Fredrik D. Johansson

Assistant professor
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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.

2021– **Member of the management group**
Chalmers AI Research Centre

2021– **Profile leader: Digitalization, Big Data & AI**
Health Engineering Area of Advance, Chalmers

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 FD Johansson, U Shalit, N Kallus, D Sontag, Predicting Progression & Generalization Bounds and Representation Learning for Estimation of Potential Outcomes and Causal Effects. *Journal of Machine Learning Research* (JMLR, to appear), 2022.

2 HV Dansson, L Stempfle, H Egilsdóttir, A Schliep, E Portelius, K Blennow, H Zetterberg, F D Johansson, Predicting Progression & Cognitive Decline in Amyloid-Positive Patients with Alzheimerś Disease. *Alzheimer's Research & Therapy*, 2021.

3 Johansson, F.D., Collins, J.E., Yau, V., Guan, H., Kim, S.C., Losina, E., Sontag, D., Stratton, J., Trinh, H., Greenberg, J. and Solomon, D.H., Predicting Response to Tocilizumab Monotherapy in Rheumatoid Arthritis: A Real-World Data Analysis Using Machine Learning. *The Journal of Rheumatology*, 2021.

4 Solomon, D.H., Xu, C., Collins, J., Kim, S.C., Losina, E., Yau, V. and Johansson, F.D., The sequence of disease-modifying anti-rheumatic drugs: pathways to and predictors of tocilizumab monotherapy. *Arthritis Research & Therapy*, 23(1), pp.1-9, 2021.

5 JE Collins, FD Johansson, S Gale, S Kim, S Shrestha, D Sontag, J Stratton, H Trinh, C Xu, E Losina, DH Solomon *ACR open rheumatology*, 2(2), pp.65-73, 2021.

6 N. Kriege, F D. Johansson, C. Morris, A Survey on Graph Kernels. *Applied Network Science*, 5(1), pp.1-42, 2020.

7 F D. Johansson, Machine Learning Analysis of Heterogeneity in the Effect of Student Mindset Interventions. *Observational Studies 5, 71–82*, 2019.

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

9 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

10 A Matsson, FD Johansson. Case-based off-policy policy evaluation using prototype learning. In *Uncertainty in Artificial Intelligence*, UAI (to appear), 2022.

11 N Mwai Kinyanjui, FD Johansson. ADCB: An Alzheimer's disease simulator for benchmarking observational estimators of causal effects. In *Proceedings of Conference on Health, Inference, and Learning*, CHIL, (to appear), 2022.

12 R Karlsson, M Willbo, Z Hussain, RG Krishnan, D Sontag, FD Johansson. Using Time-Series Privileged Information for Provably Efficient Learning of Prediction Models. In *The 25th International Conference on Artificial Intelligence and Statistics*, AISTATS, 2022.

13 E Carlsson, D Dubhashi, FD Johansson. Learning Approximate and Exact Numeral Systems via Reinforcement Learning. In *Proceedings of the Annual Meeting of the Cognitive Science Society*, CogSci, 2021.

14 E Carlsson, D Dubhashi, FD Johansson. Thompson Sampling for Bandits with Clustered Arms. In *Proceedings of the Thirtieth International Joint Conference on Artificial Intelligence*, IJCAI, 2021.

15 Samuel Håkansson, Viktor Lindblom, Omer Gottesman, Fredrik D. Johansson. Learning to search efficiently for causally near-optimal treatments. In *Proc. of Neural Information Processing Systems*, NeurIPS, 2020.

16 Maggie Makar, Fredrik D. Johansson, John Guttag, David Sontag. Estimation of Bounds on Potential Outcomes For Decision Making. In *Proc. of the International Conference on Machine Learning*, ICML, 2020.

17 M. Oberst, FD. Johansson, D. Wei, T. Gao, G. Brat, D. Sontag, KR. Varshney. Characterization of Overlap in Observational Studies. In *Proc. of Artificial Intelligence and Statistics*, AISTATS, 2020.

18 J Collins, F Johansson, S Gale, S Kim, S Shrestha, D Sontag, J Stratton, T Huong, C Xu, E Losina, D Solomon. Predicting Remission Among Patients With Rheumatoid Arthritis Starting Tocilizumab Monotherapy: Model Derivation and Validation Using Conventional Regression and Machine Learning. *Annals of the Rheumatic Diseases 2019;78:727*, 2019.

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

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

21 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

22 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

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

24 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*, NeurIPS, 2015.

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

26 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.

27 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.

28 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.

29 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.

Invited conference contributions

30 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

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

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

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

34 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

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

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

Pedagogical Achievements

Teaching experience

Chalmers University of Technology

2020– Causality & causal inference (PhD course). Developer & lecturer.
Developed and delivered all lectures and assignments.

2020– Design of AI systems (MSc course). Co-developer & lecturer.
Developed and delivered the majority of lectures and assignments.

2016 Deep Learning (PhD course). 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 (MSc course). Practice leader.

2012–2014 Algorithms, Advanced Course (MSc course). Practice leader.

2013–2014 Data structures (BSc course). Practice leader.

Massachusetts Institute of Technology

2019 Machine Learning for Healthcare (Graduate level).
Guest lecture: Reinforcement learning

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

Student Supervision

PhD Students.

2021– Tobias Karlsson. Chalmers University of Technology.
Co-supervisor

2021– Mena Nadum. Chalmers University of Technology.
Main supervisor

2020– Newton Mwai. Chalmers University of Technology.
Main supervisor

2020– Adam Breitholtz. Chalmers University of Technology.
Main supervisor

2020– Lena Stempfle. Chalmers University of Technology.
Main supervisor

2020– Anton Matsson. Chalmers University of Technology.
Main supervisor

2019– Emil Carlsson. Chalmers University of Technology.
Co-supervisor

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 (selected). Chalmers University of Technology.

2022 Bastian Jung. Efficient learning with privileged information in nonlinear time series

2021 Rickard Karlsson, Martin Willbo. Learning using Privileged Time Series

2020 Samuel Håkansson, Viktor Lindblom. Efficient search for effective treatments

2020 Hakon Valur, Hildur Egilsdottir. Artificial Intelligence for Clinical Diagnostics in Alzheimer's disease

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

Completed courses in pedagogical development

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

Supervising research students 3 HEC, Chalmers University of Technology

Supervising writing processes 2.5 HEC, Chalmers University of Technology

Pedagogical project 5 HEC, Chalmers University of Technology

Theoretical perspectives on learning 2.5 HEC, Chalmers University of Technology

Research grants and funds

2020 WASP-AI Collaboration Project. Knut och Alice Wallenbergs Stiftelse. Funding: 2 PhD Student, 1 industry PhD student. (4 years) Co-PI with Uppsala University & Astra Zeneca.

2020 Vetenskapsrådet. Kombinera satelliter och artificiell intelligens för att mäta fattigdom mellan 1982-2020 och använda dessa data för att förklara effekterna av Världsbankens och Kinesiska utvecklingsprogram i Afrika. Funding: 18M SEK over 6 years. (Co-applicant)

DSRE Seed project. Observatory of poverty – Harnessing machine intelligence to detect African poverty and inequality from satellite images. Funding: 300 kSEK (Co-applicant)

CHAIR Seed grant. Poverty traps in Afrika. Funding: 3M SEK over 3 years. (Co-applicant)

CHAIR Seed grant. AI and Missingness in Diagnostics for Alzheimer's Disease. 300 kSEK (PI)

CHAIR Seed grant. Yata – Intelligent systems to improve and support education. 300 kSEK (Named collaborator)

2019 Formas. Poverty traps in Africa. Funding: 3 MSEK (3 years) (Co-applicant)

2019 WASP-AI/Math PhD Project. Knut och Alice Wallenbergs Stiftelse. Funding: 1 PhD Student salary (4 years)

2018 WASP-AI/MLX Professorship. Knut och Alice Wallenbergs Stiftelse. Funding: Own salary (4 years), 2 PhD Student salaries (4 years), 2 Post-doc salaries (2 years).

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 Experience

Consulting services

2019 Advisor at Human Longevity, Inc. Advise the data science team on problems related to healthcare and causal inference.

Conference & workshop organization

2020 Conference on Uncertainty in Artificial Intelligence (UAI)
Publication chair

2020 3rd Swedish AI Society Workshop (SAIS)

Program chair

2018 Beyond Prediction: Counterfactual Evaluation, Learning, and Intervention. Workshop proposal submitted to *NeurIPS 2018*. Co-organizer.

Tutorials

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

Invited talks & presentations

Invited talks (selected)

2022 UR Samtiden (National public broadcaster)
Hur lär sig maskiner att lösa problem med AI?

Inria Soda Seminar
Causal effects, generalization bounds and learned representations

2021 Falsterbo-Skytts Rotaryklubb
Artificiell intelligens i vården

WASP4All
Making the most of machine learning for better decisions

2020 Biotech Atelier
Machine Learning for predicting progression of Alzheimer's disease

Vetenskapsfestivalen, Gothenburg
Algoritmer som beslutsstöd—Är det rättvist?

2019 Seminar at the Division of Systems and Control, Uppsala University, Sweden
Machine Learning, Causality & Decision-making

Joint Statistical Meeting (JSM), Denver, Colorado
Machine Learning and Overlap in Observation Studies

Harvard Center for Population and Dev Studies Lunch Seminar, Boston, MA
Machine Learning for Causal Effect Estimation

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, NeurIPS. (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 (selected)

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

Volunteer

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

2014 International Conference on Machine Learning (ICML)

Program committee (reviewer or area chair) (Selected)

Transactions of Machine Learning Research (TMLR)
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 (NeurIPS)
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.