

Functional Regression for Brain Imaging

Bin Nan

University of California, Irvine

E-mail: nanb@uci.edu

Abstract: It is well-known that the major challenges in analyzing imaging data arise from spatial correlation and high-dimensionality of voxels. Our primary motivation and application come from brain imaging studies on cognitive impairment in elderly subjects with brain disorders. We propose an efficient regularized Haar wavelet-based approach for the analysis of three-dimensional brain image data in the framework of functional data analysis, which automatically takes into account the spatial information among neighboring voxels. We conduct extensive simulation studies to evaluate the prediction performance of the proposed approach and its ability to identify related regions to response variable, with the underlying assumption that only few relatively small subregions are associated with the response variable. We then apply the proposed method to searching for brain subregions that are associated with cognition using PET images of patients with Alzheimer's disease, patients with mild cognitive impairment, and normal controls. Additional challenges, current and future directions of statistical methods in imaging analysis of AD will also be discussed.