Semiparametric Inference with an Image Predictor using Convolution Neural Network

Zhangsheng Yu

Department of Bioinformatics and Biostatistics, School of Life Sciences;
Department of Statistics, School of Mathematical Sciences, Shanghai Jiao Tong University, China

Email: yuzhangsheng@sjtu.edu.cn

In this study, we developed an algorithm based on convolution neural network to model the non structural components and allowing for the parametric covariate estimation. This algorithm can be used for model building with images where the spline and other nonparametric regression tools are difficult to apply. We derived the convergence properties of the non-structure components and also the consistency and asymptotic normality of the parametric coefficient estimators. Simulation results showed that the bias of coefficient estimators of CNN based approach was much smaller than other approaches including spline, gam and pca-based models. We also applied the proposed method to analyze a medical image study of Alzheimer disease.