

# Kasra Eshaghi

[kasra.eshaghi.74@gmail.com](mailto:kasra.eshaghi.74@gmail.com)

<https://kasra-eshaghi.github.io/blog/>

416-878-8847

23 Revcoe Drive, Toronto, Canada, M2M 2B9

## ***Education***

### *Ph.D. – Mechanical Engineering*

University of Toronto – CIMLab and ASB Lab – Sept. 2018 – Jan. 2024.

- Investigated collaborative-motion control and planning methodologies for robotic swarms with limited onboard localization capabilities.
- Collaborated on the development of swarm localization, mapping, and connectivity restoration methodologies.
- Designed, fabricated, and programmed a millimeter scale robot for algorithm verification.

### *B.A.Sc. – Mechanical Engineering*

University of Toronto – Sept. 2013 – May 2018.

- Specialized in mechatronics and control.

### *Relevant Courses*

- Robot motion planning, Mobile robots and perception, Intelligent robotic systems, Robotic manipulators, Introduction to machine learning, Mechatronic principles, Analog and digital electronics.

## ***Robot Autonomy Experience***

### *Motion Control Strategies for Robotic Swarms with Localization Limitations*

- Developed collaborative-motion control strategies for swarms that have localization limitations due to their short-range onboard proximity sensors.
- Optimized the developed strategies through path planning and combinatoric optimization to achieve minimum motion control errors.
- Implemented the developed strategy in simulation for swarms of up to twenty robots, and in practice on a swarm of six millimeter-scale robots (<https://youtu.be/24WzIfeJWNQ>).
- Achieved significant improvement in motion control compared to the state-of-the-art.

### *Constrained Swarm Motion Planning*

- Developed a motion planning methodology for robotic swarms subject to inter-robot trajectory constraints imposed through collaborative-motion control strategies.
- Formulated and solved relevant sub-problems including the division-of-labor, task-allocation, path-planning, and movement-concurrency to minimize mission execution time.
- Implemented the developed methodology in simulation for swarms of up to 100 robots (<https://youtu.be/pVI-XXai3VE>).
- Improved mission execution performance by 40% compared to the state-of-the-art.

## ***Machine Learning Experience***

### *Product Rating Prediction – Amazon Dataset*

- Developed and trained a neural network to predict Amazon product ratings based on reviewer data.
- Pre-processed the data through case-folding, tokenization, lemmatization, stop-word removal, and one-hot encoding.
- Conducted an exploratory analysis to evaluate the dependence of the available textual and contextual data on product ratings.
- Achieved a prediction error 30% better than the competing baseline using a network that considered the reviewers' comments and summaries, and the products' review times and categories. Network included dense, recurrent, and embedding layers, and was tuned through a grid-search.

## ***Robot Hardware Experience***

### *mROBERTO 2.0*

- Designed, fabricated, and debugged the mechatronic system of a 20mm x 20mm robot for swarm studies. This included PCB design for the locomotion (stepper motors), computation (ARM Cortex-M0), wireless communication (BLE & ANT), sensing (IR), and power management modules.
- Programmed the libraries for interfacing with the various modules.
- Developed the robot control architecture (perception, communication, localization, and control) for conducting swarm experiments and algorithm verification.

## ***Professional Engineering Experience***

### *Mechanical Engineering Assistant*

SciCan Ltd. Department of Research and Development, Toronto, Canada – May 2016 – July 2017.

- Collaborated with engineers, service personnel, and manufacturing staff on the development of a steam autoclave sterilizer for dental applications.
- Studied the venturi vacuum pump initiation problem and designed a fluid distortion mechanism to ensure initiation under all working conditions.
- Designed and fabricated multiple mechatronic systems dedicated to evaluating the vacuum pump, functionality of thermal switches, and hydro-pressure testing the pressure vessels.

## ***Leadership Experience***

### *Head Teacher Assistant*

University of Toronto, Probability & Statistics / Manufacturing Engineering – Sept. 2020 – May 2023.

- Taught classes of up to 40 students, organized course material, and managed up to eight teacher assistants.

## ***Technical Skills***

<i>Programming Languages</i>	<i>Programming Tools</i>	<i>Mechatronics and Design</i>
Python, Embedded C, C++, Matlab, Simulink.	TensorFlow, scikit-learn, Pandas, NumPy, Matplotlib, Git, ROS.	PCB design, Autodesk EAGLE, SolidWorks.