Foundations of Graphical Models: Homework 3

Due: Th 2016-12-01

Problem 1

Write the multinomial distribution in its canonical exponential family form. Hint: For a probability vector of size K, there are $K - 1$ natural parameters.

Problem 2

Implement mean-field variational inference for one of several models: Gaussian mixture (collapsed or uncollapsed), latent Dirichlet allocation, or Gaussian matrix factorization. Choose the model you believe is most related to your project (or, if you already know the model you will be working with, implement variational inference for that model).

Apply your code to data, either real or simulated, and discuss what you learned. You can plot and discuss whatever you like. Among the plots, we would like to see the ELBO as a function of iteration. (This is a way to see how variational inference converges.)

Problem 3

Write an abstract summarizing your planned project. We understand that your project is likely to evolve while you work on it. Writing an abstract early in the process is a great way to plan a research project and to help put it into perspective.

You might want to refer to computer science conferences (such as Neural Information Processing Systems and International Conference of Machine Learning) or journals (such as The Annals of Applied Statistics, Journal of the American Statistical Association, Journal of Machine Learning Research) to get a sense of how to write an abstract.

Also include descriptions of a figure or figures that you hope to get out of your analysis, whether it be certain benchmarks to achieve for an experiment, or how two models compare in capturing specific phenomena in the data.