Yorai Shaoul, Ph.D. Student in Robotics

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Education

2022 – present ■ **Ph.D., Carnegie Mellon University** Robotics Institute, School of Computer Science. I am researching algorithmic foundations for multi-robot systems and applying my work to *multi-arm manipulation* [2], [3]. My focus is on developing practical algorithms with strong theoretical guarantees (realized efficiently in C++) and interleaving data-driven flexible behaviors with classical techniques for task and motion planning [1]. Coursework GPA $\frac{4.17}{4.0}$.
I am grateful to have Professors Maxim Likhachev and Jiaoyang Li as my advisors.

2017 – 2021 ■ **B.Sc. Massachusetts Institute of Technology** Electrical Eng. and Computer Science. Minor in mathematics and a focus on robotics via research and coursework. GPA $\frac{4.9}{5.0}$.

Experience

2022 – present ■ **Carnegie Mellon Robotics Institute** Graduate Researcher and Teaching Assistant. In my PhD so far, I have been:

- Researching algorithms for multi-robot coordination and multi-arm manipulation.
- Assisting with teaching the graduate class *Planning and Decision-Making in Robotics* (Fall 2024, Professor Maxim Likhachev).
- In 2022, I worked on large-scale learning of fisheye camera monocular visual odometry under Professor Sebastian Scherer.

2022 – 2023 ■ **Indoor Robotics** Algorithm Engineer. I worked in industry for one year after graduating from MIT and before starting the PhD program at CMU. Joining the algorithms team at Indoor Robotics, I developed various aspects of aerial autonomous robots operating in the wild.

- I worked on projects across the autonomy stack, including on localization, mapping, and trajectory optimization using range, inertial, and visual inputs.
- I was the technical lead in multiple mapping and visual/range localization projects.

2018 – 2021 ■ **MIT CSAIL – Robust Robotics Group** Undergraduate Researcher. I conducted research under the guidance of Nicholas Roy and his students throughout most of my time at MIT. Our projects mostly revolved around computer vision, some using deep learning and others with other gradient-based optimization methods. Notable projects:

- *Ellipsoid deformations for continuous and differentiable object shape estimation*, and
- *Learned object-level visual data-association methods for object tracking and SLAM [5].*

Jun-Sep 2020 ■ **Amazon Robotics** Research and Software-Development Intern. I worked tightly with research scientists and the path planning team to develop and test new large-scale multi-robot planning algorithms.

- Warehouse efficiency increase (13%) through adaptive cost-map policies.

2019 ■ **MIT Research Laboratory of Electronics** Undergraduate Researcher. Advised by Yoel Fink and his students.

- Developed and implemented real-time compression algorithms for in-fiber embedded data storage [4].

Experience (continued)

Jun-Sep 2019   ■ **Optimus Ride** Robotics Software Development Intern.
At Optimus Ride, an autonomous vehicle startup (acquired since), I developed new techniques for motion planning and decision-making in complex traffic scenarios leveraging semantic and geometric information.

- Certain improvements yielded 80% decrease in planning time.
- Teammates and I tested my code on real autonomous vehicles.
- My project was later incorporated into Optimus' production autonomy stack.

2016-2017   ■ **Tel-Aviv University Aerodynamics Laboratory** Research Assistant.
Designed, built, and tested active-flow drag-reducing contraptions for trucks.

Research Publications

Under Review

1   **Y. Shaoul***, I. Mishani*, S. Vats*, J. Li, and M. Likhachev, "Multi-Robot Motion Planning with Diffusion Models," 2024.

Conference Proceedings

2   **Y. Shaoul***, I. Mishani*, M. Likhachev, and J. Li, "Accelerating Search-Based Planning for Multi-Robot Manipulation by Leveraging Online-Generated Experiences," in *Proceedings of the International Conference on Planning and Scheduling (ICAPS)*, **Winner: Best Student Paper**, 2024.

3   **Y. Shaoul***, R. Veerapaneni*, M. Likhachev, and J. Li, "Unconstraining Multi-Robot Manipulation: Enabling Arbitrary Constraints in ECBS with Bounded Sub-Optimality," in *Proceedings of the International Symposium on Combinatorial Search (SoCS)*, 2024. 🔗 URL: https://arxiv.org/abs/2405.01772.

Journal Articles

4   G. Loke, T. Khudiyev, B. Wang, *et al.*, "Digital electronics in fibres enable fabric-based machine-learning inference," *Nature communications*, vol. 12, no. 1, p. 3317, 2021.

Other Papers

5   **Y. Shaoul**, K. Liu, K. Ok, and N. Roy, *Online Descriptor Enhancement via Self-Labelling Triplets for Visual Data Association*, 2020.

Miscellaneous

2005-2021   ■ **Track and Field:** MIT team captain, triple jump record holder, NCAA (DIII) Indoor/Outdoor national champion, National team (ISR).

Code   ■ C++, Python, PyTorch, ROS, ROS2, Docker, Java …

CAD   ■ Autodesk Inventor/Fusion 360, SolidWorks, Autodesk Eagle (PCB Design), 3D printing.