

# Matthew Beveridge

Boston, MA

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## Current Position

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### **NODAR, Inc.**

*Computer Vision Engineer*

Somerville, MA

*Jul 2021 - Present*

Solving problems in untethered 3D perception and calibration with application to autonomous driving and robotics.  
Using signal processing and machine learning for a dense understanding of the surrounding environment.

## Education

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### **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

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### **Distributed Robotics Lab**

CSAIL, MIT

*Graduate Researcher, Advisor: Prof. Daniela Rus, Supervisors: A. Amini & I. Gilitschenski* *Sep 2020 - Jun 2021*

Researching robust depth estimation in data-driven simulation for end-to-end learning (i.e., perception-to-control) of autonomous driving policies via reinforcement learning.

### **Draper Lab**

Cambridge, MA

*Machine Learning Researcher, Advisor: Dr. Rebecca Russell*

*Jun 2020 - Aug 2020*

Formulated uncertainty quantification metrics for competency-aware reinforcement learning methods in a model-based setting. These metrics were used during deployment of trained policies as a means of interpretability.

### **Data-Driven Inference Group**

CSAIL, MIT

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

*Sep 2019 - May 2020*

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

### **NASA**

Houston, TX

*Research Engineer*

*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**

Media Lab, MIT

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

*Sep 2018 - Feb 2019*

Improved perception in degraded visual environments for autonomous robotics using visible light imagining through scattering media, validated in a purpose-built time of flight ray tracing simulation.

### **Interactive Robotics Group**

CSAIL, MIT

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

*Feb 2017 - May 2017*

Advanced human-like decision making in AI through studies with adversarial games. Research entailed experiments with human subjects navigating the games and using their performance to augment reinforcement learning policies.

## Industry Experience

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### **General Atomics ASI**

San Diego, CA

*Machine Learning Engineer*

*Jun 2018 - Aug 2018*

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

**ference, Inc.***Data Scientist*

Cambridge, MA

*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***Software Engineer*

Frederick, MD

*Jun 2017 - Aug 2017*

Optimized power grid performance from learned tenant energy use patterns and intraday fluctuations in overall grid demand to intelligently cycle water heaters and HVAC systems, thus reducing extrema in required power generation.

**Teaching, Mentorship, and Service**

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**MIT 6.862: Applied Machine Learning***Teaching Assistant*

EECS, MIT

*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***Teaching Assistant*

EECS, MIT

*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***Team Lead, Member*

Cambridge, MA

*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***Director of Corporate Relations*

Cambridge, MA

*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**

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**Best Paper: Pathway to Impact, NeurIPS (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**

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**Reviewing**

IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)

2022

**Selected Publications**

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**Preprints and Papers Under Review**

4. Woonghee Han, Randall Pietersen, Rafael Villamor Lora, Matthew Beveridge, Earl Marmar, Jim Terry, Iddo Drori. Tracking Blobs in the Turbulent Edge Plasma of Tokamak Fusion Reactors. 2021.
3. Samuel Humphries, Madeleine Jansson, Young Ryu, Matthew Beveridge, Melody Cao, Iddo Drori. Predicting Wildfire Growth. 2021.
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. 2021.
1. Alexander E. Siemenn, Matthew Beveridge, Tonio Buonassisi, Iddo Drori. Online Preconditioning of Experimental Inkjet Hardware by Bayesian Optimization in Loop. 2021.

## Peer-Reviewed Publications

8. 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.
7. 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.
6. 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.*
5. 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.
4. Evyatar Shaulsky, Alexander Siemenn, Matthew Beveridge, Tonio Buonassisi, Iddo Drori, Sara Hashmi. Artificial Intelligence Enhances Control Parameter Space Investigation in Flow-Focusing Droplet Generation. 95<sup>th</sup> **ACS Colloid and Surface Science** Symposium, 2021.
3. Woonghee Han, Nicola Offeddu, Theodore Golfopoulos, Christian Theiler, Cedric Tsui, Jose Boedo, Jim Terry, Earl Marmar, 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.
2. Sarah Mokhtar, Matthew Beveridge, Melody Cao, Iddo Drori. Pedestrian Wind Factor Estimation in Complex Urban Environments. Asian Conference on Machine Learning (**ACML**), 2021. *Long oral spotlight.*
1. 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.

## Theses

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

## Software

2. Matthew Beveridge. *replaybuffer*: The simple buffer for experience replay – built for uses in reinforcement learning, computer vision, and other applications where temporal information matters. **MIT License**, 2021.
1. Matthew Beveridge. *finpandas*: A Pythonic interface and analysis toolkit for fundamental financial information. **MIT License**, 2021.

## Selected Projects

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### 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 UAP and GAN attacks on FL systems, and ways to defend 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*: Taking an information theoretic approach to apply the horse racing problem to Roulette in a similar manner to portfolio theory. 2019.

## Key Skills

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**Programming:** Python; Julia; Java; R; SQL; C++; Git; \*nix OS; HTML; C#; PyTorch; Tensorflow; Drake; ROS.

**Machine Learning:** Deep Learning including CNNs, RNNs, GANs, Transformers, and VAEs; Machine Learning including SVM, KNN, Decision Trees, Bayes, and AutoML.; Federated Learning including attacks and defenses.

**Computer Vision:** OpenCV; SfM/MVS; SLAM; Calibration; Multi-sensor arrays; RGB, LWIR, and LiDAR sensors.

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

## References

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**Daniela Rus**

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*Director, CSAIL, MIT*

*Andrew and Erna Viterbi Professor of EECS, MIT*

*Deputy Dean of Research, Schwarzman College of Computing, MIT*

**Russ Tedrake**

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*Toyota Professor of EECS, Aero/Astro, MechE, MIT*

*Vice President, Robotics Research, Toyota Research Institute*

**Iddo Drori**

idrori@mit.edu

*Professor Lecturer, Department of EECS, MIT*

*Adjunct Associate Professor, Department of Computer Science, Columbia University*