Ilia Sucholutsky

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Education

PhD, Statistics, University of Waterloo ***(Sept 2017 – June 2021)***
BMath with Distinction, Statistics, University of Waterloo ***(Sept 2014 – Aug 2017)***

Research Experience

Postdoctoral Research Associate/Fellow, Princeton University ***(July 2021 - Present)***

Topic 1: Efficient deep representation learning
Topic 2: 'Less than one'-shot learning in humans and machines
Topic 3: Maximizing the value of human supervision
Supervisor: Dr. Tom Griffiths, Cognitive Science and Computer Science

PhD Research, University of Waterloo ***(Sept 2017 - June 2021)***

Topic 1: Deep learning for anomaly detection and loss restoration
Topic 2: Soft-label dataset distillation
Topic 3: "Less than one"-shot learning: Learning N classes using M<N samples
Thesis: Learning with almost no data
Supervisor: Dr. Matthias Schonlau, Statistics and Actuarial Science

Research Associate, University of Waterloo ***(May 2017 - Aug. 2017)***

Topic: Deep learning for anomaly detection in safety-critical real-time embedded systems
Supervisor: Prof. Sebastian Fischmeister, ECE

Research Assistant, University of Waterloo ***(May 2017 - Aug. 2017)***

Topic: Customizable neural networks in Stata
Supervisor: Dr. Matthias Schonlau, Statistics and Actuarial Science

Research Assistant, University of Waterloo ***(Nov. 2016 - Apr. 2017)***

Topic: Text mining with n-gram variables
Supervisor: Dr. Matthias Schonlau, Statistics and Actuarial Science

Industry Experience

AI Advisor, Kin-Keepers ***(May 2021 - Present)***

The Kin-Keepers mission is to improve quality of life for those suffering from incurable cognitive declines like Alzheimer's and other forms of dementia by helping them communicate and feel understood.

AI Advisor, StratumAI ***(Aug 2020 - Present)***

Leading research and development of algorithms to make mining efficient and environmentally sustainable
Adapting deep learning methods for 3D spatial regression on highly sparse datasets
Improving explainability and uncertainty estimation of neural network predictions
Developing methods for integrating geological insights as priors into neural network training

Data Guru (Research Team), Athos ***(May 2016 – Aug. 2016)***

Created Luigi pipelines to automate away EMR jobs saving each team member an average of 8-10 hours per week
Increased calibration accuracy by 90% by creating patch to recalculate values in backend and push to users' app
Developed and automated system for surfacing defect analytics internally, leading to 10% increase in contact quality
Investigated root cause of churn and improved user experience through visualizations of progress metrics
Extracted new features from multi-channel time-series data including real 3D motion and muscle-use timing
Performed study on data from elite and non-elite athletes to determine what leads to high performance

Data Scientist, Capital One ***(May 2015 – Aug. 2015)***

Completed cross-functional Facebook advertising insourcing project start-to-finish
Increased app volume to 260% and decreased cost per app by 50% with net benefit of $2 million per year
Interfaced with Facebook API programmatically to create a fully automated data pipeline
Used NLP techniques to identify relevant demographic segments
Performed rank-order and slope analysis to identify optimal bids for demographic segment
Transitioned model and data infrastructure from Linux server to Hadoop

Consulting Experience

Consulting and Advising ***(Jan. 2017 – July 2021)***

Helped rapidly growing accounting firm automate data-entry/bookkeeping pipelines
Received controlled goods clearance and provided ML consulting to a large defence contractor
Worked with a mining startup to improve their results when using deep learning to model extremely sparse 3D data
Consulted fintech startup on improving data-efficiency using latest few-shot, active, and online learning research
Developed R&D plan for deepfake entertainment startup (10M+ users) to improve models and enable efficient scaling
Advised (pro-bono) early-stage startups on developing ML systems, planning ML R&D, getting the most out of data, etc.

President, UW Apprentice ***(Jan. 2015 – Jan. 2017)***

Managed diverse team of 40 students spanning two universities
Provided pro-bono consulting to 20+ startups ranging from pre-seed to Series B
Negotiated sponsorship deals with firms including Blackberry, Kik, Capital One, and Velocity to fund this initiative

Academic and Administrative Experience

Instructor, University of Waterloo ***(Jan 2020 - April 2020)***

Course: Stat 231 - Statistics
Evaluation: Received a 4.4 (out of 5) weighted score on student evaluations

Co-founder & Treasurer, Stats Anti-Depression (S.A.D.) Club ***(Jan 2018 - May 2021)***

Started grassroots mental health initiative for graduate students
S.A.D. Club provides students with a safe, relaxed, social setting where they can unwind, socialize with peers, have some nutritious snacks, and hopefully just overall reduce their stress levels

Teaching Assistant, University of Waterloo ***(Jan. 2017 – Apr. 2017)***

Course: Math 135 - Algebra for Honours Mathematics

Teaching Assistant, University of Waterloo ***(Sept. 2016 – Dec. 2016)***

Course: Math 114 - Linear Algebra for Science

Student Councillor, FEDS, University of Waterloo ***(May 2016 – Apr. 2017)***

Elected to represent undergraduate mathematics students

Supervision and Collaboration

Virtual Machine Learning Research Lab

I started and run the Virtual Machine Learning Research (VMLR) Lab. VMLR Lab is an unofficial virtual lab where students and recent graduates can work on machine learning and deep learning research under my mentorship. I mentor over 40 members from around the world, working in groups on 11 research projects. Topics being researched include: explainability in computer vision, synthetic data for active learning, real-time audio-to-video synthesis, natural language augmentations, few-shot image classification, reinforcement learning for process control, and several more.

Ongoing Collaborations

CBRE - Extreme Few-Shot Learning with Hierarchical Classification and Interpretable Features

Stratum.ai - Deep Learning for Resource Modeling and Other Mine Planning Applications

WOMBO.ai - Extracting Underlying Driving Video Information from Deepfake Faceswaps

UC Davis, Pathology and Laboratory Medicine - Multi-Modal Multi-Task Few-Shot Learning for Renal Pathology

Community Building and Memberships

Peer Reviewer - BMC Medical Imaging
Peer Reviewer - Electronics Letters
Peer Reviewer - The Stata Journal
Peer Reviewer - 2020 IEEE International Conference on Systems, Man and Cybernetics (SMC 2020)
PC Member - The 7th IEEE International Conference on Data Science and Advanced Analytics 2020 (DSAA 2020) Special Session: Data Science for Cyber Physical Systems
Member - International Neural Network Society
Member (Student) - American Statistical Association
Associate Member (Student) - Statistics Society of Canada

Honors

NSERC Postdoctoral Fellowship	**(Apr. 2022 - Mar. 2024)**
Waterloo AI Institute Graduate Scholarship	**(Jan. 2020)**
Statistics and Actuarial Science Chair's Award	**(Sept. 2020)**
Ontario Graduate Scholarship	**(Jan. 2021 - Dec. 2021)**
SSC Student Travel Award for the 2020 SSC Annual Meeting	**(June 2020)**
Ontario Graduate Scholarship	**(Jan. 2020 - Dec. 2020)**
Statistics and Actuarial Science Chair's Award	**(Sept. 2019)**
Math Senate Graduate Scholarship	**(Jan. 2019)**
Statistics and Actuarial Science Chair's Award	**(May 2018)**
Faculty of Mathematics Scholarship (recurring)	**(Sept. 2014 - Aug. 2017)**
University of Waterloo President's Scholarship	**(Sept. 2014)**

Research

Peer-reviewed

1. Sucholutsky, I., Schonlau, M. Soft-label dataset distillation and text dataset distillation. International Joint Conference on Neural Networks (IJCNN), 2021. Forthcoming. Pre-print available at arXiv:1910.02551.
2. Sucholutsky, I., Kim, N., Schonlau, M. One line to rule them all: Generating LO-shot soft-label prototypes. 2021 International Joint Conference on Neural Networks (IJCNN), 2021. Forthcoming. Pre-print available at arXiv:2102.07834.
3. Sucholutsky, I., Schonlau, M. `Less Than One'-Shot Learning: Learning N Classes From M < N Samples. Proceedings of the AAAI Conference on Artificial Intelligence, 35(11), 9739-9746. ***See below for press coverage on this research.***
4. Sucholutsky, I., Schonlau, M. SecDD: Efficient and Secure Method for Remotely Training Neural Networks (Student Abstract). Proceedings of the AAAI Conference on Artificial Intelligence, 35(18), 15897-15898.
5. Sucholutsky I, Schonlau M. 2021. Optimal 1-NN prototypes for pathological geometries. PeerJ Computer Science, 7:e464, April 2021.
6. Sucholutsky, I., Narayan, A., Schonlau, M., Fischmeister, S. Pay attention and you won't lose it: a deep learning approach to sequence imputation. PeerJ Computer Science, 5:e210, August 2019.
7. Sucholutsky, I., Narayan, A., Schonlau, M., Fischmeister, S. Deep learning for system trace restoration. In 2019 International Joint Conference on Neural Networks (IJCNN). IEEE, July 2019. doi: 10.1109/IJCNN2019.8852116. Pre-print at arXiv:1904.05411.
8. Sucholutsky, I., Schonlau, M. ConvART: Improving adaptive resonance theory for unsupervised image clustering. Journal of Computational Vision and Imaging Systems. Dec 2018, 4(1).
9. Schonlau, M., Guenther, N. Sucholutsky, I. Text mining using ngram variables. The Stata Journal. Dec 2017, 17(4), 866-881. Preprint also available at http://ssrn.com/abstract=2759033.

Presentations

AAAI 2021 Main Track - "Less than one"-shot learning: learning N classes using M<N samples.
AAAI 2021 Student Abstract and Poster Program - SecDD: Efficient and Secure Method for Remotely Training Neural Networks

International Joint Conference on Neural Networks 2021 (IJCNN) - Soft Label Data Distillation and Text Data Distillation
International Joint Conference on Neural Networks 2021 (IJCNN) - Generating LO-shot soft-label prototypes

International Joint Conference on Neural Networks 2019 (IJCNN) - Deep Learning for System Trace Restoration

4th Annual Conference on Vision and Intelligent Systems (CVIS 2018) - ConvART: Improving Adaptive Resonance Theory for Unsupervised Image Clustering

University of Toronto StartAI 2018 Conference - Making the Most of Graduate Research in AI

Statistics Society of Canada Annual Meeting 2018 - Deep Learning for Lost Data Restoration and Imputation. Abstract available at https://ssc.ca/en/meeting/annual/presentation/deep-learning-lost-data-restoration-and-imputation

University of Waterloo Data Science Club - Part 1: Deep Learning for Lost Data Restoration and Imputation
University of Waterloo Data Science Club - Part 2: Breaking into Deep Learning: 5 Projects To Get You Inspired
University of Waterloo Real-time Embedded Systems Group - A Gentle Introduction to Generative Adversarial Networks

Press Coverage

MIT Technology Review - A radical new technique lets AI learn with practically no data
"This could make AI more accessible to companies and industries that have thus far been hampered by the field's data requirements. It could also improve data privacy, because less information would have to be extracted from individuals to train useful models."

Scientific American - How to Make Artificial Intelligence More Democratic
"Not only does LO-shot learning make the barriers to entry lower by reducing training costs and lowering data requirements, but it also provides more flexibility for users to create novel data sets and experiment with new approaches. By reducing the time spent on data and architecture engineering, researchers looking to leverage AI can spend more time focusing on the practical problems they are aiming to solve."

Digital Trends - This groundbreaking new style of A.I. learns things in a totally different way
"... a new research paper from the University of Waterloo in Ontario describes a potential breakthrough process called LO-shot (or less-than-one shot) learning. This could enable machines to learn far more rapidly in the manner of humans. That would be useful for a wide range of reasons, but particularly scenarios in which large amounts of data do not exist for training."

KDnuggets* - *Doing the impossible? Machine learning with less than one example
"Machine learning algorithms are notoriously known for needing data, a lot of data -- the more data the better. But, much research has gone into developing new methods that need fewer examples to train a model, such as "few-shot" or "one-shot" learning that require only a handful or a few as one example for effective learning. Now, this lower boundary on training examples is being taken to the next extreme."

Actu IA - Des chercheurs de l'Université de Waterloo présentent le Less Than One-Shot Learning pour créer des modèles sur des datasets limités
"Ilia Sucholutsky et Matthias Schonlau, tous deux chercheurs au sein de l'University of Waterloo, au Canada, ont développé une nouvelle méthode visant à rendre le machine learning plus efficace, même avec des datasets limités."

Radical Ventures - Radical Reads: A radical new technique lets AI learn with practically no data
"Research breakthroughs on few-shot learning could make a big difference for AI research and applications which depend on large datasets and the expensive cloud compute infrastructures required to train AI. The less data needed to train AI, the more accessible the technology will be for companies and industries, and the lower the costs of computation. There may also be privacy benefits as less information must be collected to create useful models."

TechTalks - Machine learning with less than one example

The Next Web - How 'less-than-one-shot learning' could open up new venues for machine learning research

Singularity Hub - How Future AI Could Recognize a Kangaroo Without Ever Having Seen One

Tech Xplore - A math idea that may dramatically reduce the dataset size needed to train AI systems

Nikola News - Researchers Demonstrate Less-than-One Shot Machine Learning

University of Waterloo Stories - There's a new faster way to train AI

Digital Today - 데이터 많이 필요 없는 AI 시대가 오고 있다

University of Waterloo Imprint - Know more than you know

AI.Science - 'Less Than One'-Shot Learning