

Litman, Yehonathan

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Education

Carnegie Mellon University

Pittsburgh, Pennsylvania

PH.D., ROBOTICS

Sep. 2022 - Present

- Advisors: Shubham Tulsiani & Fernando De la Torre

M.S., ROBOTICS

Aug. 2020 - Aug. 2022

- Cumulative GPA: 3.96/4
- Advisor: Michael Kaess

State University of New York at Stony Brook

Stony Brook, New York

B.S., COMPUTER SCIENCE MAJOR, ELECTRICAL ENGINEERING MINOR

Aug. 2016 - May 2020

- Cumulative/Computer Science GPA: 3.5/4, **Cum Laude**
- University Scholars Honors Program

Awards

- 2022 **NSF Graduate Research Fellowship Program (GRFP)**
- 2020 **Provost's Award for Academic Excellence**, Given to 6/1000+ graduates
- 2019 **IROS Student and Developing Countries Travel Award**, Merit-based
- 2019 **NSF & Lehigh I-DISC Travel Award**, Merit-based
- 2017 **URECA Fellowship Grant**, \$4,000

Publications

JOURNAL PROCEEDINGS

- [1] **Yehonathan Litman**, Neeraj Gandhi, Linh Thi Xuan Phan, and David Saldaña. "Vision-Based Self-Assembly for Modular Multirotor Structures". In: *IEEE Robotics Automation Letters (RA-L) with presentation at 2021 IEEE International Conference on Robotics and Automation, (ICRA)*. 2021, **Finalist Paper in Multi-Robot Systems**.

CONFERENCE PROCEEDINGS

- [1] **Yehonathan Litman**, Or Patashnik, Kangle Deng, Aviral Agrawal, Rushikesh Zawar, Fernando de la Torre, and Shubham Tulsiani. *MaterialFusion: Enhancing Inverse Rendering with Material Diffusion Priors*. Under Review.
- [2] **Yehonathan Litman***, Daniel McGann*, Eric Dexheimer, and Michael Kaess. "Global Visual-Inertial Ground Vehicle State Estimation via Image Registration". In: *2022 IEEE International Conference on Robotics and Automation, (ICRA)*. Philadelphia, USA, May 2022.
- [3] **Yehonathan Litman**, Ya Wang, and Ji Liu. "Accelerated Visual Inertial Navigation via Fragmented Structure Updates". In: *2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. Macau, China, Nov. 2019.
- [4] **Yehonathan Litman**, Libo Wu, and Ya Wang. "Invariant Filter Based Preintegration for Addressing the Visual Observability Problem". In: *2018 IEEE MIT Undergraduate Research Technology Conference (MIT-URTC)*. Cambridge, Massachusetts, Oct. 2018.
- [5] Libo Wu, Haili Liu, **Yehonathan Litman**, and Ya Wang. "Shuttered Passive Infrared Sensor for Occupancy Detection: Exploring a Low Power Electro-Mechanical Driving Approach". In: *2018 Conference on Smart Materials, Adaptive Structures and Intelligent Systems (ASME)*. Tech. Rep. San Antonio, Texas, Sept. 2018. URL: <https://yehonathanlitman.github.io/papers/SMASIS2018.pdf>.

Service

XRNeRF Workshop: Advances in NeRF for the Metaverse

CVPR 2023 - Vancouver, Canada

ORGANIZER

CVPR, NeurIPS, ICRA, IROS

REVIEWER

MSCV Admissions Committee

REVIEWER

16682 - Robotics Systems Development Project II

TEACHING ASSISTANT

16825 - Learning for 3D

TEACHING ASSISTANT

CMU - Pittsburgh, Pennsylvania

Spring 2023

CMU - Pittsburgh, Pennsylvania

Fall 2020

CMU - Pittsburgh, Pennsylvania

Spring 2023

Research & Experience

Human Sensing Laboratory - Robotics Institute

CMU - Pittsburgh, Pennsylvania

GRADUATE RESEARCH ASSISTANT

Sep. 2022 - Present

- Implemented an inverse rendering pipeline that employs a prior in the form of StableDiffusion to improve appearance modeling.
- Currently working on using the StableDiffusion prior for more accurate acquisition of the underlying material, texture, geometry, and lighting information in 3D objects from multi view images in order to improve relighting quality under novel virtual environments.

Robot Perception Lab - Robotics Institute

CMU - Pittsburgh, Pennsylvania

GRADUATE RESEARCH ASSISTANT

Sep. 2020 - Aug. 2022

- Part of the US military Aided Threat Recognition from Mobile Cooperative and Autonomous Sensors (ATR-MCAS) program.
- Deployed a 1-point RANSAC approach in visual inertial odometry with multiple stereo cameras and a single IMU for UGV navigation.
- Developed a large scale mapping representation for UGVs using an efficient 3D occupancy scrolling grid.
- Developed a custom graph optimization scheme that combined image registration and local VIO measurements in order to produce drift-corrected global localization measurements at a high rate using little computational resources.
- In conjunction with a scan matching image registration technique, showed superior results to state-of-the-art algorithms, as the system was able to conduct global localization both in real time and at a much higher accuracy.

AirLab - Robotics Institute

CMU - Pittsburgh, Pennsylvania

GRADUATE RESEARCH ASSISTANT

Jul. 2021 - May 2022

- Constructed a self-supervised autoencoder model that extracted illumination and lighting orientation features from panorama image batches, to condition relighting across a time distribution.
- Implemented code for acquiring and building a training/testing dataset of panorama images from Google Street View and Google Earth Studio.

DARPA Subterranean Challenge - Team PLUTO

UPenn - Philadelphia, Pennsylvania

RESEARCH ASSISTANT

Aug. 2019 - Dec. 2019

- Inspired by direct visual SLAM, devised a bundle adjustment approach on both thermal and RGB images using direct image alignment, providing a robot with a metric dense environmental representation with multi-spectral information to significantly aid object detection.
- Made a direct matching methodology that utilizes only a single standard camera in order to thoroughly fuse and stitch together multiple thermal images while compensating for weaknesses in thermal readings.

GRASP Laboratory - SUNFEST REU

UPenn - Philadelphia, Pennsylvania

RESEARCH ASSISTANT

May 2019 - Aug. 2020

- Drove a swarm assembly algorithm that could make extensive modular quadrotor formations using only vision and onboard sensors.
- By fusing visual, inertial, and magnetic measurements, derived a novel controller algorithm for detecting a docking between two quadcopters that is also resistant against external forces encountered outdoors.
- Made a testing framework in Gazebo using ROS and PX4-SITL for simulating a swarm of modular quadrotor robots. By simulating magnetic forces, the testing framework proved to be a realistic simulation that can be applied onto real quadcopters with no modifications to the software.

Nanomaterial Energy Harvesting and Sensing Laboratory

SUNY SBU - Stony Brook, New York

UNDERGRADUATE RESEARCH ASSISTANT

Sep. 2016 - May 2020

- Improved the theory behind incremental based SLAM in order to dramatically accelerate tracking using a learned fragmentation process, exhibiting vastly superior position tracking performance when compared to other leading visual-inertial methodologies.
- Developed, Using the aforementioned algorithm, an extremely light yet highly accurate visual inertial odometry tracking algorithm for ultra-low power ARM-based processors such as a Raspberry Pi.
- Devised an invariant Extended Kalman Filter algorithm for a more robust visual inertial odometry strategy that considered yaw, leading to competitive performance against other leading visual inertial based odometry techniques.
- Due to the unavailability of a motion capture system for experimental validation, built a quadcopter platform equipped with an NVIDIA Jetson processor capable of generating groundtruth stereo depth data via convolutional neural network training.
- Formulated a novel optical flow based background reduction algorithm for human detection in cluttered environments for 99% accurate detection of stationary humans and 90% accurate detection of moving humans.

- Designed an interlinked multi-redundancy SLAM system for reliable position sensing in both outdoor and indoor settings by fusing the readings of a 3D sensing camera, LiDAR, IMU, GPS, and a barometer.
- Implemented a simplified attitude control algorithm for use in both basic and complex maneuvers.
- Constructed quadcopter capable of 3D SLAM both indoors and outdoors for several functions such as aerobatic displays, outdoor GPS assisted navigation, indoor navigation in constrained areas, and swarm formations.

Presentations

- [1] **Yehonathan Litman**, David Saldaña, and Vijay Kumar. “Vision-based Docking and Assembly for Modular Quadrotor Structures”. In: *2019 National Science Foundation (NSF) Robot Learning Workshop*. Bethlehem, Pennsylvania, Oct. 2019, Poster Presentation.
- [2] **Yehonathan Litman**, Haili Liu, and Ya Wang. “A Simple Interlinked Controller-Sensor Framework for Robust SLAM and Autonomy on MAVs”. In: *2018 Undergraduate Research & Creative Activities (URECA) Annual Research Symposium*. Stony Brook, New York, Apr. 2018, Poster Presentation.

Skills

Programming	C/C++, Python, Java, JavaScript, LaTeX, Bash
Frameworks	OpenCV, PyTorch, ROS, GTSAM, Pixhawk, Neon SIMD, Arduino
General	Linux, Git, Vim, Adobe Photoshop, Blender, Autodesk Inventor, Vicon
Languages	Hebrew, English, German (A2)