Sanae Lotfi

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Research Interests

Robustness to Distribution Shift, Out-of-Distribution Generalization, Probabilistic Modeling, Bayesian Learning, Large-Scale Optimization, and Time Series Modeling.

Education

2020–current **Ph.D. in Data Science, New York University**, USA
GPA: 4.0/4.0
- Supervisor: Andrew Gordon Wilson
- Affiliations: CDS, CILVR

2018–2020 **M.Sc. in Applied Mathematics, Polytechnique Montreal**, Canada
GPA: 4.0/4.0
- Supervisors: Andrea Lodi, Dominique Orban
- Affiliations: MILA, CERC, GERAD

2015–2018 **M.Eng. in Applied Mathematics, Centrale Paris**, France
GPA: 3.97/4.33

Publications

Conference papers:

2022 PAC-Bayes Compression Bounds So Tight That They Can Explain Generalization
Sanae Lotfi*, Sanyam Kapoor*, Marc Anton Finzi, Andres Potapczynski, Micah Goldblum, Andrew Gordon Wilson (*: equal contribution)
Neural Information Processing Systems (NeurIPS), to appear on arxiv and conference proceedings

2022 Bayesian Model Selection, the Marginal Likelihood, and Generalization [arxiv]
Sanae Lotfi, Pavel Izmailov, Gregory Benton, Micah Goldblum, Andrew Gordon Wilson
International Conference on Machine Learning (ICML), **long oral presentation, top 2% submissions**
Outstanding Paper Award

2022 Adaptive First- and Second-Order Algorithms for Large-Scale Machine Learning [arxiv]
Sanae Lotfi, Tiphaine Bonniot de Ruisselet, Dominique Orban, Andrea Lodi
Annual Conference on Machine Learning, Optimization, and Data Science (LOD), **oral presentation**

2022 Evaluating Approximate Inference in Bayesian Deep Learning [pmlr]
Andrew Gordon Wilson, **Sanae Lotfi**, Sharad Vikram, Matthew D. Hoffman, Yarin Gal, Yingzhen Li, Melanie F. Pradier, Andrew Foong, Sebastian Farquhar, Pavel Izmailov
NeurIPS Competition and Demonstration Track, Proceedings of Machine Learning Research (PMLR)

2022 Ocular Cataract Identification Using Deep Convolutional Neural Networks
Feliciana Manuel, Saide Saide, Felermino Ali, **Sanae Lotfi**
International Conference on Intelligent and Innovative Computing Applications

2021 Dangers of Bayesian Model Averaging under Covariate Shift [arxiv]
Pavel Izmailov, Patrick Nicholson, **Sanae Lotfi**, Andrew Gordon Wilson
Neural Information Processing Systems (NeurIPS)

2021 Stochastic Damped L-BFGS with Controlled Norm of the Hessian Approximation [arxiv]
Sanae Lotfi, Tiphaine Bonniot de Ruisselet, Dominique Orban, Andrea Lodi
SIAM Conference on Optimization, 2021, **oral presentation**

2021 Loss Surface Simplexes for Mode Connecting Volumes and Fast Ensembling [arxiv]
Gregory W. Benton, Wesley J. Maddox, **Sanae Lotfi**, Andrew Gordon Wilson
International Conference on Machine Learning (ICML), **spotlight presentation**

Publications Cont.

Workshop papers:

2020 Stochastic Damped L-BFGS with Controlled Norm of the Hessian Approximation [arxiv]
Sanae Lotfi, Tiphaine Bonniot de Ruisselet, Dominique Orban, Andrea Lodi
NeurIPS Optimization for Machine Learning Workshop, **spotlight presentation**

2019 Home Health Care Resource Allocation Problem: A Reinforcement Learning Approach
Sanae Lotfi, Abderrahim Khalifa, Amine Bellahsen, Ola Bdawy, Loubna Benabbou, Ismail El Hallaoui
NeurIPS ML for the Developing World Workshop

2019 Planning in home Health Care Structures using Reinforcement Learning [pdf]
Sanae Lotfi, Abderrahim Khalifa, Amine Bellahsen, and Loubna Benabbou
ICLR AI for Social Good Workshop, problem introduction track, **oral presentation**

Thesis:

2020 Stochastic First and Second Order Optimization Methods for Machine Learning [polymtl]
Sanae Lotfi
Master's thesis, Polytechnique Montreal
Best Master's Thesis Award, Department of Mathematics and Industrial Engineering

Awards and Honors

2022-2023 **Meta AI Research Funding**
Covers full tuition and stipend as a part of the Meta AI Mentorship Program

2022 **Outstanding Paper Award, International Conference on Machine Learning (ICML)**
Awarded for first-authored paper "Bayesian Model Selection, the Marginal Likelihood, and Generalization"

2020 – 2021 **DeepMind Fellowship**
One of three DeepMind Fellows to join NYU in 2020–2021

2020 **McKinsey First Generation Achievement Award**
Prize for outstanding individuals who are the first in their family to earn a higher-education degree

2020 – 2025 **Data Science Graduate Fellowship**
5-year graduate fellowship awarded by NYU Center for Data Science

2020 **Best Master's Thesis Award at Polytechnique Montreal**
Awarded by the department of Mathematics and Industrial Engineering at Polytechnique Montréal

2015 – 2018 **French Government Scholarship for Excellence**
3-year scholarship. Awarded for ranking 2nd in CentraleSupélec's entrance exam

2013 – 2021 **Académie Hassan II Scholarship for Excellence**
8-year scholarship. Awarded for ranking 1st in a nationwide open competition in mathematics

2010 – 2013 **Various first prizes in regional mathematics and physics Olympiads in Morocco**

Work Experience

Oct. 2022 – current **Visiting Researcher, Meta AI, Fundamental AI Research (FAIR)**, New York, USA
- Supervisor: Brandon Amos.
- Research on robustness to model misspecification.

May – Oct. 2022 **Applied Scientist Intern, Amazon AWS**, Santa Clara, USA
- Supervisors: Yuyang (Bernie) Wang and Richard Kurle.
- Research on time series modeling under distribution shift.

Feb. – Aug. 2018 **Research Intern, Air Liquide**, Paris, France
- Designing algorithms to predict the gas consumption and optimize the production planning.

July – Dec. 2017 **Research Intern, BeeBryte**, Singapore
- Developing and optimizing strategies for trading and hedging in the electricity markets.

June – July 2016 **Research Assistant, USTEM (Electron Microscopy Laboratory)**, Vienna, Austria
- Conducting mathematical and numerical simulations of the atomic diffusion in dissimilar materials.

Selected Talks

Bayesian Model Selection, the Marginal Likelihood, and Generalization

2022 ML Collective, Deep Learning: Classics and Trends
2022 Amazon Web Services, Forecast Science Talks
2022 International Conference on Machine Learning (ICML), Long Oral, [video]
2022 INRIA Social Data Group
2022 Morocco AI, Webinar Series, [video]
2022 Center for Data Science Graduate Student Seminar

Understanding and Quantifying Generalization in Deep Learning Models

2021 DeepMind Montreal
2021 Women in Data Science at NYU

Dangers of Bayesian Model Averaging under Covariate Shift

2021 Neural Information Processing Systems (NeurIPS), [video]
2021 Women in Mathematics at NYU, Research Talks

Adaptive First and Second Order Algorithms for Large-Scale Machine Learning

2021 SIAM Conference on Optimization
2020 NeurIPS Optimization for ML Workshop, Spotlight Presentation, [video]
2019 Montreal Machine Learning and Optimization Group

Planning in Home Health Care Structures using Reinforcement Learning

2019 ICLR AI for Social Good, Spotlight Presentation

Invited Panels

2022 Affinity Group Supported Pathways to ML Research Panel and Social, International Conference on Artificial Intelligence and Statistics (AISTATS)
2021 Data Science Career Panel, Women in Data Science (WiDS) at NYU

Other Research Projects and Surveys

2022 Understanding the Generalization of Deep Neural Networks through PAC-Bayes bounds [report]
Joint with Andres Potapczynski, Anthony Chen, and Chris Ick

2021 Causal Representation Learning [report]
Joint with Taro Makino and Lily Zhang

2019 Analysis of High Dimensional Distributions with Decoupled Norm and Direction [report]
Joint with Jose Gallego, Ankit Vani, and Max Schwarzer

2019 Variance Reduction with Neighbours for Adaptive Optimization [report]
Joint with Jose Gallego

Teaching

2021 - 2022 New York University
- Section Leader for "DS-GA 3001: Introduction to Data Science for PhD Students"
- Grader for "DS-GA 1004: Big Data"

2019 - 2020 University of Montreal
- Teaching Assistant for "IFT 6135: Representation Learning"
- Section Leader for "MTH3302: Probability and Statistics for AI"

Professional and Community Activities

Reviewing

Conferences NeurIPS 2022, ICML 2022

Workshops NeurIPS 2022 Women in Machine Learning Workshop - Area Chair, NeurIPS 2021 Bayesian Deep Learning Workshop, NeurIPS 2019 Women in Machine Learning Workshop

Organizing and Leadership

2022 Co-leader of the "Robustness of Deep Learning Models to Distribution Shift" session at the Women in Machine Learning Workshop, ICML

2021 Founding organizer of research talks, *Tea-Talks*, at the NYU Association of Women in Mathematics

2021 Co-organizer of the NeurIPS competition "Approximate Inference in Bayesian Deep Learning"

2017 Leader of a mental health campaign to promote emotional well-being and prevent suicide among hundreds of students at Centrale Paris

2016 Co-founder of the competitive programming association at Centrale Paris

Research Mentorship

2021 Mentored Feliciana Manuel to conduct her undergraduate research on "Cataract Identification using Deep Learning on Retinal Images" at Lúrio University, Mozambique. Research paper accepted to the 2022 International Conference on Intelligent and Innovative Computing Applications.

Outreach and Volunteering

2022 Student volunteer at the International Conference on Machine Learning (ICML)

2021-2022 Mentor for the Deep Learning Indaba Mentorship Programme to support and strengthen the African machine learning community

2019 Graduate student representative in the Disciplinary Board at Polytechnique Montreal

2016-2018 Mathematics and physics instructor for students from disadvantaged backgrounds at Renovo

Summer Schools

2021 Deep Learning Theory Summer School at Princeton

2021 Harnessing Quantum Matter Data Revolution, Virtual Summer School, Teaching Assistant

Technical Skills

Proficient Python (Scikit-learn, SciPy stack, PyTorch), Git, Latex

Experienced TensorFlow, Julia, Matlab, R

Selected Media Coverage

2021 *Scholar Q&A: Sanae*, DeepMind

2020 *DeepMind Fellow Profile: Sanae Lotfi*, NYU Center for Data Science

2016 *Barcelonnette vise l'autonomie énergétique*, Magazine Barcelonnette