

Matthew Beveridge

Cambridge, MA

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Current Position

NODAR, Inc.

Computer Vision Engineer, Advisors: Dr. Leaf Jiang & Dr. Piotr Swierczynski

Somerville, MA

Jul 2021 - Present

Solving untethered, vision-based 3D perception and calibration with application to autonomous robotics. Utilizing principles from signal processing and deep learning, we sense surroundings at unprecedented resolution and range.

Education

Massachusetts Institute of Technology (MIT)

Master of Engineering (MEng); Electrical Engineering and Computer Science – Artificial Intelligence

Cambridge, MA

2021

Advised by: Prof. Daniela Rus

Massachusetts Institute of Technology (MIT)

Bachelor of Science (SB); Electrical Engineering and Computer Science

Cambridge, MA

2020

Bachelor of Science (SB); Mathematics

Minor: Theater Arts

Research Experience

Distributed Robotics Lab

Graduate Researcher, Advisor: Prof. Daniela Rus, Supervisors: A. Amini & I. Gilitschenski

CSAIL, MIT

Sep 2020 - Jun 2021

Researched robust monocular depth estimation, data-driven simulation, and reinforcement learning for end-to-end (i.e., perception-to-control) autonomous driving control policies.

Draper Lab

Machine Learning Researcher (Internship), Advisor: Dr. Rebecca Russell

Cambridge, MA

Jun 2020 - Aug 2020

Formulated uncertainty quantification metrics for competency-aware reinforcement learning. These metrics were used during the deployment of trained policies as a means of interpretability.

Data-Driven Inference Group

Undergraduate Researcher, Advisor: Prof. John Guttag, Supervisor: D. Blalock

CSAIL, MIT

Sep 2019 - May 2020

Derived a novel neural network pooling layer framework to adaptively choose the pooling metric, in effect treating it as a learned parameter by binning and weighting activations.

NASA

Research Engineer (Internship)

Houston, TX

Jun 2019 - Aug 2019

Prototyped, tested, and analyzed system reliability measures for the ISS, Orion spacecraft, and Gateway space station to ensure containment of mission-critical applications (e.g., telemetry) from noncritical ones (e.g., email).

Camera Culture Group

Undergraduate Researcher, Advisor: Prof. Ramesh Raskar, Supervisor: G. Satat

Media Lab, MIT

Sep 2018 - Feb 2019

Improved perception in degraded visual environments (e.g., fog) by (1) modeling the diffraction of a pulsed visible laser in scattering media, then (2) subtracting it from the reading to extract the signal photons from the target.

Interactive Robotics Group

Undergraduate Researcher, Advisor: Prof. Julie Shah, Supervisor: R. Ramakrishnan

CSAIL, MIT

Feb 2017 - May 2017

Advanced decision-making in AI through studying adversarial games. Devised and executed human subject experiments to play said games and use their outcomes to inform RL policy design and human-robot interaction.

Industry Experience

General Atomics ASI

Machine Learning Researcher (Internship)

San Diego, CA

Jun 2018 - Aug 2018

Developed deep learning-based visual quality assurance using object detection and classification. Included the creation of a custom, self-supplementing dataset from scratch. The model was deployed on augmented reality headsets.

ference, Inc. Cambridge, MA
Data Scientist (Internship) Feb 2018 - Jun 2018
 Analyzed sentiment of social media posts using natural language processing to gauge user reactions to prescription drugs. Also parsed disease indicators to map relational trees by semantic association.

Mosaic Power Frederick, MD
Software Engineer (Internship) Jun 2017 - Aug 2017
 Optimized power grid efficiency by learning tenant energy use patterns and intraday fluctuations in grid-wide demand to intelligently cycle commercial water heaters and HVAC systems, reducing peak loads without interrupting service.

Teaching, Mentorship, and Service

MIT Micro-Internship Program NODAR, Inc. & MIT
Mentor Jan 2022 - Present
 Supervise MIT undergraduate students on computer vision and robotics projects while a part of NODAR.
 • **Megan Ngo** (Jan 2022 - Feb 2022): Design, fabrication, and implementation of a multisensor vehicular perception rig including 4x RGB, 2x LWIR, 1x LiDAR, and 1x GPS/INS sensors.

MIT 6.862: Applied Machine Learning EECS, MIT
Teaching Assistant Sep 2020 - Jun 2021
 Mentored graduate students on semester-long projects in machine learning. Developed and taught tutorials, and reviewed writing and presentations for a course of 43 and 69 students in the Fall and Spring semesters respectively.

MIT 6.036: Introduction to Machine Learning EECS, MIT
Teaching Assistant Sep 2020 - Dec 2020
 Developed course materials and instructed laboratory sessions for MIT's introductory machine learning course of 473 students. Aided in the transition to remote instruction due to COVID-19.

MIT Driverless Cambridge, MA
Team Lead, Member Aug 2020 - Jul 2021
 Led a team of engineers to innovate simulation environments for high-speed, multi-agent autonomous racing at the inaugural Indy Autonomous Challenge and Roborace Season Beta.

MIT EnergyHack Cambridge, MA
Director of Corporate Relations Jun 2019 - May 2020
 Coordinated corporate sponsorships and guided challenge creation for MIT's premier energy and climate hackathon. Organized and executed event proceedings for more than 330 participants across multiple days.

Honors and Awards

Best Paper: Pathway to Impact, NeurIPS (CCAI Workshop)	2021
Northrop Grumman Engineering Scholar	2016 - 2020
NEWMAC Academic All-Conference	2017
Society of American Military Engineers (SAME) Scholar	2016, 2017
Academic All-American in Lacrosse	2016
National Football Foundation Scholar Athlete	2016

Professional Activity

Reviewing

IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)	2022, 2023
European Conference on Computer Vision (ECCV)	2022
International Conference on 3D Vision (3DV)	2022
IEEE Winter Conference on Applications of Computer Vision (WACV)	2023

Programs

NeurIPS Climate Change AI Mentorship Program – <i>Mentee</i>	2022
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Selected Publications

Journal Publications

2. Woonghee Han, Randall Pietersen, Rafael Villamor-Lora, Matthew Beveridge, Nicola Offeddu, Theodore Golfopoulos, Christian Theiler, James L. Terry, Earl S. Marmor, Iddo Drori. Tracking Blobs in the Turbulent Edge Plasma of a Tokamak Fusion Device. **Scientific Reports**, 2022.
1. Alexander E. Siemenn, Evyatar Shaulsky, Matthew Beveridge, Tonio Buonassisi, Sara Hashmi, Iddo Drori. A Machine Learning and Computer Vision Approach to Rapidly Optimize Multiscale Droplet Generation. **ACS Applied Materials & Interfaces**, 2022.

Conference Publications

3. Sarah Mokhtar, Matthew Beveridge, Melody Cao, Iddo Drori. Pedestrian Wind Factor Estimation in Complex Urban Environments. Asian Conference on Machine Learning (**ACML**), 2021. *Oral spotlight.*
2. Nikhil Singh, Jeff Mentch, Jerry Ng, Matthew Beveridge, Iddo Drori. Image2Reverb: Cross-Modal Reverb Impulse Response Synthesis. IEEE/CVF International Conference on Computer Vision (**ICCV**), 2021.
1. Woonghee Han, Nicola Offeddu, Theodore Golfopoulos, Christian Theiler, Cedric Tsui, Jose Boedo, Jim Terry, Earl Marmor, Randall Pietersen, Rafael Villamor Lora, Matthew Beveridge, Iddo Drori. Exploring the Edge/SOL Fluctuations in Negative Triangularity Plasmas on TCV. Annual Meeting of the **American Physical Society Division of Plasma Physics**, 2021.

Workshop and Symposium Publications

5. Matthew Beveridge, Lucas Pereira. Interpretable Spatiotemporal Forecasting of Arctic Sea Ice Concentration at Seasonal Lead Times. Neural Information Processing Systems (**NeurIPS**) Workshop on Tackling Climate Change with Machine Learning (Proposals Track), 2022.
4. Jared M. Cochrane, Matthew Beveridge, Iddo Drori. Generalizing Imaging Through Scattering Media With Uncertainty Estimates. IEEE Winter Conference on Applications of Computer Vision (**WACV**) Workshop on Applications of Computational Imaging, 2022.
3. Glenn Liu, Peidong Wang, Matthew Beveridge, Young-Oh Kwon, Iddo Drori. Predicting Atlantic Multidecadal Variability. Neural Information Processing Systems (**NeurIPS**) Workshop on Tackling Climate Change with Machine Learning, 2021. *Best paper; oral spotlight.*
2. Ellen Park, Jae Deok Kim, Nadege Aoki, Melody Cao, Yamin Arefeen, Matthew Beveridge, Roo Nicholson, Iddo Drori. Predicting Critical Biogeochemistry of the Southern Ocean. Neural Information Processing Systems (**NeurIPS**) Workshop on Tackling Climate Change with Machine Learning, 2021.
1. Evyatar Shaulsky, Alexander Siemenn, Matthew Beveridge, Tonio Buonassisi, Iddo Drori, Sara Hashmi. Artificial Intelligence Enhances Control Parameter Space Investigation in Flow-Focusing Droplet Generation. 95th **ACS Colloid and Surface Science** Symposium, 2021.

Patents

1. Piotr Swierczynski, Leaf Jiang, Matthew Beveridge. 3D Vision System with Automatically Calibrated Stereo Vision Sensors and Lidar Sensor. **Patent pending**, 2022.

Theses

1. Matthew Beveridge. Consistent Depth Estimation in Data-Driven Simulation for Autonomous Driving. Master's Thesis, **Massachusetts Institute of Technology**, 2021.

Preprints and Papers Under Review

3. Alexander E. Siemenn, Matthew Beveridge, Tonio Buonassisi, Iddo Drori. Online Preconditioning of Experimental Inkjet Hardware by Bayesian Optimization in Loop. arXiv, 2022.
2. Kyle Lennon, Katharina Fransen, Alexander O'Brien, Yumeng Cao, Matthew Beveridge, Yamin Arefeen, Nikhil Singh, Iddo Drori. Image2Lego: Customized LEGO® Set Generation from Images. arXiv, 2022.

1. Samuel Humphries, Madeleine Jansson, Young Ryu, Matthew Beveridge, Melody Cao, Iddo Drori. Predicting Wildfire Growth. 2021.

Software

1. Matthew Beveridge. *finpandas*: A Pythonic interface and analysis toolkit for fundamental financial information. **MIT License**, 2021.

Selected Projects

Machine Learning

2. Matthew Beveridge, Ryan Shubert, Daniel Wrafter. *Neural Circuit Policies for Interpretable Multi-Agent Autonomous Driving*: Employing liquid time-constant neural networks in a competitive, multi-agent reinforcement learning environment. 2021.
1. Matthew Beveridge, Victor Morestes, Chessa Hoekstra. *Deep Federated Learning – Attacks and Defenses*: An exploration into perturbative and generative attacks on federated learning, and defenses against them. 2020.

Robotics

1. Matthew Beveridge, Ryan Shubert. *Robotic Juggling*: A 7 degree of freedom robotic manipulator developed to stably juggle a ball with a paddle in simulation. 2020.

Mathematics

4. Matthew Beveridge. *Fast (and Fun!) Cosine Transforms*: Revisiting the history and benchmarking numerical derivations of the discrete cosine transform – from brute force computation, to the FFT, and arriving at Lee's Algorithm: a recursive Cooley-Tukey-like FCT. 2020.
3. Matthew Beveridge, Barış Ekim, Justin Lim. *Assymetric Processes*: Examining the behavior of open and closed Markov chains, and under which circumstances they are equivalent. 2020.
2. Matthew Beveridge, Barış Ekim, Justin Lim. *Percolation*: Mathematically determining the rate at which something (a disease, idea, object, etc.) propagates as a function of transmission probability. 2020.
1. Matthew Beveridge. *Optimal Roulette Betting*: Applying the principles of information theory, namely portfolio theory, to derive betting strategies for the game of Roulette. 2019.

Key Skills

Computer Vision: Depth Perception; Object and Obstacle Detection; Semantic Segmentation; Stereo Vision; SfM and MVS; SLAM; Intrinsic and extrinsic sensor calibration (both online and offline); Multi-sensor arrays; RGB, LWIR, and LiDAR sensors; Sensor triggering, synchronization, and networking.

Machine Learning: Deep Learning including CNNs, RNNs, GANs, and VAEs; Machine Learning including SVM, KNN, Decision Trees, Bayes, and AutoML.; Federated Learning including attacks and defenses; Dataset creation and curation from scratch.

Mathematics: High-Dimensional Geometry; Optimization; Numerical Analysis; Information Theory; Graph and Combinatorial Theory; Statistics and Probability; Stochastic Processes; Algorithms; Linear Algebra and Differential Equations.

Programming: Python; Julia; Java; R; SQL; C/C++; Git; *nix OS; HTML; C#; PyTorch; Tensorflow; Drake; ROS; NumPy, Pandas, SciPy, OpenCV, Open3D and similar tools; CI/CD; Docker; Cloud Computing including AWS and Google Cloud.