

Ghazal Fazelnia

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EDUCATION

Ph.D. Candidate in Electrical Engineering Department and Data Science Institute	2015 - Present
Columbia University, New York, NY	
Advisor: Prof. John Paisley	
M.S. in Electrical Engineering	2013 - 2015
Columbia University, New York, NY	
Advisor: Prof. Javad Lavaei	
B.S. in Electrical Engineering	2009 - 2013
Sharif University of Technology, Tehran, Iran	
Advisor: Prof. Babak Khalaj	

RESEARCH INTERESTS

Machine Learning, Probabilistic Modeling, Approximate Inference, Optimization and Convex Relaxations, Deep Generative Models, Recurrent Neural Networks

HONORS AND AWARDS

- Columbia Data Science Institute Outstanding TA Award 2019
- **Travel Award** for the International Conference on Machine Learning (**ICML**) 2018
- **Microsoft Research Graduate Women’s Scholarship**, 2015
(One of the 10 students in the US and Canada to receive this award)
- **Best Paper Finalist** at IEEE Conference on Decision and Control (CDC) 2014
- Iran Four-year *National Elite Foundation Fellowship* 2009 – 2013
- Among Top %0.06 Students out of 350,000 Participants in the *National Universities Entrance Exam (Konkoor)*, Iran 2009
- **Bronze Medalist** in the *National Mathematics Olympiad*, Iran 2008

COMPUTER SKILLS

Python (PyTorch, TensorFlow), R (Stan, Hadoop, SparkR), Matlab, C++

SELECTED PUBLICATIONS

1. [P] **G. Fazelnia**, M. Ibrahim, C. Modarres, K. Wu, J. Paisley, “Mixed Membership Recurrent Neural Networks,” under review.
2. [P] **G. Fazelnia**, J. Paisley, “Probabilistic Orthogonal Matching Pursuit,” under review.
3. [P] **G. Fazelnia**, J. Paisley, “Stochastic Variational Inference as Annealing,” under review.
4. [C] **G. Fazelnia**, J. Paisley, “CRVI: Convex Relaxation for Variational Inference,” *International Conference on Machine Learning (ICML)*, 2018.

Preprint, conference, and journal papers are marked by P, C and J, respectively.

5. [J] **G. Fazelnia**, R. Madani, A. Kalbat, J. Lavaei, “Convex Relaxation for Optimal Distributed Control Problem”, *IEEE Transactions on Automatic Control*, 2017.
6. [J] R. Madani, S. Sojoudi, **G. Fazelnia**, and J. Lavaei, “Finding Low-rank Solutions of Sparse Linear Matrix Inequalities using Convex Optimization,” *SIAM Journal on Optimization*, 2017.
7. [J] S. Fattahi, **G. Fazelnia**, J. Lavaei, M. Arcak, “Transformation of Optimal Centralized Controllers Into Near-globally Optimal Static Distributed Controllers,” *IEEE Transactions on Automatic Control*, 2017.
8. [C] **G. Fazelnia**, R. Madani, J. Lavaei, “Convex Relaxation for Distributed Controller Design,” In *Proceedings of IEEE Conference on Decision and Control*, 2014.
9. [C] S. Fattahi, **G. Fazelnia**, J. Lavaei, “Transformation of Optimal Centralized Controllers Into Near-Global Static Distributed Controllers,” In *Proceedings of IEEE Conference on Decision and Control*, 2015.
10. [C] R. Madani, **G. Fazelnia**, S. Sojoudi, J. Lavaei, “Low-Rank Solutions of Matrix Inequalities With Applications to Polynomial Optimization and Matrix Completion Problems,” In *Proceedings of IEEE Conference on Decision and Control*, 2014 (**Best paper finalist**).
11. [C] S. Sojoudi, R. Madani, **G. Fazelnia**, J. Lavaei, “Graph-Theoretic Algorithms for Solving Polynomial Optimization Problems,” In *Proceedings of IEEE Conference on Decision and Control*, 2014.
12. [C] A. Kalbat, R. Madani, **G. Fazelnia**, J. Lavaei, “Efficient Convex Relaxation for Stochastic Optimal Distributed Control Problem,” In *Proceedings of Allerton Conference*, 2014.

RESEARCH AND PROFESSIONAL EXPERIENCES

Columbia University

- **Under the supervision of Prof. John Paisley** 2015 – present
My research is mainly focused on: (1) introducing new frameworks for scalable posterior approximation in variational inference and variational autoencoders for generative models using convex relaxation techniques; (2) developing new EM-based inference algorithms for Bayesian nonparametric models and latent factors analysis with applications to sparse data representation and dictionary learning; (3) developing new mixed membership recurrent neural network and algorithm to model sequential data by learning global properties of data as well as group-specific latent features; (4) designing an active learning algorithm for social science experiment design and probabilistic data acquiring process; (5) analyzing decision boundaries learned in deep neural networks to improve model robustness and expressiveness.
- **Under the supervision of Prof. Javad Lavaei** 2013 – 2015
(1) Proposed new convex relaxation algorithm for solving nonconvex optimization problems and derived guaranteed tightness bounds using graph theoretic tools; (2) introduced new methods for low-rank matrix inequalities with applications to polynomial optimization and sparse matrix completion; (3) designed distributed and sparse controller for stochastic systems using semidefinite relaxation and combinatorial optimization.

* All works are implemented in Python, Matlab or R with applications in various areas such as vision, audio processing, text analysis, sequential and time series data, social science studies and networked systems.

J.P. Morgan and Chase, New York, NY

Summer 2017

- Quantitative researcher in the Wholesale Credit Group in Commercial Investment Bank
(1) Introduced and developed machine learning methods to assess risk in the financial market under different crisis scenarios; (2) developed new Bayesian regression models for loan management; (3) implemented sparse Bayesian nonparametric model to analyze loss and predict it over time.

IBM T.J. Watson Research Center, Yorktown Heights, NY

Summer 2015

- Research intern under supervision of Dr. Ching-Yung Lin in SystemG Group
 - (1) Introduced statistical methods for Information Retrieval problem from a large-scale graph data base;
 - (2) combined graph mining and statistical inference approaches to train and learn a fast algorithm to search on the graph database;
 - (3) proposed a Bayesian hierarchical model to extract information from the database;
 - (4) developed a Markov-based algorithm to rank and retrieve nodes in the graph for user-specified queries;
 - (5) built a fast scalable method to search for subgraph similarities in the database.

SELECTED TALKS AND PRESENTATIONS

- MIT Clinical Machine Learning Group Seminar April 2019
- MIT Found. of Data Science Workshop on Deep Learning and Nonconvex Optimization Jan. 2019
- International Conference on Machine Learning (ICML) July 2018
- Columbia University Data Science Day April 2017, 2018, 2019
- New York Academy of Sciences Machine Learning Symposium March 2017, 2018
- Columbia University Data Science Seminar Dec. 2017
- INFORMS Annual Meeting Oct. 2014
- IEEE 53rd Conference on Decision and Control Dec. 2014

SELECTED GRADUATE LEVEL COURSES

Machine Learning, Advanced Machine Learning, Bayesian Models in Machine Learning, Bayesian Statistics, Foundations of Graphical Models, Computational Complexity, Algorithms I, Algorithms II, Convex Optimization, Stochastic Processes, Graph Theory.

TEACHING EXPERIENCE

Instructor

- Instructor in Columbia University Data Science Bootcamp for Machine Learning, Neural Networks, and Probabilistic Models. Winter 2018
- Mentored in edX Online Program for Machine Learning with more than 200,000 Registered Students Worldwide. Spring 2017
- Mentored Three High School Students for Machine Learning and Data Analysis Through Engineering the Next Generation (ENG) Program, Columbia University. Summer 2016

Selected Graduate Level Teaching Assistant

- Bayesian Models in Machine Learning Fall 2016, 2017, 2018
- Machine Learning Spring 2016, 2017, 2018, 2019
- Advanced Big Data Analytics Spring, Fall 2015
- Convex Optimization Fall 2014
- Power Systems Analysis Spring 2014

SELECTED REVIEWER FOR JOURNALS AND CONFERENCES

- Neural Information Processing Systems (NeurIPS) 2018 – Present
- International Conference on Learning Representation (ICLR) 2019
- International Conference on Machine Learning (ICML) 2018 – Present
- NIPS Workshop on Advances on Approximate Bayesian Inference (AABI) 2015 – Present
- International Joint Conference on Artificial Intelligence (IJCAI) 2016
- IEEE Conference on Decision and Control 2014 – Present
- System Science and Control Engineering Journal 2014
- American Conference on Control 2014 – Present
- IEEE Transactions on Control of Network Systems 2015, 2016