Universität Basel

Publication

Automatic deformable registration of histological slides to {μCT} volume {3D}-Data

JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

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Localizing a histological section in the threedimensional dataset of a different imaging modality is a challenging 2D3D registration problem. In the literature, several approaches have been proposed to solve this problem; however, they cannot be considered as fully automatic. Recently, we developed an automatic algorithm that could successfully find the position of a histological section in a micro computed tomography (μCT) volume. For the majority of the datasets, the result of localization corresponded to the manual results. However, for some datasets, the matching μCT slice was off the groundtruth position. Furthermore, elastic distortions, due to histological preparation, could not be accounted for in this framework. In the current study, we introduce two optimization frameworks based on normalized mutual information, which enabled us to accurately register histology slides to volume data. The rigid approach allocated 81 % of histological sections with a median position error of 8.4 μm in jaw bone datasets, and the deformable approach improved registration by 33 μm with respect to the median distance error for four histological slides in the cerebellum dataset.