A Bootstrap Resampling Approach: Tests of Significance on Brain Imaging Data

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Abstract

In neuroimaging studies it is of interest to test for changes in imaging data among subjects in different groups. Testing hypotheses voxel by voxel results in a multiple comparisons problem for which solutions should take into account the spatial correlation structure inherent in the imaging. Statistical Parametric Mapping (SPM) and the permutation test have become popular in this setting but they rely on parametric and exchangeability assumptions, respectively, which are not always satisfied in practice. We propose a bootstrap approach (L1) that is free of the parametric assumptions made by SPM and also are more flexible than the permutation test. We compare the performance of the L1 method with that of SPM, the permutation test, and another bootstrap approach (L2). For the L2 method, we present sufficient conditions that ensure asymptotic control of the family-wise error rate.