

# SAFWAN HOSSAIN

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## EDUCATION

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**University of Toronto (Vector Institute)**

September 2018 - Present

PhD. in Computer Science

Specialization: Machine Learning and Algorithmic Game Theory

Advisor: Dr. Nisarg Shah and Dr. Frank Rudzicz

**University of Toronto**

September 2013 - June 2018

B.A.S.c in Electrical and Computer Engineering - High Honours

GPA: 3.95/4.00

Specialization: Software and Control Systems

## RELEVANT COURSEWORK

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Undergraduate: Robot Modelling and Control, Advanced Algorithms, Machine Learning,  
Probability and Statistics

Graduate: Random Processes, Deep Reinforcement Learning, Computational Linguistics,  
Statistical Learning Theory, Algorithms for Collective Decision Making

## TECHNICAL SKILLS

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**Modeling/Simulations**

MATLAB, Mathematica

**Programming Languages/Framework**

Python, C/C++, pyTorch, TensorFlow, cvxpy, NLTK

## RECENT RESEARCH PROJECTS

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### **The Effect of Strategic Noise on Linear Regression**

We consider linear regression wherein each data point is supplied by a self-interested agent which can misreport values to skew the regression toward their preference. We investigate whether a pure equilibrium always exists in this game, the quality of this equilibrium, and algorithms that achieve this.

**Accepted as full paper at AAMAS 2020.**

### **Fairly Fair Classifiers via Economic Fairness Notions**

We adapt two fairness notions from economics, envy-free and equitability, for a group setting in machine learning. We show that our proposed definitions subsume a number of existing fairness notions in literature, prove that they can be learned under a PAC framework, and theoretically and experimentally consider the trade-off between fairness and loss minimization.

**Accepted as full paper with Oral at WebConf 2020 (WWW 2020).**

### **Surprising power of hiding information in Facility Location**

We consider the classic facility location problem and propose a novel framework for strategic manipulation: hiding data points. We analyze the properties of strategyproof algorithms in this setting, and prove some surprising results that have wider ramifications beyond facility location.

**Accepted as full paper at AAAI 2020.**

### **JacNet - Learning functions with structured Jacobians**

We consider learning functions satisfying regularity conditions expressible in terms of the derivative (eg: invertibility, Lipschitz). To achieve this, we propose learning a function's Jacobian, imposing regularity conditions via output activation, and using a numerical integrator for loss computation and evaluation.

**Accepted at the Workshop on Invertible Neural Networks at ICML 2019 (INNF).**

## WORK EXPERIENCE

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### **Xanadu AI**

October 2019 - January 2020

*Research Intern*

Mitacs research intern at Xanadu AI, a photonic quantum computing firm. Working with the Quantum Machine Learning research team to investigate new quantum computational models that offer significant advantages for both discriminative and generative tasks.

### **Vector Institute**

May 2018 - August 2018

*Research Intern*

Worked with Dr. Frank Rudzicz on an NLP project investigating text generation with GANs using word vector representation. Attempted to incorporate grammatical information to aid generation, experimented with various GAN training regimes, and designed the generator architecture. Resulting work was **Accepted at the Workshop on Representation Learning for NLP at ACL 2019**.

### **Intel**

May 2016 - July 2017

*Compiler Engineering Intern*

Year long internship in Intel's FPGA compiler team. Worked on optimizing routing algorithms to reduce clock skew. Modelled clock placement as a constraint satisfaction problem that resulted in 1.5% increase in the maximum operating frequency of the latest Intel FPGA chips.

### **Arista Networks**

May 2015 - August 2015

*Software Engineering Intern*

Worked in the software defined networking team. Created an API to program against VSphere, VMware's cloud platform, to enable easy testing and deployment of cloud networking solutions.

## PUBLICATIONS AND MANUSCRIPTS

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- S. Hossain and N. Shah. *The Effect of Strategic Noise on Linear Regression*. Proc. of the 19th International Conference on Autonomous Agents and Multiagent Systems (AAMAS 2020).
- S. Hossain, A. Mladenovic, and N. Shah. *Designing Fairly Fair Classifiers via Economic Fairness Notions*. Proc. 29th International World Wide Web Conference (WWW 2020).
- S. Hossain, E. Micha, and N. Shah. *The Surprising Power of Hiding Information in Facility Location*. Proc. of the 34th AAAI Conference on Artificial Intelligence (AAAI 2020).
- S. Hossain and J. Lorraine. *JacNet: Learning Functions with Structured Jacobians*. Workshop on Invertible Neural Nets and Normalizing Flows at ICML 2019
- A. Budhkar, K. Vishnubhotla, S. Hossain. *Generative Adversarial Networks for Text Using word2vec Intermediaries*. Workshop on Representation Learning at ACL 2019
- Y. Li, S. Hossain, K. Jamali, F. Rudzicz. *DeepConsensus: Using Consensus of Features From Multiple Layers to Attain Robust Image Classification*. Arxiv 2019
- S. Hossain, K. Jamali, Y. Li, F. Rudzicz. *ChainGAN: A Sequential Approach to GANs*. Arxiv 2018

## AWARDS AND DISTINCTIONS

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Recipient of the Ontario Provincial Graduate Scholarship	June 2019
Recipient of the Vector Scholarship in Artificial Intelligence	November 2018
Recipient of the Arts and Science Graduate Fellowship	October 2018
Recipient of the Wolfond Graduate Scholarship	September 2018
Ranked 2nd in the graduating class of Electrical Engineering	June 2018