A Bayes Random Field Approach for Integrative Large-Scale Regulatory Network Analysis

Yinyin Yuan and Chang-Tsun Li
Department of Computer Science, University of Warwick, Coventry, UK

Abstract

We present a Bayes-Random Fields integration framework which is capable of inferring large-scale network from unlimited data sources in order to discover relevant network architecture in a seamless and coherent manner. The random field potentials are designed to impose a cluster constraint for efficient network inference, teamed with a full Bayesian approach for incorporating heterogenous data. The probabilistic nature of our framework facilitates robust analysis in order to minimize the influence of noise inherent in the data on the inferred structure, which is later proved in the applications to both large-scale synthetic data sets and *Saccharomyces Cerevisiae* data sets.

Conclusions

The success of BRFs is a direct result of the inherent elegant yet straightforward integrative framework. Its flexibility enables unlimited heterogeneous data types to be integrated in a stochastic manner to facilitate robust estimation. As previously addressed, different data are of various formats and sparsity. BRFs propagate through modelling the two distributions in the available data without resorting to accounting for missing data, thus is more computationally efficient. In particular, the random fields component introduces a known feature of gene network for more accurate modelling. In summary, BRFs aims to achieve the limit of the available data, its power of integration is demonstrated through the ROC curves.