

RUNZE ZUO

Birth date: January 11, 2000; Nationality: Chinese
University of Toronto, Department of Electrical & Computer Engineering
Undergraduate; Fourth Year Computer Engineering with Robotics Minor

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EXPERIENCE

Robotics researcher at
Prof. Xinyu Liu's Lab, University of Toronto

Soft Robotics

📅 May 2019 – Present 📍 Toronto, Canada

- Publications: See Google scholar page for 'Runze Zuo'
- Worked as the project leader for 4 research projects.
- Actively participated in lab member's research.
- Equipment maintainer in the lab (e.g. 3D Printer, Laser Cutter).

ACHIEVEMENTS

- Presented a soft robotic project as the first author on ICRA.
- Second Place at MakeUofT 2019, the largest Makerthon in Canada.
- MIE Summer Research Fellowship.
- Mitacs Student Research Fellowship.
- First Place at UofT SEEK 2019, a Mars rover competition.
- Third Place at UofT SUMO 2019, a combat robot competition.
- Fourth Place at ECE297 algorithm leader board, a C++ programming course in UofT.

RESEARCH HIGHLIGHTS

Research Paper (First author; Published, ICRA2021): A Soft Robotic Gripper with Anti-Freezing Ionic Hydrogel-Based Sensors for Learning-Based Object Recognition

- To explore the designs of smart, sensorized manipulators for fragile object handling in the sub-zero environment, I developed a soft robotic gripper with an array of ionic hydrogel tactile sensors attached to its palm. This gripper is able to sense the shape of the grasped objects using the force feedback and a MATLAB-based LSTM model. The gripper can achieve an overall recognition accuracy of 100% across the test set of 10 commonly seen objects.

Research Paper (First author; Ready to submit to IEEE TMech): Compact Underwater Robot with Depth Independent Hydraulic Powered Soft Gripper

- To address the lack of a method for exploring underwater places with complex and constrained-space environments, I developed an extremely compact, self-propelled soft gripper system that substitutes the current robot arm + gripper configuration. The self-propelled soft gripper achieved a cross-sectional area smaller than 1/3 of a free diver. This robot Demonstrated the ability to accurately find and grasp underwater objects through remote control with visual feedback.

Research Paper (Third author; Published, Advanced Functional Materials): An anti-freezing, ambient-stable and highly stretchable ionic skin with strong surface adhesion for wearable sensing and soft robotics

- Developed an ionic hydrogel strain sensor and attached it to a soft robotic crawler, a soft silicone glove, and a soft robotic gripper. The feedback signal from the sensor is utilized to perform closed-loop control and human-machine interaction applications.

Research Project (Fifth Author; Target: Biosensor and Bioelectronics): A Portable Paper-Chip Based Device for COVID-19 Nucleic Acid Detection

- As the programmer of the team, I wrote the Arduino-based C++ program for each subsystem. Also designed and implemented a TFT touchscreen-based GUI for the device.

A 16-Channel Expansion and a MATLAB Interface for the Agilent E4980A LCR Meter.

- Developed a high-precision multiplexer unit for the LCR meter. Also wrote an interface using MATLAB to simultaneously get readings from the LCR meter and control the channel swapping of the multiplexer. This series of projects received 27 stars on GitHub and the open-source code has already been adopted into many research projects worldwide.

A High Accuracy Portable Electrochemical Workstation with Touch Screen Display

- Developed a phone-sized device that has comparable accuracy with the Auto-Lab electrochemical workstation. The project utilizes STM32F4 as the controller. Due to the lack of documentation, my skill in IC-level programming is greatly improved. Also, I developed a C-Library that can conveniently configure and add new testing procedures to the device.

Other Accepted/Finished Works

- **Co-1st Author, Accepted: T-ASE**
▷ A Sensory Soft Robotic Gripper Capable of Learning-Based Object Recognition and Force-Controlled Grasping
- **3rd Author, Target: T-RO**
▷ A Cable-Driven Soft Biomimetic Robotic Hand with In-hand RGB-D Camera for Dexterous Grasping and Manipulation
- **4th Author, Submitted: RA-L**
▷ 3D Co-Printing of Ionic Hydrogel and Elastomer for Facile Fabrication of Wearable Sensors and Soft Robots
- **4th Author, Submitted: Analyst**
▷ A Nitrocellulose Paper-based Multi-well Plate for Point-of-care ELISA

ACADEMIC HISTORY

Pursuing BASc in Computer Engineering

Technical GPA: 3.97/4

General GPA: 3.86/4

University of Toronto

📅 September 2018 – Current

- **Physics Average:** 98.5
- **Linear Algebra MAT188:** 95
- **Other Math Average:** 91.4
- **Digital Circuit Average:** 92.25
- **Operating System ECE344:** 100
- **Machine Learning APS360:** 91

Upper & Lower Secondary

Tsinghua University High School

📅 2012 – 2018

TECHNICAL SKILLS

• SOFTWARE

▷ Very skilled and experienced in C/C++. Besides the language itself, I have a solid knowledge of operating systems, computer architecture, and digital systems.

▷ Skilled in multiple other programming languages like Python, MATLAB, etc. I'm also familiar with constructing various deep neural networks using PyTorch.

• ELECTRONICS

▷ Very experienced in using microcontrollers and their peripherals and have a solid understanding of electronics (9 years of project experience).

• MANUFACTURE

▷ Skilled at making 3D models with Solidworks. Started using it on daily basis for the last 10 years.

▷ I am a 3D printing enthusiast. I know the printers from the inside out and know the characteristics of different materials. I am good at adjusting the printer to fulfill special demands such as waterproofing. For the past 3 years, I'm responsible for maintaining our lab's printer as well. I am also skilled at using the laser cutter, CNC milling machine, and many more!

PUBLICATIONS

A soft robotic gripper with anti-freezing ionic hydrogel-based sensors for learning-based object recognition

R Zuo¹, Z Zhou¹, B Ying, X Liu

2021 IEEE International Conference on Robotics and Automation

An anti-freezing, ambient-stable and highly stretchable ionic skin with strong surface adhesion for wearable sensing and soft robotics

B Ying, RZ Chen, R Zuo, J Li, X Liu

Advanced Functional Materials 31 (42), 2104665

An Ionic Hydrogel-Based Antifreezing Triboelectric Nanogenerator

B Ying, R Zuo, Y Wan, X Liu

ACS Applied Electronic Materials 4 (4), 1930-1938

Compact Underwater Robot with Depth Independent Hydraulic Powered Soft Gripper

R Zuo, Z Zhou, Z Qin, P Pan, S Wang, B Ying, X Liu

In preparation

A Sensory Soft Robotic Gripper Capable of Learning-Based Object Recognition and Force-Controlled Grasping

Z Zhou¹, R Zuo¹, B Ying, J Zhu, Y Wang, X Wang, X Liu

Accepted: T-ASE-2022-281.R1

A Cable-Driven Soft Biomimetic Robotic Hand with In-hand RGB-D Camera for Dexterous Grasping and Manipulation

Z Zhou, M Du, R Zuo, X Liu

In preparation

A Low-cost, Portable, Paper-Based Platform for SARS-CoV-2 Point-of-Care Detection

Z Qin, ..., R Zuo (5th Author), ..., X Liu

In preparation

3D Co-Printing of Ionic Hydrogel and Elastomer for Facile Fabrication of Wearable Sensors and Soft Robots

S Wang, ..., R Zuo (4th Author), ..., X Liu

In submission: RA-L

A Nitrocellulose Paper-based Multi-well Plate for Point-of-care ELISA

Z Qin, Z Huang, P Pan, Y Pan, R Zuo, Y Sun*, X Liu*

In submission: Micromachines