Fredrik D. Johansson

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Research Interests

My research is focused on advancing machine learning methods and theory to improve decision making with applications in healthcare. I have also worked on machine learning for use with graph data, reinforcement learning, algorithmic fairness and natural language processing.

Appointments

2019– **Assistant Professor**
Computer Science & Engineering. Chalmers University of Technology, Sweden.

2017–2019 **Postdoctoral Associate**
Institute for Medical Eng. & Science, and CSAIL. Massachusetts Institute of Technology.
Advisor: David Sontag

Education

2017 **Ph.D.** Computer Science & Engineering. Chalmers University of Technology, Sweden.
Advisor: Devdatt Dubhashi. Thesis: *Learning with Geometric Embeddings of Graphs*

2012 **M.Sc.** Computer Science & Engineering. Chalmers University of Technology, Sweden.

2010 **B.Sc.** Engineering Physics. Chalmers University of Technology, Sweden.

Visiting Positions

2015 **Visiting Research Scholar**
Clinical Machine Learning Group. Department of Computer Science, New York University.
Advisor: David Sontag

Columbia Machine Learning Lab. Department of Computer Science, Columbia University.
Advisor: Tony Jebara.

Publications

Peer reviewed journal articles

1 N. Kriege, F D. Johansson, C. Morris, A Survey on Graph Kernels. *Applied Network Science*, *Accepted for publication*, 2019.

2 O. Gottesman, F D. Johansson, et al. Guidelines for reinforcement learning in healthcare. *Nature Medicine* 25 (1), 16–18, 2019.

3 N. Tahmasebi, L. Borin, G. Capannini, D. Dubhashi, P. Exner, M. Forsberg, Gerhard Gossen, F. D. Johansson, R. Johansson, M. Kågebäck, O. Mogren, P. Nugues, T. Risse. Visions and Open Challenges for a Knowledge-Based Culturomics. *International Journal on Digital Libraries*, 2015.

Peer reviewed conference contributions

4 F D. Johansson, D. Sontag, R. Ranganath. Support and Invertibility in Domain-Invariant Representations. In *Proc. of Artificial Intelligence and Statistics*, AISTATS, 2019.

5 I. Chen, F D. Johansson, D. Sontag. Why is my classifier discriminatory? In *Proc. of Neural Information Processing Systems*, NIPS, 2018. Awarded spotlight talk.

6 U. Shalit, F D. Johansson, D. Sontag. Estimating individual treatment effect: generalization bounds and algorithms. In *Proc. of the International Conference on Machine Learning*, ICML, 2017

7 A. Panahi, D. Dubhashi, F D. Johansson, C. Bhattacharyya. Clustering by Sum of Norms: Stochastic Incremental Algorithm, Convergence and Cluster Recovery. In *Proc. of the International Conference on Machine Learning*, ICML, 2017

8 F D. Johansson, U. Shalit, D. Sontag. Learning Representations for Counterfactual Inference. In *Proc. of the International Conference on Machine Learning*, ICML, 2016

9 F D. Johansson, A. Chattoraj, C. Bhattacharyya, D. Dubhashi. Weighted Theta Functions and Embeddings with Applications to Max-Cut, Clustering and Summarization. In *Proc. of Neural Information Processing Systems*, NIPS, 2015.

10 L. Hermansson, F D. Johansson and O. Watanabe Generalized Shortest Path Kernel on Graphs. In *Proc. of the International Conference on Discovery Science*, 2015.

11 F. Johansson, D. Dubhashi. Learning with similarity functions on graphs using matchings of geometric embeddings. In *Proc. of the International Conference on Knowledge Discovery and Data Mining*, KDD, 2015.

12 F. Johansson, V. Jethava, D. Dubhashi, C. Bhattacharyya. Global graph kernels using geometric embeddings. In *Proc. of the International Conference on Machine Learning*, ICML, 2014.

13 F. Axelsson, B. Rydback, F. Johansson, J. Bengtsson, S. Marinov. Data-driven Coreference Resolution for Swedish. In *Proc of the Swedish Language Technology Conference*, SLTC, 2014.

14 L. Hermansson, T. Kerola, F. Johansson, V. Jethava, D. Dubhashi. Entity Disambiguation in Anonymized Graphs Using Graph Kernels. In *Proc of the International Conference on Information and Knowledge Management*, CIKM 2013.

Peer-reviewed workshop contributions

15 M. Kågebäck, F. Johansson, R. Johansson, D. Dubhashi. Neural context embeddings for automatic discovery of word senses. In *Proc. of NAACL-HLT*, 2015.

16 F. Johansson, V. Jethava, D. Dubhashi. DLOREAN: Dynamic LOcation- aware REconstruction of multiwAy Networks. In *Proc. of the International Conference on Data Mining Workshops*, ICDM-W, 2013.

17 F. Johansson, T. Färdig, V. Jethava, and S. Marinov. Intent-aware temporal query modeling for keyword suggestion. In *Proc of the International Conference on Information and Knowledge Management Workshops*, CIKM-W, 2012.

Invited conference contributions

18 F D. Johansson, O. Frost, C. Retzner, and D. Dubhashi Classifying large graphs with differential privacy. In *Proc of Modeling Decisions for Artificial Intelligence*, MDAI, 2015.

Technical reports

19 FD. Johansson Machine Learning Analysis of Heterogeneity in the Effect of Student Mindset Interventions. In *arXiv preprint arXiv:1811.05975*, 2018.

20 F D. Johansson, N. Kallus, U. Shalit, D. Sontag. Learning Weighted Representations for Generalization Across Designs. In *arXiv preprint arXiv:1802.08598*, 2018.

21 O. Gottesman, FD. Johansson, et al. Evaluating Reinforcement Learning Algorithms in Observational Health Settings. In *arXiv preprint arXiv:1805.12298*, 2018.

22 E. Jorge, M. Kågebäck, F D. Johansson, E. Gustavsson. Learning to Play Guess Who? and Inventing a Grounded Language as a Consequence. In arXiv preprint arXiv: 1611.03218, 2016.

Other publications

23 F D. Johansson. Learning with geometric embeddings of graphs. *Doctoral Thesis*, 2017

24 F D. Johansson. Query Concept Interaction over Time. *MSc Thesis*, 2012

Pedagogical Achievements

Teaching experience

Massachusetts Institute of Technology

2018 Causal Inference & Deep Learning (Graduate level). Co-developer & lecturer. Course within the MIT IAP format with ∼70 students.

MIT Beavers Works Summer Institute (High-school level). Guest lecture: Clinical Machine Learning

Cornell Tech

2017 Causality and Learning for Intelligent Decision Making (Graduate level). Guest-lecture: Estimating Individual Treatment Effect: Generalization Bounds & Algorithms.

Columbia University

2015 Introduction to Machine Learning (Undergraduate level). Guest-lecture: Support Vector Machines & Kernels

Chalmers University of Technology

2016 Deep Learning (Graduate level). Co-developer & lecturer. Flipped classroom format with ∼30 students.

2015–2016 Algorithms for Machine Learning and Inference (Graduate level). Practice leader & guest lecturer.

2012–2016 Algorithms (Graduate level). Practice leader.

2012–2014 Algorithms, Advanced Course (Graduate level). Practice leader.

2013–2014 Data structures (Undergraduate level). Practice leader.

Student Supervision

Undergraduate Research Opportunities Program (UROP). MIT.

2019 Suchan Vivatsethachai. Discovering clinical practice variation.
Primary supervisor

2019 David Amirault. Bounding epistemic uncertainty in causal estimation
Primary supervisor

2018 Christina Ji. Sequential Decision Making in Healthcare.
Primary supervisor

MSc. Theses. Chalmers University of Technology.

2015 Henrik Alburg. Tracking temporal evolution in word meaning with distributed word representations.
Primary supervisor

Jonatan Kilhamn. Fast shortest-path kernel computations using approximate methods.
Primary supervisor

Kristoffer Tapper. Learning to rank, a supervised approach for ranking of documents.
Primary supervisor

2014 F Axelsson & B Rydback. Data-driven Coreference Resolution for Swedish.
Assistant supervisor. *Thesis work presented at SLTC '14*

Otto Frost & Carl Retzner. Graph Classification with Differential Privacy.
Primary supervisor. *Thesis work published in MDAI '15*

2013 Linus Hermansson & Tommi Kerola. Entity Disambiguation in Anonymized Graphs Using Graph Kernels.
Assistant supervisor. *Thesis work published in CIKM '13*

Pedagogical qualifications

Course: Teaching, Learning and Evaluation 3 HEC, Chalmers University of Technology

Research grants and funds

2017 MIT-IBM Watson AI Lab. Exploratory Proposal: *Making Interpretable Causal Estimation of Individual Effect into a Science: Addressing the U. S. Opioid Epidemic and Other Health Policies*. Co-wrote the application. Main applicant: David Sontag.

MIT-IBM Watson AI Lab. Exploratory Proposal: *Learning Optimal Dynamic Treatment Strategies from Temporal ICU Monitoring Data*. Co-wrote the application. Main applicant: David Sontag.

Roche-Genentech Project Grant. In collaboration with Brigham & Women's hospital. *Finding the Target Population for Tocilizumab Monotherapy in Rheumatoid Arthritis*. Co-wrote the application. Main applicant: David Sontag.

Office of Naval Basic Research Challenge: *Predictive and Causal Modeling—Bridging the Gap*. Co-wrote the application. Main applicant: David Sontag.

2015 Sverige-Amerika Foundation Fellowship
Funded research visits for 6 months at Columbia and NYU.

Professional Activities

Tutorials

2019 Causality & Causal Inference. *WASP Summer School, Stockholm*. Developed and delivered a 3-hour tutorial for 50–60 PhD students in the WASP program.

Talks & presentations

Invited talks

2018 Harvard School of Public Health Luncheon Seminar, Cambridge
Causal Effects and Overlap in High Dimensions

Microsoft Research Machine Learning Seminar, Seattle
Causal Effects and Overlap in High Dimensions

IBM Causal Inference Workshop, Cambridge
Causal Effects and Overlap in High Dimensions

UMass Amherst Learning and Friends Lunch, Amherst
Machine Learning for Estimating Causal Effects

Atlantic Causal Inference Conference, Pittsburgh
Empirical Investigations of Methods for Treatment Effect Heterogeneity

Atlantic Causal Inference Conference, Pittsburgh
Counterfactual prediction & Domain Adaptation in High Dimensions

Broad Institute, Cambridge MA
Causal Inference Primer

2016 Deep Learning Symposium, NIPS. (Invited as co-author. Did not give talk.)
Learning representations for counterfactual inference

Machine Learning—What, how and why? Göteborg Science Festival, Göteborg

Machine Learning Seminars, Linköping University, Sweden
What if...? Machine Learning and Causal Inference.

Machine Learning Workshop, Chalmers University of Technology
Introduction to Machine Learning

Göteborg Film Festival Panel, Chalmers University of Technology
Panel on Turing AI & The Imitation Game

Conference presentations

2017 International Conference on Machine Learning
Estimating individual treatment effect: generalization bounds and algorithms

International Conference on Machine Learning
Clustering by Sum of Norms: Stochastic Incremental Algorithm, Convergence and Cluster Recovery

2016 International Conference on Machine Learning
Learning representations for counterfactual inference

2015 International Conference on Knowledge Discovery & Data Mining
Learning with similarity functions on graphs using matchings of geometric embeddings

2014 International Conference on Machine Learning
Global graph kernels using geometric embeddings

2013 International Conference on Information & Knowledge Management
Entity disambiguation in anonymized graphs using graph kernels

Workshop organizer

2018 Beyond Prediction: Counterfactual Evaluation, Learning, and Intervention. Co-organizer. Workshop proposal in submission to *NIPS 2018*.

Student Volunteer

2015 The 21st Conference of Knowledge Discovery and Data Mining, (KDD)

2014 International Conference on Machine Learning (ICML)

Peer-review service (Selected)

Journal of Machine Learning Research (JMLR)
Uncertainty in Artificial Intelligence (UAI)

International Conference on Artificial Intelligence and Statistics (AISTATS)
Association for the Advancement of Artificial Intelligence (AAAI)
Neural Information Processing Systems (NIPS)
International Conference on Machine Learning (ICML)
International Conference on Knowledge Discovery and Data Mining (KDD)
European Conference on Machine Learning and Principles and Practice of Knowledge Discovery.

References

David Sontag, Massachusetts Institute of Technology, USA
Postdoctoral advisor

Devdatt Dubhashi, Chalmers University of Technology, Göteborg, Sweden
Doctoral advisor

Finale Doshi-Velez, Harvard University, USA
Chiranjib Bhattacharyya, Indian Institute of Science, Bangalore, India
Nathan Kallus, Cornell Tech, USA

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