Zhe Gan

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Research Interests

I focus on designing efficient and scalable Bayesian inference algorithms for deep learning models. Specifically,

- High-dimensional Data Modeling: (*i*) Deep directed generative models, *e.g.*, sigmoid belief networks, and variational auto-encoder; (*ii*) Bayesian latent variable models, *e.g.*, factor analysis for real-valued data and topic modeling for count-based data.
- Scalable Bayesian Inference: (*i*) stochastic MCMC; (*ii*) stochastic variational inference.

Education

Duke University, Durham, NC

Ph.D., Electrical and Computer Engineering, 09/2013 - 09/2018 (Expected)

- Advisors: Lawrence Carin, Ph.D

Peking University, Beijing, China

M.S., Electrical Engineering, 09/2010 - 07/2013

- GPA: 3.77/4, Emphasis in Signal Processing.

B.S., Electrical Engineering , 09/2006 - 06/2010

- GPA: 3.71/4, Excellent Undergraduate Thesis.

Experience

Research Assistant 09/2013 - present

Information Initiative at Duke (iiD), Duke University

Advisor: Lawrence Carin, Ph.D

Projects

- **Scalable Deep Poisson Factor Analysis for Topic Modeling**
  A new framework for topic modeling is developed, based on deep graphical models, where interactions between topics are inferred through deep latent binary hierarchies. Scalable inference algorithms are derived by applying Bayesian conditional density filtering algorithm, in addition to extending recently proposed work on stochastic gradient thermostats.
- **Learning Deep Sigmoid Belief Networks with Data Augmentation**
  Deep directed generative models are developed. The multi-layered model is designed by stacking sigmoid belief networks. Learning and inference of layer-wise model parameters are implemented in a Bayesian setting. Efficient Gibbs sampling and VB inference are developed.
- **Inference of Gene Networks Associated with the Host Response to Infectious Disease**
  Discriminative factor models are developed for gene-expression analysis. Bayesian shrinkage priors and nonparametric techniques are employed. Two discriminative loss functions are investigated, i.e., the logistic log-loss and the max-margin hinge loss. Efficient VB inference is developed.

Publications

1. **Z. Gan**, C. Chen, R. Henao, D. Carlson and L. Carin "Scalable Deep Poisson Factor Analysis for Topic Modeling", *Int. Conf. Machine Learning* (ICML),2015.
2. **Z. Gan**, R. Henao, D. Carlson and L. Carin "Learning Deep Sigmoid Belief Networks with Data Augmentation", *Artificial Intelligence and Statistics* (AISTATS), 2015.

Papers Submitted

1. **Z. Gan**, X. Yuan, R. Henao, E. Tsalik and L. Carin "Inference of Gene Networks Associated with the Host Response to Infectious Disease", to appear in the Book *Big Data Over Networks*.
2. **Z. Gan**, C. Li, R. Henao, D. Carlson and L. Carin "Deep Temporal Sigmoid Belief Networks for Sequence Modeling", submitted to NIPS 2015.
3. R. Henao, **Z. Gan**, J. Lu and L. Carin "Deep Poisson Factor Modeling", submitted to NIPS 2015.
4. R. Henao, **Z. Gan** and L. Carin "Deep Sigmoid Belief Networks for Differential Gene Expression Analysis", preparing.

Software Skills Matlab, Python, R and C

Awards

- ECE Fellowship, Duke University, 2013
- National Scholarship, Department of Minister of Education of China, 2010-2013.

Teaching Experience

- Teaching Assistant 09/2014-12/2014
  STA 601 - Bayesian and Modern Statistics
  Instructor: David Dunson, Ph.D
- Teaching Assistant 01/2015-05/2015
  ECE 587 - Information Theory
  Instructor: Ahmad Beirami, Ph.D

Graduate Coursework Bayesian and Modern Statistics, Probabilistic Machine Learning, Advanced Machine Learning, Statistical Inference, Statistical Computation, Information Theory, Graphical Models & Inference, Optimization For Engineers

References Available upon request