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A Bayesian Approach to Network Classification

Monday, 11 September 2023 11:00 (30 minutes)

We propose a novel Bayesian binary classification framework for networks with labeled nodes. Our approach is motivated by applications in brain connectome studies, where the overarching goal is to identify both regions of interest (ROIs) in the brain and connections between ROIs that influence how study subjects are classified. We develop a binary logistic regression framework with the network as the predictor, and model the associated network coefficient using a novel class of global-local network shrinkage priors. We perform a theoretical analysis of a member of this class of priors (which we call the Network Lasso Prior) and show asymptotically correct classification of networks even when the number of network edges grows faster than the sample size. Two representative members from this class of priors, the Network Lasso prior and the Network Horseshoe prior, are implemented using an efficient Markov Chain Monte Carlo algorithm, and empirically evaluated through simulation studies and the analysis of a real brain connectome dataset.

Keywords

Global-Local Shrinkage Prior; Node Selection; High-Dimensional Binary Regression

Classification

Both methodology and application

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