TIME-VARYING ESTIMATION AND DYNAMIC MODEL SELECTION WITH AN APPLICATION OF NETWORK DATA

Abstract

In many biomedical and social science studies it is important to identify and predict the dynamic changes of associations among network data over time. We propose a varying-coefficient model to incorporate time-varying network data, and impose a piecewise-penalty function to capture local features of the network associations. The advantages of the proposed approach are that it is semi-parametric and therefore flexible in modeling dynamic changes of association for network data problems, and capable of identifying the time regions when dynamic changes of associations occur. To achieve sparsity of network estimation at local time intervals, we implement a group penalization strategy involving overlapping parameters among different groups. However, this imposes great challenges in the optimization process for handling large-dimensional network data observed at many time points. We develop a fast algorithm, based on the smoothing proximal gradient method, which is computationally efficient and accurate. We illustrate the proposed method through simulation studies and children’s attention deficit hyperactivity disorder fMRI data, and show that the proposed method and algorithm efficiently recover dynamic network changes over time.