SKELETON-BASED 3D RECONSTRUCTION OF HISTOLOGICAL SECTIONS

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Accurate three-dimensional reconstruction of biological structures from histological sections requires proper recovery of the original tissue alignment, which is normally lost during the tissue sectioning and staining stages. Different methods have been proposed to solve this problem in 2D (e.g. fiduciary markers, elastic deformations of the images, piece-wise registration, warping, etc.). However, these methods are computationally expensive and therefore not practical for large images. We propose a new low computational cost algorithm for the visualization of biological structures in 3D from sets of histological sections. Our method starts with a rough alignment of the sections using a multiresolution rigid-body registration of the sections. From that initial registration, the structures of interest are identified and rendered in 3D, showing inaccurate surfaces due to local non-linear registration problems. Then we refine the registration by calculating the volume's skeleton and correcting the alignment of each contour using a trajectory B-Splines interpolation, using the skeleton knots as control points. The robustness of the B-Splines guarantees reliability against outliers (caused by distortion in some sections) and smoothness in the trajectories. We have used this method to reconstruct the mammary gland of mice. We will present results of applying our algorithm and quantify the improvement introduced by our registration method.

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