Luyang Zhao

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Research Interests

My research is primarily focused on the development and application of robotics and artificial intelligence. Key areas include:

○ **Robotics:** Specializing in **Soft Robotics, Modular Robotics, Swarm Robotics,** and **Bio-Inspired Systems**.

○ **Artificial Intelligence:** Emphasizing applications in **Machine Learning** and **Large Language Models (LLMs)** for robotic design and decision-making.

○ **Robotic Systems and Simulation:** Focused on **Multi-Robot Systems**, **Motion Planning**, **Simultaneous Localization and Mapping (SLAM)**, and developing advanced methods for **Robot Simulation** and **Robotic Perception** to enhance real-world applications.

Education

Dartmouth College   **Hanover, NH**
Ph.D. in Computer Science   *Sep. 2018–Expected June 2025*
　　– Advisor: Prof. Devin Balkcom
　　– Honors: Neukom Outstanding Graduate Research Prize
　　– Dissertation title: *From Modular Tensegrity Structures to Bioinspired Sea Robots:*
　　　　　Combining the Best Properties of Soft and Modular Robots

University of Minnesota   **Minneapolis, MN**
B.S. in Computer Science   *Graduated with distinction in 2018*
　　– Research advisor: Prof. Maria Gini
　　– Honors: Dean's list
　　– Thesis: *Recursive Wall Follower Algorithm for Object-Finding Robot in Unknown Maze*

B.A. in Mathematics
　　– Senior project advisor: Prof. Karel Prikry
　　– Honors: Dean's list
　　– Thesis: *Simulating a doubly infinite Turing machine on a one-way infinite tape*

Professional Experience

Dartmouth College	Sep. 2018 – Present
Doctoral Researcher, Dartmouth Reality and Robotics Lab (Advisor: Prof. Devin Balkcom)	*Hanover, NH*
Amazon Robotics	June 2021 – Sep. 2021
Applied Scientist II (Mentor: Andreas Kolling)	*Westborough, MA*
TuSimple	June 2022 – Sep. 2022
Research Scientist (Mentor: Yujia Wu)	*San Diego, CA*
University of Minnesota	Sep. 2016 – May 2018
Undergraduate Research Assistant, Robotics Lab (Advisor: Prof. Maria Gini)	*Minneapolis, MN*

Honors and Awards

Admissions Ambassador for Dartmouth College (2023-2024)
Neukom Outstanding Graduate Research Prize (2023), Dartmouth College
Dartmouth's Guarini Travel Award (2023, 2024)
Dartmouth **Fellowship** (2018)
Undergraduate Research Opportunities Program (UROP) **Scholarship** (2016), University of Minnesota

Media Coverage

Computer Science Researcher Creates Flexible Robots: Dartmouth News, Science Springs, Tech Xplore
Scientists Develop Shape-Shifting Robot Helpers Inspired by Ants: Knowridge Science Report
Computer Science Researchers Create Modular, Flexible Robots: ACM News
Computer Science Students Win Neukom Research Prizes: Dartmouth CS News

Mentorship Experience

Lab Mentor   Sep. 2018 – Now
Dartmouth Reality and Robotics Lab   *Hanover, NH*

- Master students: Chun-Yi She (2023-now), Yitao Jiang (2022-now, PhD student at Dartmouth), Yijia Wu (2021-2022, now PhD student at WPI), Weishu Zhan (2022, now PhD student at The University of Manchester)
- Undergraduate students: Josiah Putman (now in Google), Maxine Perroni-Scharf (now PhD student at MIT)

Teaching Assistant   Sep. 2018 – Now
Dartmouth College   *Hanover, NH*

- **CS89/189**: Robot Motion Planning – 2024 Fall
- **CS89/189**: The Dark Side of AI/ML – 2024 Spring
- **CS81/281** : Principles of Robot Design and Programming – 2018 Fall
- **CS76/276** : Artificial Intelligence – 2018 Winter, 2019 Fall and 2023 Fall
- **CS1** : Introduction to Programming and Computation – 2019 Spring and 2020 Spring
- **CS50** : Software Design and Implementation – 2019 Summer
- **CS59** : Principles of Programming Languages – 2024 Summer

Teaching Assistant, Summer Computing Academy   June 2017
University of Minnesota   *Minneaplis, MN*

- Mentored senior high school students in developing programs for Scribbler robots, image processing, video, 3D printing, and other applications.

Publications

* Equal contribution

JOURNALS

J1. **Luyang Zhao**, Y. Jiang, M. Chen, K. Bekris, and D. Balkcom. Modular Shape-Changing Lightweight Blocks for Robotic Locomotion, Manipulation, and Structure Formation Science Robotics. (Under review) [paper] [video]

J2. **Luyang Zhao**, Y. Jiang, C. She, H. Dong, A. Q. Li, M. Chen, and D. Balkcom. SoftRafts: Floating Soft Modular Robots. (To be submitted to Nature Communications by November 30)

J3. **Luyang Zhao**, Y. Jiang, C. She, M. Chen, and D. Balkcom. SoftSnap: Rapid Prototyping of Untethered Soft Robots Using Snap-Together Modules. <u>Soft Robotics</u> (Under review) [paper] [video]

J4. **Luyang Zhao**, Y. Wu, W. Yan, W. Zhan, X. Huang, J. Booth, A. Mehta, K. Bekris, R. Kramer-Bottiglio, and D. Balkcom. Starblocks: Soft actuated self-connecting blocks for building deformable lattice structures. <u>IEEE Robotics and Automation Letters</u>, 8(8):4521–4528, 2023 [paper] [video]

J5. **Luyang Zhao**, Y. Wu, J. Blanchet, M. Perroni-Scharf, X. Huang, J. Booth, R. Kramer-Bottiglio, and D. Balkcom. Soft lattice modules that behave independently and collectively. <u>IEEE Robotics and Automation Letters</u>, 7(3):5942–5949, 2022 [paper] [video]

CONFERENCES

C1 **Luyang Zhao**, Y. Jiang, C. She, D.Balkcom, H. Dong, M. Chen. Design and Experiment of a Lightweight Robotic Tensegrity Morphing Wing. <u>AIAA SciTech2025</u> (Accepted)

C2 **Luyang Zhao***, Y. Jiang*, C.-Y. She, M. Jeong, H. Dong, A. Q. Li, M. Chen, and D. Balkcom. An Untethered Bioinspired Robotic Tensegrity Dolphin with Multi-Flexibility Design for Aquatic Locomotion. <u>IEEE RoboSoft 2025</u> (Under review) [paper] [video]

C3 W. Ma*, **Luyang Zhao***, C. She*, Y. Jiang, A. Sun, B. Zhu, D. Balkcom, S. Vosoughi. On the Exploration of LM-Based Soft Modular Robot Design. <u>IEEE RoboSoft 2025</u> (Under review) [paper]

C4 **Luyang Zhao**, J. Putman, W. Wang, and D. J. Balkcom. PLRC*: a piecewise linear regression complex for approximating optimal robot motion. In <u>IEEE IROS 2020</u> [paper]

C5 J. Putman, L. Oh, **Luyang Zhao**, E. Honnold, G. Brown, W. Wang, and D. J. Balkcom. Piecewise linear regressions for approximating distance metrics. <u>CoRR</u>, abs/2002.12466, 2020 [paper]

C6 J. Putman, L. Oh, **Luyang Zhao**, E. Honnold, G. Brown, W. Wang, and D. J. Balkcom. LLDM: locally linear distance maps for robot motion planning: Extended abstract. In <u>International Symposium on Multi-Robot and Multi-Agent Systems, MRS 2019</u> [paper]

C7 L. Ferland, Z. Li, S. Sukhani, J. Zheng, **Luyang Zhao**, and M. L. Gini. Assistive AI for coping with memory loss. In <u>The Workshops of the The Thirty-Second AAAI Conference on Artificial Intelligence, 2018</u>, AAAI Workshops [paper]

C8 M. Jeong, A. Chadda, Z. Ren, **Luyang Zhao**, H. Liu, M. Roznere, A. Zhang, Y. Jiang, S. Achong, S. Lensgraf, and A. Q. Li. Multi-modal perception dataset of in-water objects for autonomous surface vehicles. In <u>IEEE ICRA Workshop on Field Robotics</u>, 2024 [paper]

PROFESSIONAL SERVICES

Workshop Organizer

o Tensegrity Robotics Workshop, IROS 2023, Detroit (link)

Reviewer

o IEEE Robotics and Automation Letters (RA-L)

- IEEE International Conference on Robotics and Automation (ICRA)

- IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)

- IEEE-RAS International Conference on Soft Robotics (RoboSoft)

- IEEE RAS EMBS International Conference on Biomedical Robotics and Biomechatronics (BioRob)

CONFERENCE AND INVITED TALKS

Invited Talks

- "Applications of Soft Modular Robots" – The Georgia Institute of Technology Robotics Seminar, June 28, 2024

- "Self-Assembling Soft Modular Robots for Manipulation" – NEMS 2024, May 31, 2024.

- "Soft Modular Robotics: Design and Applications" – Rutgers University Robotics Seminar, Oct 17, 2022.

Conference Talks

- "StarBlocks: Soft Actuated Self-Connecting Blocks for Building Deformable Lattice Structures" – RoboSoft 2024.

- "FlexBlocks: Untethered Self-Reconfiguring Morphable Modular Robots for Field Deployment" – IROS 2023 Tensegrity Workshop.

- "StarBlocks: Soft Actuated Self-Connecting Blocks for Building Deformable Lattice Structures" – ICRA 2022 MSRR Workshop and NERC 2022.

- "Soft Lattice Modules That Behave Independently and Collectively" – RoboSoft 2022.

- "PLRC*: A Piecewise Linear Regression Complex for Approximating Optimal Robot Motion" – IROS 2020.

- "LLDM: Locally Linear Distance Maps for Robot Motion Planning" – MRS 2019.

REFERENCES

Prof. Devin Balkcom
Professor and Department Chair, Computer Science
Dartmouth College   Email: devin.balkcom@dartmouth.edu

Prof. Kostas Bekris
Professor, Computer Science
Rutgers University   Email: kostas.bekris@cs.rutgers.edu

Prof. Alberto Quattrini Li
Associate Professor, Computer Science
Dartmouth College   Email: alberto.quattrini.li@dartmouth.edu

Prof. Muhao Chen
Assistant Professor, Mechanical and Aerospace Engineering
University of Kentucky   Email: muhaochen@uky.edu

Prof. Xiaonan (Sean) Huang
Assistant Professor, Robotics
University of Michigan   Email: xiaonanh@umich.edu