A Hierarchical Registration Algorithm based on Comparative Centerline Assessment Technique for Evaluating Altered Tortuosity in Cerebral Vessels

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Abstract

Three-dimensional cerebral registration is mostly performed with atlas based methods. However, in case of compact and pre-constructed (segmented) regions of interest (ROIs) involving only blood vessels which are prone to torturous changes; atlas-based approach does not offer the best output. This article suggests a hierarchical (top to bottom) skeleton based registration approach for similar cases. The method has been applied on five sets of cerebral artery locations with aneurysms in order to evaluate their post invasive structural changes. The algorithm works in a semi-automatic manner where the bifurcation zone has been selected as the reference zone. This landmark matching approach works as the basis of the initial stage, coarse affine transformation. The non-rigid intermediate stage is optional and is dependent on the difference of the comparative angular orientation of the models in three dimensional space. Afterward, a third stage of iterative affine transformation is applied for finer adjustments if there is scope for any. Once registered with limiting boundaries, the branch by branch structural comparisons are interpreted quantitatively with box and whisker plots. In order to verify the proposed method, overlapping for one of the fifteen branch sets has also been evaluated with
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dice similarity indices. The resulting comparison gives a good support in favour of the proposed method.

References


Index Terms

Computer Science

Algorithms
Keywords

Pre-segmented neural blood vessels, centerline matching, auto landmark identification