

# 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]. I focus on developing practical algorithms (realized efficiently in C++) and interleaving **data-driven flexible behaviors** with classical techniques for **task and motion planning** [1].  
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.
- Researching algorithms for multi-robot coordination and multi-arm manipulation.
  - Actively working with **diffusion-models**, MAPF algorithms, and **graph-search techniques for planning** and long-horizon decision making.
  - Assisting with teaching the graduate class *Planning and Decision-Making in Robotics* (Fall 2024, Professor Maxim Likhachev).
  - During the first year of my PhD, I worked on **large-scale learning** ( $\geq 50$  TB datasets) of fisheye monocular visual odometry under Professor Sebastian Scherer.
- 2021 – 2022 ■ **Indoor Robotics** Algorithm Engineer.
- I developed various aspects of aerial autonomous robots operating in the wild.
- My work spanned across the autonomy stack, including localization, mapping, and trajectory optimization using range, inertial, and visual inputs.
  - I was the technical lead in multiple **mapping** and visual/range **localization** projects. These drastically improved the efficiency of mapping new deployment sites (**minutes instead of days**) and opened up new markets for Indoor (by introducing visual localization signals to state estimation).
- 2018 – 2021 ■ **MIT CSAIL – Robust Robotics Group** Undergraduate Researcher.
- I conducted research under the guidance of Nicholas Roy and his students at MIT. Our projects mostly revolved around **computer vision**, some using deep learning and others with different 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 software engineers to develop and test new **large-scale multi-robot planning algorithms** for thousands of robots.
- Developed adaptive cost-map policies to reduce congestion in fulfillment centers.
  - Estimated warehouse efficiency increased by 13%.
- 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 an 80% decrease in planning time.
  - My project was later incorporated into Optimus' production autonomy stack.

## Experience (continued)

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

## Research Publications

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### Under Review

- 1 Y. Shaoul\*, I. Mishani\*, S. Vats\*, J. Li, and M. Likhachev, "Multi-Robot Motion Planning with Diffusion Models," under review for ICLR 2025.

### 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.

### Journal Articles

- 4 G. Loke, T. Khudiyev, B. Wang, S. Fu, S. Payra, Y. Shaoul, J. Fung, I. Chatziveroglou, P.-W. Chou, I. Chinn, *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-Labeling Triplets for Visual Data Association*, 2020.

## Miscellaneous

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- 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.