

Education

University of Toronto	Toronto, Canada	Fall 2020 - Current
Ph.D. in Computer Science		GPA: 4.0/4.0
Ph.D. Thesis: Vision-based Autonomous Cutting with Surgical Instruments Using Agents Trained in Simulation		
University of Ottawa	Ottawa, Canada	Fall 2014 – Summer 2020
M.A.Sc. in Biomedical Engineering, Graduated August 2020		GPA: 9.8/10 (Dean's Honour List)
Masters Thesis: AR C-Arm Development and Synthetic X-rays Using Generative Adversarial Networks		
B.H.Sc. in Health Sciences, Graduated April 2018		GPA: 9.53/10 (Dean's Honour List)
Bachelor Thesis: Integration of Biomechanical Analysis into Augmented Reality Games for Rehabilitation		

Experience

Research	MedCVR Lab - SickKids Hospital	September 2020 – Current
<ul style="list-style-type: none">Developing a simulation for surgical robotics systems using the da Vinci Research Kit, and building a modular framework for robotic teleoperation and execution of autonomous agents trained from simulationResearching vision-based reinforcement learning for manipulation and cutting tasks with sim2real transfer from simulation, learning of soft-body physics using graph networks, and perception techniques from sensor sources including depth and stereo for end-to-end vision-based autonomyResearching Large Language Model integration for simulation learning and autonomous robotic manipulation in surgery, GPU acceleration for simulation, and foundation models for soft-body and cutting manipulation		
Robotics/ML PhD Resident	(Google) X, The Moonshot Factory	March 2022 - August 2022
<ul style="list-style-type: none">Research and develop machine learning approaches for a cutting-edge project based on wearable robotic systems, focusing on reinforcement learning algorithms for learning optimal robotic locomotion with on-device learning		
Teaching Assistant	University of Toronto & Ottawa	September 2018 – Current
<ul style="list-style-type: none">Teaching Assistant for CSC108 (Intro to Comp Programming), CSC384 (Intro to AI), MCG5138 (Graduate Class - Machine Learning/Control Theory), MCG 5138 (Graduate Class - Robotic Surgery) and other courses.		
Research	Metrics Lab - University of Ottawa	January 2017 – July 2020
<ul style="list-style-type: none">Pioneered three large projects: pix2xray, Desired Views, and Magic Mirror. Research focused on computer vision for human full body tracking, deep learning through adversarial networks for synthetic data generation, and real-time augmented reality systems with interactive elementsManaged the lab in a leadership position, supervising over 15 undergraduate and graduate students. Presented at multiple conferences and meetings, and communicated with shareholders across the university and hospital.		
Research Intern	CARD Lab - Balgrist University Hospital	June 2019 – August 2019
<ul style="list-style-type: none">Implemented the Camera Augmented Mobile C-arm device built using a C-arm and multiple cameras to allow for augmented reality image-guided surgical procedures through multi-modal camera fusion.Pioneered novel augmented reality rendering algorithms, including point-based rendering, as well as multi-camera multi-modal calibration and image reconstruction.		

Projects

- Autonomous Surgical Robotics (2021-2024):** Reinforcement learning for autonomous vision-based manipulation in surgery, including cutting, sim2real transfer techniques, and scene perception.
- Surgical Robotics Simulation (2021-2024):** Robotics simulation environment for reinforcement and imitation learning for surgical robotics using Unity, PyTorch and Mujoco, written in C#, Python, and C++.
- pix2xray (2020):** Simulation and deep Learning to generate synthetic X-rays using atypical inputs. (Python, TensorFlow, C++, OpenGL)
- CAM-C (2019):** Surgical overlay of X-ray and video using multi-modal camera fusion (C++, OpenGL, OpenCV)
- Magic Mirror (2017-2018):** Augmented reality medical education tool that overlays medical anatomy on a mirror interface using the Kinect (C++, OpenGL)

Languages and Technologies

Languages: C++, C, C#, Python, Java, HTML/CSS/JavaScript
Frameworks: PyTorch, TensorFlow, OpenGL, OpenCV, VTK/ITK, Qt, Mujoco
Tools: Git, CMake, Linux, Docker, AWS, Blaze, Slurm

Awards

Canada Graduate Scholarship - PhD	2020
Natural Sciences and Engineering Research Council of Canada (NSERC) Masters Scholarship	2019
Ontario Graduate Scholarship (Declined)	2018
University of Ottawa Excellence Scholarship – Masters	2018-2019
University of Ottawa Dean's Honour List	2014-2018
Natural Sciences and Engineering Research Council of Canada (NSERC) Undergraduate Student Research Award	2018
Natural Sciences and Engineering Research Council of Canada (NSERC) Undergraduate Student Research Award	2017
Undergraduate Research Opportunity Program Award - University of Ottawa	2016

Peer Reviewed Publications:

Mustafa Haiderbhai, Radian Gondokaryono, Andrew Wu, Lueder A Kahrs. Sim2Real Rope Cutting With a Surgical Robot Using Vision-Based Reinforcement Learning. IEEE Transactions on Automation Science and Engineering 2023 (will be presented at ICRA@40).

Radian Gondokaryono, **Mustafa Haiderbhai**, Sai Aneesh Suryadevara, Lueder A Kahrs. Learning Nonprehensile Dynamic Manipulation: Sim2real Vision-based Policy with a Surgical Robot. IEEE Robotics and Automation Letters 2023 (presented at ICRA 2024).

Kanishkan Senthilkumar, Radian Gondokaryono, **Mustafa Haiderbhai**, Lueder Kahrs. Simulating Mesh Cutting with the dVRK in Unity. The 15th Hamlyn Symposium on Medical Robotics 2023.

Mustafa Haiderbhai, Radian Gondokaryono, Thomas Looi, James Drake, Lueder A. Kahrs. Robust Sim2Real Transfer with the da Vinci Research Kit: A Study On Camera, Lighting, and Physics Domain Randomization. International Conference on Intelligent Robots and Systems (IROS) 2022.

Radian Gondokaryono, **Mustafa Haiderbhai**, Adnan Munawar, Thomas Looi, James Drake, Lueder Alexander Kahrs. A modular ROS-based dVRK teleoperation controller architecture. Hamlyn Symposium on Medical Robotics 2022.

Mustafa Haiderbhai, Sergio Ledesma, Sing Chun Lee, Phillip Fürnstahl, Nassir Navab, Pascal Fallavollita. pix2xray: Converting RGB images into X-rays using generative adversarial networks. International Journal of Computer Assisted Radiology and Surgery 2020.

Mustafa Haiderbhai, Sergio Ledesma, Nassir Navab, Pascal Fallavollita. Generating X-ray Images from Point Clouds Using Conditional Generative Adversarial Networks. International Conferences of the IEEE Engineering in Medicine and Biology Society (EMBC) 2020.

Mustafa Haiderbhai, Jesus Guerrero-Turrubiates, Vinod Gutta, Pascal Fallavollita. Automatic C-arm Positioning Using Multi-Functional User Interface. The 42nd Canadian Medical and Biological Engineering Conference (CMBEC) 2019.

Jeffrey Lao, Stephanie Chevrier, **Mustafa Haiderbhai**, Shelia Gonzalez-Reyna, Mina Zeroual, Michel Désilets, Pascal Fallavollita. Comparison of a mixed-reality technology to cadavers for gross anatomy learning. The 16th Annual Imaging Network Ontario (ImNO) Symposium 2018.

Fady Said, David Burbidge, **Mustafa Haiderbhai**, Sheila Esmeralda Gonzalez-Reyna, Mina Zeroual, Michel Désilets, Pascal Fallavollita. A mixed-reality user interface for gross anatomy learning. The 16th Annual Imaging Network Ontario (ImNO) Symposium 2018