



Department of Decision Sciences

## An Introduction to Variational Methods for Approximate Inference in Graphical Models

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### Abstract

For many graphical models of practical interest performing inference, that is estimating the conditional probability distribution of the hidden variables given the observed variables, is an intractable problem. In such situations we need to employ approximation schemes, which can be divided broadly into stochastic and deterministic methods. Stochastic methods such as Markov Chain Monte Carlo have the property that they can generate exact results given infinite computational resources. In practice, they are often computationally demanding and it can be hard to diagnose their convergence. On the other hand, deterministic methods such as variational methods are based on analytical approximations to the posterior distributions and therefore cannot give exact results. However, they can often reach very good accuracy and be computationally more advantageous than stochastic methods. Furthermore, these methods can provide bounds on the probabilities of interest and their convergence can be assessed very easily. In this talk we give a tutorial introduction to variational methods, discuss their properties and provide some comparison with Markov Chain Monte Carlo techniques.