The junction tree expanders and their application to structure learning in graphical models using particle Gibbs

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May 18, 2016

Abstract

A novel family of graph algorithms, the junction tree expanders, for expanding junction trees in the sense that the number of nodes in the underlying decomposable graph is increased by one will be presented. This family is equipped with a number of theoretical results including a characterization stating that every junction tree and consequently every decomposable graph can be constructed iteratively by using a junction tree expander. Further, an important feature of a stochastic implementation of a junction tree expander is the Markovian property inherent to the propagation dynamics. Using this property, a sequential Monte Carlo algorithm, having the junction tree expander as proposal kernel, for approximating probability distributions defined on the space of decomposable graphs is developed. Specifically, results from a particle Gibbs algorithm for structure learning in decomposable Gaussian graphical models will be demonstrated.