Defense Announcement

Unsupervised Discovery of Hidden Geometry in High dimensional Datasets for Arbor Analytics

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Brain cells such as microglial, neurons, and astrocytes, undergo varieties of morphological and functional changes during their life cycle, or responding to micro environmental perturbation. To better understand the functions of these cells in different status and sub-status, it is essential to study the morphological characteristics of the cells. More importantly, the process of categorizing cells into different status and sub-status serves as a prerequisite for further analysis. In this dissertation, we propose a robust unsupervised hidden structure discovery method for analyzing quantitative arbor morphology data for ensembles of brain cells for the purpose of robustly identifying groups and sub-groups of cells with similar morphologies, and simultaneously identifying the hierarchical grouping patterns among the corresponding arbor measurements for the purpose of interpreting the characteristics of the identified cell groups.The robustness of this co-clustering algorithm derives from using a combination of methods including the diffusion distance measure, harmonic analysis theory, and a Haar-like wavelet basis for data smoothing.