Vinith M. Suriyakumar

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Research Interests	**Areas:** Machine Learning, Theoretical Computer Science **Topics:** Differential Privacy, Algorithmic Fairness, Cryptography **Applications:** Healthcare & Social Welfare

Education

University of Toronto, Toronto, Ontario Canada

Department of Computer Science
M.S., Computer Science (Machine Learning), Sept 2019 - Present
GPA: 3.90/4.00
Focus: Differential Privacy, Algorithmic Fairness, and Cryptography for ML4H
Advisors: Dr. Marzyeh Ghassemi, Dr. Nicolas Papernot, Dr. Anna Goldenberg, Dr. Berk Ustun
Affiliations: Vector Institute, The Hospital for Sick Children

Queen's University, Kingston, Ontario Canada

School of Computing
B.Computing., Biomedical Computing, May, 2019
GPA: 4.14/4.30 (Overall), 4.30/4.30 (Major)
Thesis: Deep Classification and Generative Models for Prostate Cancer MRIs
Advisors: Dr. Gabor Fichtinger & Dr. Parvin Mousavi
Affiliations: Kingston Health Sciences Centre

Honors and Awards

Ethics of AI Graduate Research Fellowship, University of Toronto, August 2020

Vector Institute Research Grant, April 2020

Mitacs Accelerate Research Fellowship, December 2019

University of Toronto Arts and Science Fellowship, September 2019

Queen's University: Graduated Dean's Honor List with Distinction, June 2019

NSERC Industrial Undergraduate Research Award, August 2017

1st Degree Black Belt in Karate, October 2010

Academic Experience

University of Toronto, Toronto, Ontario Canada

Graduate Student **September, 2019 - Present**

Includes current Masters level coursework and research projects. Courses: Machine Learning, Neural Networks and Deep Learning, Probabilistic Learning and Reasoning, Ethics of AI in Context

Teaching Assistant **September, 2019 - present**

Duties at various times have included office hours, assignment and exam marking, assignment development, and holding tutorials. Courses: Introduction to Databases, Introduction to Artificial Intelligence, and Capstone Design Project.

Queen's University, Kingston, Ontario Canada

Research Assistant **September, 2017 - May, 2019**

Worked in biomedical engineering lab developing generative models to improve MRI image quality from 1.5T to 3.0T for improving image quality in developing / rural regions. Developed classification models using neural networks to detect cancer lesions in prostate MRIs. Worked on combination of graphics and HCI research developing open source treatment planning visualization system with over 10 000 downloads worldwide.

Peer Tutor **September 2016 - May 2017**

Individualized tutoring for students in introductory computer science courses such as discrete mathematics and introduction to programming.

Publications

Suriyakumar, V.M., N. Papernot, A. Goldenberg, and M. Ghassemi. 2020. Chasing Your Long Tails: Differentially Private Prediction in Health Care Settings, ACM FAccT 2021 (Accepted).

Cheng, V., V.M. Suriyakumar, N. Dullerud, S. Joshi, and M. Ghassemi. 2020. Can You Fake It Until You Make It?: Impacts of Differentially Private Synthetic Data on Downstream Classification Fairness, ACM FAccT 2021 (Accepted).

Suriyakumar, V.M., N. Papernot, A. Goldenberg, and M. Ghassemi. 2020. The Challenges of Differentially Private Prediction in Healthcare, NeurIPS 2020 Privacy Preserving Machine Learning Workshop (Accepted).

Suriyakumar, V.M., N. Papernot, A. Goldenberg, and M. Ghassemi. 2020. The Pitfalls of Differentially Private Prediction in Healthcare, Theory and Practice of Differential Privacy 2020 (Accepted).

Chang. A*, V.M. Suriyakumar*, A. Moturu*, N. Tewattanarat, A. Doria, and A. Goldenberg. 2020. Using Generative Models for Pediatric wbMRI. Medical Imaging in Deep Learning 2020. * denotes equal contribution.

Suriyakumar, V.M., R. Xu, C. Pinter, G. Fichtinger. Collision detection for external beam radiation therapy applications in SlicerRT. 2017. Imaging Network Ontario Conference.

Suriyakumar, V.M., R. Xu, C. Pinter, G. Fichtinger. Open-source software for collision detection in external beam radiation therapy. 2017. SPIE: Journal of Medical Imaging 2017, 10135-51.

Conference Presentations

Suriyakumar, V.M., N. Papernot, A. Goldenberg, and M. Ghassemi. Chasing Your Long Tails: Differentially Private Prediction in Health Care Settings, AI 4 Social Good Workshop, IJCAI 2021, Remote, January 2021

Chang. A*, V.M. Suriyakumar*, A. Moturu*, N. Tewattanarat, A. Doria, and A. Goldenberg. 2020. Using Generative Models for Pediatric wbMRI. Medical Imaging in Deep Learning 2020. * denotes equal contribution. (Oral)

Chang. A*, V.M. Suriyakumar*, A. Moturu*, A. Doria, and A. Goldenberg. 2019. Early pediatric cancer detection in whole-body MRIs. Evolution of Deep Learning Symposium 2019. * denotes equal contribution. (Poster)

Suriyakumar, V.M., R. Xu, C. Pinter, G. Fichtinger. Collision detection for external bream radiation therapy applications in SlicerRT. 2017. Imaging Network Ontario Conference. (Poster)

Suriyakumar, V.M., R. Xu, C. Pinter, G. Fichtinger. Open-source software for collision detection in external beam radiation therapy. 2017. SPIE: Journal of Medical Imaging 2017, 10135-51. (Oral)

Suriyakumar, V.M., R. Xu, C. Pinter, G. Fichtinger. Improving accessibility of radiation therapy software in developing countries. Canadian Undergraduate Conference on Healthcare 2017. (Oral)

Invited Talks

Chasing Your Long Tails: Differentially Private Prediction in Health Care Settings, Ethics of AI in Context: Emerging Scholars, Centre for Ethics, University of Toronto, October 2020

Chasing Your Long Tails: Differentially Private Prediction in Health Care Settings, Vector Institute, University of Toronto, October 2020

Challenge Participation

NeurIPS 2020 Hide-and-Seek Challenge: Membership Inference on Clinical Time Series
In collaboration with Christopher A. Choquette-Choo

Skills

Data Processing Frameworks: Pandas, Numpy
Machine Learning Frameworks: Tensorflow, PyTorch
ML DevOps Frameworks: Weights and Biases, Tensorboard
Languages: Python, Java
Markup: LaTeX, Markdown

Papers in Preparation

Differentially Private Fair Learning with Geometric Diversity
In collaboration with Nicolas Papernot and Marzyeh Ghassemi.

Fair Use of Sensitive Attributes in Machine Learning for Healthcare
In collaboration with Berk Ustun and Marzyeh Ghassemi.

Multi-Label Private and Secure Model Agnostic Collaborative Learning
In collaboration with Adam Dziedzic, Natalie Dullerud, Christopher A. Choquette-Choo, Nicolas Papernot, Somesh Jha, and Xiao Wang

Privacy Amplification for Data-Dependent Subsampling
In collaboration with Natalie Dullerud, Victoria Cheng, and Marzyeh Ghassemi

Differentially Private Time Series Generation
In collaboration with Shrey Jain, Victoria Cheng, and Marzyeh Ghassemi

Anomaly Detection for Pediatric Cancer Screening: A Multi-Site Study
In collaboration with Alex Chang, Abhishek Moturu, Nipaporn Tewattanarat, Andrea Doria, and Anna Goldenberg.

Mentoring and Advising

Shrey Jain, Undergraduate Researcher, Summer 2020 - Present

Victoria Cheng, Undergraduate Researcher, Summer 2020

Reviewing

Program Committee, IJCAI 2020 AI for Social Good Workshop
Program Committee, NeurIPS 2020 Machine Learning for Health Workshop
External Reviewer, USENIX Security 2021

Selected Professional Experience

The Hospital for Sick Children, Toronto, Ontario Canada

Research Assistant **May, 2019 - Present**

Building anomaly detection methods using generative models for early detection of pediatric cancer in whole body MRIs. This project is in collaboration with clinicians in the SickKids' Radiology department.

Cape Privacy (formerly Dropout Labs), Remote

Consultant **June, 2019 - August, 2019**

Contributed tutorials to the open-source library TF Encrypted for machine learning under secure multiparty computation protocols. Started investigations into using self-learning activation functions using polynomial approximations to speed up training time.

Square, San Francisco, California USA

Data Science Intern **May, 2018 - August, 2018**

Developed a representation learning algorithm to cluster merchants into different business categories for improved pricing algorithms with 90% accuracy. Involved in ethics and governance of AI in products committee analyzing what Square's principles would be when implementing AI into its products.

Helpful (acquired by Shopify), Toronto, Ontario Canada

Machine Intelligence Intern **September, 2017 - April, 2018**

Improved transcriptions for speech recognition problems such as getting names and company specific jargon correct by 4-10x. Investigated computational linguistic techniques such as phoneme matching and pronunciation modelling to further improve transcriptions in the presence of different accents.

IBM, Toronto, Ontario Canada

Deep Learning and Systems Research Intern **May, 2017 - August, 2017**

Led a research project exploring improvements to traditional query optimization in databases using machine learning. Implemented a few shot learning algorithm based on matching networks improving the database speed by 30% across standard SQL query speed benchmarks. Currently, I have 1 patent pending from this work.

Service and Volunteering

Director of Finance & Advisor, CUSEC **January 2019 - Present**

I manage a budget of approximately $100,000 for a nationwide software engineering conference of 500 students. The conference brings over 15 industry sponsors and 20 speakers from all over North America to Montreal for three days to engage in a variety of topics in software engineering. I advise the chairs and the conference organizers on best practices.

NeurIPS 2019 Student Volunteer **December 2019**

I was selected to be a student volunteer in helping run this premier machine learning research conference that brings over 12 000 researchers from all over the world. My role involved organizing attendees into different lectures and paper presentations.

Co-Chair, Toronto Health Data Hackathon **September 2019 - October 2019**

I led a team of 5 to organize this important hackathon in collaboration with the Vector Institute and St. Michael's Hospital. The event gathered 100 computer scientists and doctors to build new machine learning for health products over the course of two days.

Chair, QHacks **April 2018 - February 2019**

I lead a team of 17 students to create a 500 person hackathon to engage and empower students to build products and connect with the tech industry. I developed a sustainable internal operating structure focusing on team autonomy and transparency. Provided bi-weekly mentorship to each individual to ensure important growth in desired areas. I ran discussions on gender and racial discrimination in tech and how we as an organization can support these marginalized groups.

Co-Chair, CUSEC **January 2018 - January 2019**

I lead a team of 25 students remotely to create a 500 person conference to engage and empower students to explore different areas of the software engineering industry. I improved engagement

across a number of Canadian universities and engaged a more diverse set of speakers so gender, racial, and sexual orientation representation were present. Provided bi-weekly mentorship to each individual to ensure important growth in desired areas.

Director of Events, CUSEC **January 2017 - January 2018**
I managed and executed the logistics for five different events and 12 different workshops at the scale of 500 attendees. Led the pilot of a new event to increase engagement between students about pressing issues of gender and racial discrimination.

VP Operations, Queen's Computing Students' Association **March 2017 - April 2018**
I hired, led, and supported a team of 7 commissioners who lead efforts in academics, casual events, formal events, marketing, finance, equity and governance. Restructured our hiring process to reduce biases and improve equity. I piloted a first year internship program within the association which increased first year student engagement by 50%.