coming from adjacent vertebrae.

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