Improving Spatial Mapping and Imputation of Cell Migration Data Using Optimal Transport

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Spatial mapping of transcriptional states provides crucial information for understanding cellular behavior within tissues, including cell migration. Accurate 3D cell segmentation plays an important role in enabling a more complete spatial mapping, but current approaches designed to automate 3D segmentation are limited. Additionally, cell migration data is often limited to 2D snapshots taken at different time points, impeding the understanding of continuous cell behavior and hindering disease tracking and treatment efficacy. This study investigates the use of different regularizations to the loss function to incorporate spatial information and improve the alignment of 3D cell segmentation through optimal transport methods. The resulting function will facilitate the calculation of optimal transport maps between cell distributions obtained from snapshots. Topological changes will be identified by comparing these optimal transport maps. The proposed optimal transport method can be integrated into existing computational frameworks, improving the accuracy of imputation in cell simulations.