

Bayesian Mixture Models: Variants, MCMC Inference, and Applications

Abstract:

In the realm of unsupervised learning, mixture models provide a powerful framework for key statistical tasks such as clustering and density estimation. This talk will focus on several variants of the well-known Bayesian mixture models (exemplified by the Bayesian Gaussian Mixture Model), their MCMC inference, and some of their applications in computer vision, machine learning, and robotics. These variants include incorporation of one or more of the following: hierarchy; nonlinear geometry; parallel and distributed MCMC inference; Bayesian nonparametric extensions (i.e., where K , the number of components, is unknown), or topological constraints.

Joint work with John Fisher's Sensing, Learning Inference group and John Leonard's Marine Robotics group, both at MIT CSAIL.

Relevant papers:

A Mixture of Manhattan Frames: Beyond the Manhattan World
[Straub, Rosman, Freifeld, Leonard, and Fisher, CVPR '14]

A Dirichlet Process Mixture Model for Spherical Data
[Straub, Chang, Freifeld, and Fisher, AISTATS '15]

A Fast Method for Inferring High-Quality Simply-Connected Superpixels
[Freifeld, Li, and Fisher, ICIP '15]

The Manhattan Frame Model -- Manhattan World Inference in the Space of Surface Normals
[Straub, Freifeld, Rosman, Leonard and Fisher, Accepted to PAMI]

Distributed MCMC Inference in Dirichlet Process Mixture Models Using Julia
[Yu, Fisher, and Freifeld, under review]

Inferring Projected Bayesian Nonparametric Mixtures
[Freifeld, Yu, Zheng, and Fisher, in preparation].

About the speaker:

In October 2016, Oren Freifeld joined Ben-Gurion University Computer Science department as a Senior Lecturer. Previously, he was a postdoc at John Fisher's Sensing, Learning and Inference group at MIT CSAIL. He earned his PhD (advisor: Michael Black) and ScM in Applied Mathematics from Brown University. During his PhD he was also a Visiting Scholar at Stanford Electrical Engineering (host: Krishna Shenoy). Earlier, he graduated from Tel-Aviv University with MSc (advisors: Hayit Greenspan and Jacob Goldberger) and BSc in Biomedical Engineering. His main research areas are computer vision, statistical inference, and machine learning. Additional research fields he is interested in are stochastic processes, image processing, statistical signal processing, medical image analysis, and large-scale data analysis.