ZACHARY SERLIN

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ABOUT ME

I am currently a lead research scientist at MIT Lincoln Laboratory. In this role, I lead a research portfolio of multiple programs focused on autonomy and AI for national security applications. My portfolio focuses on verifiable multi-robot system coordination, formal methods for control systems, verifiable reinforcement learning, motion planning, and large vision model visual-semantic mapping. This work is being applied to large-scale logistics and command systems, automated strategy generation for multi-robot coordination, and verifiable and resilient uncrewed platform planning and control. My future research goals are focused on applying techniques from formal methods to provide guarantees on the behavior of learning-based embodied AI systems.

EDUCATION

Doctor of Philosophy | Mechanical Engineering | Boston University
Dissertation title: Distributed Formal Methods and Sensing for Autonomous Systems
Advisors: Prof. Calin Belta and Prof. Roberto Tron

Master of Science | Mechanical Engineering | Tufts University
Thesis title: A Novel Approach for the Simulation of *Xenopus laevis* Tail Regeneration
Honors 5th Year Dual B.Sc./M.Sc. Program

Bachelor of Science | Mechanical Engineering | Tufts University
Magna Cum Laude
Dean's List all Semesters

EXPERIENCE

Technical Staff - Lead Research Scientist Aug. 2020 - Present
MIT Lincoln Laboratory *Boston, MA*

- Developing real-time multi-robot planning and control algorithms for coordinating robots in Python and C++.
- Leading a large government team focusing on visual-language navigation and simulation-to-real transfer of neurosymbolic perception systems.
- Designing and building marine/aerial robotics hardware for large tactical swarms. These platforms use ROS and MOOS-IvP along with custom decision making algorithms, electronics, and mechanical designs.
- Leading and managing a team of 5+ researchers funded by 6+ US government sponsored R&D programs.
- Collaborating with academic partners (e.g., MIT, Stanford, BU, etc.) on multiple research grants.
- Regularly present to large groups, sponsors, top conferences, and peers about technical results, strategy directions, and technical recommendations.

Student Technical Assistant Co-op June 2018 - Aug. 2020
MIT Lincoln Laboratory *Boston, MA*

- Developed optimization based algorithms for heterogeneous multi-robot decision making.
- Built and tested hardware-in-the-loop full scale experiment of 13 autonomous heterogeneous robots (drones and ground robots) in a motion capture environment using ROS, Optitrack, MAVROS, Python, and C++.

SKILLS

Coding	Python • ROS/ROS2• MOOS-IvP • LaTeX• C++ • HTML • JAX • TensorFlow • PyTorch
Software	RLlib • Solidworks • Gazebo • PX4/Mavlink • Git • Adobe Photoshop, Premiere, and Illustrator
Other	Secret Clearance Eligible • Budget Creation • Strategy and Road Map Creation
Interests	Sailing • Hiking • Board Games • Gardening • LEGO

PUBLICATIONS

[1] O. So, **Z. Serlin**, M. Mann, J. Gonzales, K. Rutledge, N. Roy, and C. Fan. How to train your neural control barrier function: Learning safety filters for complex input-constrained systems. In *IEEE International Conference on Robotics and Automation (ICRA) (Submitted)*, 2024.

[2] K. Leahy, M. Mann, and **Z. Serlin**. Safety-aware task composition for discrete and continuous reinforcement learning (preprint). In *arXiv 2306.17033*, 2024.

[3] W. Liu, K. Leahy, **Z. Serlin**, and C. Belta. Catlnet: Learning communication and coordination policies from catl+ specifications. In *Proceedings of The 5th Annual Learning for Dynamics and Control Conference (L4DC)*, Proceedings of Machine Learning Research, 2023.

[4] M. Cohen, **Z. Serlin**, K. Leahy, and C. Belta. Temporal logic guided safe model-based reinforcement learning: A hybrid systems approach. *Nonlinear Analysis: Hybrid Systems*, 47, 2023.

[5] M. Cai, M. Mann, **Z. Serlin**, K. Leahy, and C. Vasile. Learning minimally-violating continuous control for infeasible linear temporal logic specifications. In *2023 American Control Conference (ACC)*, 2023.

[6] **Z. Serlin**, G. Yang, M. Cohen, C. Vasile, R. Tron, and C. Belta. Safe and reactive sampling-based motion planning subject to temporal logic constraints. In *IEEE Transactions on Robotics (T-RO) (Submitted)*, 2023.

[7] K. Leahy, **Z. Serlin**, C. Vasile, A. Schoer, A. Jones, R. Tron, and C. Belta. Scalable and robust algorithms for task-based coordination from high-level specifications (scratches). *IEEE Transactions on Robotics (T-RO)*, 2022.

[8] M. Cai, K. Leahy, **Z. Serlin**, and C. Vasile. Probabilistic coordination of heterogeneous teams from capability temporal logic specifications. In *IEEE Robotics and Automation Letters (RA-L)*, 2022.

[9] W. Liu, K. Leahy, **Z. Serlin**, and C. Belta. Robust multi-agent coordination from catl+ specifications. In *2023 American Control Conference (ACC)*, 2023.

[10] **Z. Serlin**, G. Yang, B. Sookraj, C. Belta, and R. Tron. Distributed and consistent multi-image feature matching via quickmatch. In *International Journal of Robotics Research (IJRR)*, 2020.

[11] Xiao Li, **Z. Serlin**, Guang Yang, and Calin Belta. A formal methods approach to interpretable reinforcement learning for robotic planning. *Science Robotics*, 4(37), 2019.

[12] A. Jones, K. Leahy, C. Vasile, S. Sadraddini, **Z. Serlin**, R. Tron, and C. Belta. Scratchs: Scalable and robust algorithms for task-based coordination from high-level specifications. In *International Symposium of Robotics Research (ISRR)*, 2019.

[13] Guang Yang, Bee Vang, **Z. Serlin**, Calin Belta, and Roberto Tron. Sampling-based motion planning via control barrier functions. In *3rd International Conference on Automation, Control and Robots (ICACR)*, 2019.

[14] **Z. Serlin**, Kevin Leahy, Roberto Tron, and Calin Belta. Distributed sensing subject to temporal logic constraints. In *IEEE International Conference on Intelligent Robots and Systems (IROS)*, 2018.

[15] **Z. Serlin**, Brandon Sookraj, Calin Belta, and Roberto Tron. Consistent multi-robot object matching via quickmatch. In *International Symposium on Experimental Robotics (ISER)*. IFRR, 2018.

[16] Cassandra Donatelli, **Z. Serlin**, Piers Echols-Jones, Anthony Scibelli, Alexandra Cohen, Jeanne-Marie Musca, Shane Rozen-Levy, David Buckingham, Robert White, and Barry Trimmer. Soft foam robot with caterpillar-inspired gait regimes for terrestrial locomotion. In *IEEE International Conference on Intelligent Robots and Systems (IROS)*, 2017.

[17] **Z. Serlin**, Jason Rife, and Michael Levin. A level set approach to simulating xenopus laevis tail regeneration. In *Proceedings of the Artificial Life Conference (ALIFE)*, pages 528 – 535. MIT Press, 2016.