

# Romina Abachi

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[Github](#)   [Scholar](#)

## Research Interests

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Reinforcement Learning (model-based, robustness, safe exploration, risk-averse, industrial and robotic applications, control on networks); Machine Learning (statistical learning theory, optimization)

## Education

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### **P.h.D Student in Computer Science**

*University of Toronto, Artificial Intelligence*

**Toronto ON**

*Feb 2020 -- present*

- Supervisors: Amir-massoud Farahmand and Sheila McIlraith
- Relevant courses: Minimizing Expectations, Knowledge Representation and Reasoning, Algorithms in Private Data Analysis, Algorithms in Collective Decision Making

### **M.A.Sc. in Electrical and Computer Engineering**

*University of Toronto, Probabilistic and Statistical Systems Lab*

**Toronto ON**

*Sept 2017 -- Jan 2020*

- Supervisors: Amir-massoud Farahmand and Brendan Frey
- Thesis: “Policy-Aware Model-based Reinforcement Learning”
- Relevant courses: Statistical Learning Theory, Convex Optimization, Probabilistic Learning and Reasoning

### **B.A.Sc. in Electrical Engineering, High Honours, with PEY**

*University of Toronto*

**Toronto ON**

*Sept 2012 -- Jun 2017*

- Capstone project: “Quadcopter-based Solar Panel Cleaning”
  - Supervised by: Professor Olivier Trescases
- Relevant courses: Machine Learning, Digital Communications, Algorithms & Data Structures
- Cumulative GPA: 3.92/4.00

## Publications

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- **Abachi, Romina**, Mohammad Ghavamzadeh, and Amir-massoud Farahmand. "Policy-Aware Model Learning for Policy Gradient Methods." arXiv preprint arXiv:2003.00030 (2020)
- Nikishin, Evgenii, **Romina Abachi**, Rishabh Agarwal, and Pierre-Luc Bacon. "Control-Oriented Model-Based Reinforcement Learning with Implicit Differentiation." arXiv preprint arXiv:2106.03273 (2021).
- **Abachi, Romina\***, Claas Voelcker\*, Animesh Garg, and Amir-massoud Farahmand. “VIPer: Iterative Value-Aware Model Learning on the Value Improvement Path.” Decision Awareness in Reinforcement Learning Workshop at the International Conference on Machine Learning (ICML) 2022. (\* equal contribution)
- **Abachi, Romina**, and Amir-massoud Farahmand. "Optimistic Risk-Aware Model-based Reinforcement Learning." The 15th European Workshop on Reinforcement Learning (EWRL 2022).

## Research Experience

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### Research Assistant for Industrial Applications of RL

Toronto ON

University of Toronto - Vector Institute for Artificial Intelligence (jointly with Telus Comm., Linamar Corp., Loblaw's Ltd.)

May 2019 -- Jan 2020

- Assisted in teaching a class of 6-10 industry participants the foundations of reinforcement learning, created assignments and conducted reading group sessions
- Working individually with each company's group to guide the design of a simulation for their project and implement it in Python, and to come up with possible solutions
- Projects were: allocation of trucks to gates at a distribution centre, datacenter cooling, and short-distance fleet management. Some results presented [here](#).

### Research Scientist Intern

Toronto ON

Borealis AI - Fundamental Team

May -- Oct 2018

- Studied literature on verifiable robustness bounds to adversarial attacks, especially those using convex relaxations and duality theory to obtain trainable robust networks with guarantees
- Improved on the state-of-the-art robustness bounds based on convex relaxations by ~8% by replacing the activation function in the dual network by a dual version of leaky ReLU (not published).

## Projects

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### Stochastic Dueling Contextual Bandits for Discovery of Collective Art Preferences

Toronto ON

University of Toronto

Jan 2022 -- March 2022

- On a quest to find the "Most preferred painting" of a group of people, we created a tool (unpublished) using a StyleGAN model and stochastic dueling contextual bandits to gradually find the collective preferences of different individuals by moving in the latent space of a generative model (inspired by: [The People's Choice](#) project).

### Robust Planning for Model-based Reinforcement Learning

Toronto ON

University of Toronto

Jan 2021 -- April 2021

- Studied robust planning problem given a probabilistic constraint on the dynamics model
- Using the modified differential method of multipliers, formulated the constrained optimization in terms of gradient descent updates
- Preliminary results showed improvement over using the MLE for planning. Some further steps are being explored.

### PAC Learning with zero-Concentrated Differential Privacy

Toronto ON

University of Toronto

Sept 2020 -- Jan 2021

- Studied probably approximately correct (PAC) learning under zero-concentrated differential privacy (zCDP) constraints. Since this is a notion of privacy not as strict as pure-DP and not as loose as approximate-DP, we expect to find the sample complexity to be in-between these two notions.
- We gave sample complexity results for finite hypothesis classes and point functions. This work is ongoing.

### Learning Planning Models from Partially-Observed Data

Toronto ON

University of Toronto

Sept 2020 -- Jan 2021

- We studied the performance of symbolic planning with partially-observed image data. We combined the Latplan framework for learning symbolic models for planning directly from image inputs (proposed by Asai and Fukunga, 2018) and the GP-VAE algorithm (proposed by Fortuin et al, 2020) for missing-input imputation. In this way we leveraged developments in the probabilistic imputation of multi-variate time series to improve planning performance with missing data.

## **Crafting Adversarial Attacks using Generative Adversarial Networks**

**Toronto ON**

*University of Toronto - Course project for Scalable Models of Uncertainty*

*Sept -- Dec 2017*

- Developed a method for fast creation of adversarial attacks using Generative Adversarial Networks, improving on the performance of the Fast-Gradient Sign Method (FGSM) attack, while beating the time of both FGSM and Carlini-Wagner attacks.

## **Quadcopter-based Solar Panel Cleaning**

**Toronto ON**

*University of Toronto - Capstone project*

*Sept 2016 -- Apr 2017*

- Designed and implemented an autonomous quadcopter-based solution to cleaning loose dirt from solar panels
- Created a daylight simulator and used it in combination with a power monitor to automatically detect when solar panel needs to be cleaned due to loose dirt lowering power output, triggering a quadcopter into flight.
- Developed a navigation algorithm using a PID controller to correct for drifts and errors.
- Used the OpenCV library to detect solar panel from camera feed of drone.
- Self-taught Node.js in order to develop a web-based GUI to monitor the position of the drone and the power status of the solar panel.

## **Scholarships and Awards**

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|-------------------------------------------------------------------------|------------------------------|
| • Edward S. Rogers Sr. Graduate Scholarship                             | <i>Sept 2017 -- Jan 2018</i> |
| • General Motors Women in Electrical and Mechanical Engineering Award   | <i>Oct 2014 -- Oct 2015</i>  |
| • Trinity College Chancellor's Scholarship                              | <i>Sept 2012</i>             |
| • Perimeter Institute Luke Santi Memorial Award for Student Achievement | <i>July 2011</i>             |

## **Teaching Experience**

### **Teaching Assistant**

**University of Toronto**

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|-----------------------------------------------------|-------------------------------------|
| • Introduction to Reinforcement Learning (Graduate) | <i>Winter 2021</i>                  |
| • Introduction to Machine Learning (CSC311)         | <i>Fall 2020, 2021, Winter 2022</i> |
| • Introduction to Machine Learning (MIE324)         | <i>Fall 2018</i>                    |
| • Introduction to Electromagnetics (ECE221)         | <i>Winter 2018</i>                  |
| • Fields and Waves (ECE320)                         | <i>Fall 2017</i>                    |

## **Work Experience**

### **Hardware Design Engineer, Intern**

**San Diego CA**

*Qualcomm Technologies, Inc.*

*May -- Aug 2016*

- Developed a tool in VBA for automating the calculation of trace width on a PCB based on electrical current requirements.
- Performed simulations to check the resistance of traces on PCB to ensure losses did not exceed margin.
- Designed a circuit to break-out GPIO connections for testing.
- Designed a test vehicle board for testing chips with very fine-pitch ball grid arrays.