Statistical Analysis for Structural and Functional Brain Images

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Abstract

Inspired by key questions in neuroscience and medicine, it becomes extremely important to develop statistical methods that can accurately and efficiently recover useful quantitative information from large amounts of brain images. The underlying computational issues are challenging and often hampered by uncertainties in imaging acquisition parameters, the variability of human anatomy and physiology, as well as the nature of the imaging data to be handled such as the presence of noise and correlation, and the sample and data sizes, etc. In this talk, I will present the statistical methods we have developed for several problems in the realms of brain morphometry, neural circuits and individual differences from analyzing structural and functional magnetic resonance imaging data. The discussion will be focused by looking primarily at localization of regional anatomical and shape changes, characterization of brain function, and prediction of individual differences in learning. Results on both simulated and real imaging data using the statistical approaches will also be presented.