

Alexander Amini

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EDUCATION

- **Massachusetts Institute of Technology (MIT)** Cambridge, MA
Doctor of Philosophy (PhD); Computer Science Aug. 2017 – May 2022 (anticipated)
- **Massachusetts Institute of Technology (MIT)** Cambridge, MA
Master of Science (SM); Computer Science Aug. 2017 – Jun. 2018
- **Massachusetts Institute of Technology (MIT)** Cambridge, MA
Bachelor of Science (SB); Major: EECS, Minor: Mathematics Aug. 2013 – Jun. 2017
- **Castleknock College** Dublin, Ireland
Leaving Certification; Honours Concentration in Mathematics and Science Aug. 2010 – Jun. 2012

EXPERIENCE

- **Distributed Robotics Laboratory** CSAIL, MIT
Graduate Researcher; Advisor: Prof. Daniela Rus Aug. 2017 - Present
My research focuses on machine learning algorithms for end-to-end control (i.e., perception-to-actuation) of autonomous systems and formulating reliable and robust uncertainty estimation for these deep learning algorithms.
- **NVIDIA Corporation** Holmdell, NJ
Deep Learning Researcher; Advisor: Dr. Urs Muller Jun. 2017 - Aug. 2017
Worked with NVIDIA's end-to-end driving team to design and develop novel confidence measures for estimating the uncertainty of deep neural networks. My work was deployed on full-scale self-driving vehicles.
- **MIT 6.S191: Introduction to Deep Learning** EECS, MIT
Organizer and Lecturer Jan. 2018, 2019, 2020, 2021, 2022
I am a lead lecturer and organizer of the course; including developing the curriculum, teaching the lectures, handling sponsorship from industrial partners, and publishing the content online.
- **International Business Machines (IBM) Research** Yorktown Heights, NY
Summer Internship; Advisor: Dr. Catherine Crawford Jun. 2016 - Sep. 2016
Developed methods for training end-to-end control models in an online and adaptive setting, using a distributed collection of embedded devices thus accounting for vastly greater numbers of possible conditions a vehicle encounters.
- **Laboratory for Information & Decision Systems** CSAIL, MIT
UROP Researcher; Advisor: Prof. Swrit Sra Jun. 2015 - Sep. 2015
Evaluated state-of-the art gradient based optimization techniques on non-convex deep architectures, and also presented new variant combo optimization algorithms utilizing variance reduction techniques.
- **Senseable City Laboratory** MIT
Research Fellow; Advisor: Prof. Carlo Ratti Sep. 2012 - Jun. 2013
Developed new mathematical models to uncover patterns in human mobility using passive sensing modalities such as large-scale mobile phone records, credit card transactions, and taxi trips.
- **CLARITY Research** Dublin, Ireland
Internship Scholarship; Advisor: Prof. Noel O'Connor Jun. 2011 - Sep. 2011
Developed analytical and learning algorithms for big data from adaptive sensor technologies. Collected 400 GB of tennis sensor data, developed software tools to extract features, and trained, evaluated and deployed models.

AWARDS

- **JP Morgan Chase Graduate Research Fellowship** 2021-2022
- **National Science Foundation (NSF) Graduate Research Fellowship** 2017-2022
- **Best Overall Paper Finalist (2.5%), IEEE Robosoft** 2021
Co-Learning of Task and Sensor Placement for Soft Robotics by Spielberg*, **Amini***, Chin, Matusik, Rus.
- **MIT Outstanding Mentor for Undergraduate Researchers** 2020
Annual MIT-wide award to recognize an individual graduate or postdoctoral research mentor who has demonstrated exceptional guidance and teaching in a research setting.
- **Best Overall Paper Finalist (0.1%), IEEE ICRA** 2019
Variational End-to-End Navigation and Localization by **Amini**, Rosman, Karaman, Rus.

- **Travel Award, NeurIPS Bayesian Deep Learning** 2018
Spatial Uncertainty Sampling for End-to-End Control by **Amini**, Soleimany, Karaman, Rus.
- **Grand Prize Winner, European Union Young Scientist** 2011
 Top prize winning project: *Tennis Sensor Data Analysis: An Automated System for Macro-motion Refinement*; which developed mathematical models for detecting the subtle differences in motion to classify and provide corrective feedback.
- **Grand Prize Winner, BT Young Scientist and Technologist** 2011
 Top prize winner in Ireland's national science competition for: *Tennis Sensor Data Analysis*. Selected to represent the nation of Ireland at the international level, against 38 different countries, where the work again won the top grand prize.

SELECTED PUBLICATIONS

* denotes equal contribution

1. **Amini, A.***, Wang, T.*, Gilitschenski, I., Schwarting, W., Liu, Z., Han, S., Karaman, S., Rus, D. (2021). VISTA 2.0: An open, data-driven simulator for multimodal sensing and policy learning for autonomous vehicles. arXiv: 2111.12083. Under review at IEEE ICRA 2022.
2. Wang, T.*, **Amini, A.***, Schwarting, W., Gilitschenski, I., Karaman, S., Rus, D. (2021). Learning interactive driving policies via data-driven simulation. arXiv: 2111.12137. Under review at IEEE ICRA 2022.
3. Vorbach, C.*, Hasani, R.*, **Amini, A.**, Lechner, M., Rus, D. (2021). Causal Navigation by Continuous-time Neural Networks. *Neural Information Processing Systems (NeurIPS)*.
4. Liebenwein, L.*, Hasani, R.*, **Amini, A.**, Rus, D. (2021). Sparse flows: Pruning continuous-depth models. *Neural Information Processing Systems (NeurIPS)*.
5. Soleimany, A.*, **Amini, A.***, Goldman, S.*, Rus, D., Bhatia, S. N., Coley, C. W. (2021). Evidential Deep Learning for Guided Molecular Property Prediction and Discovery. *ACS central science*, 7(8), 1356-1367.
6. Liu, Z.*, **Amini, A.***, Zhu, S., Karaman, S., Han, S., Rus, D. (2021). Efficient and Robust LiDAR-Based End-to-End Navigation. *IEEE International Conference on Robotics and Automation (ICRA)*.
7. Spielberg, A.*, **Amini, A.***, Chin, L., Matusik, W., Rus, D. (2021). Co-Learning of Task and Sensor Placement for Soft Robotics. *IEEE Robotics and Automation Letters (RA-L)*. *Best Paper Finalist: 2.5%, Joint at RA-L & RoboSoft*
8. Hasani, R., Lechner, M., **Amini, A.**, Rus, D., Grosu, R. (2021). Liquid time-constant networks. *AAAI Conference on Artificial Intelligence*. *Oral spotlight*
9. **Amini, A.**, Schwarting, W., Soleimany, A. and Rus, D. (2020) Deep Evidential Regression. *Neural Information Processing Systems (NeurIPS)*.
10. Lechner, M.*, Hasani, R. M.*, **Amini, A.**, Henzinger, T., Rus, D., Grosu, R., (2020) Neural Circuit Policies Enabling Auditable Autonomy. *Nature Machine Intelligence*, *In press*.
11. **Amini, A.**, Gilitschenski, I., Phillips, J., Moseyko, J., Banerjee, R., Karaman, S., Rus, D. (2020) Learning Robust Control Policies for End-to-End Autonomous Driving from Data-Driven Simulation. *IEEE Robotics and Automation Letters (RA-L)*. *Joint acceptance to RA-L & ICRA*
12. **Amini, A.***, Lipton, J.*, Daniela, R. (2020) Uncertainty Aware Texture Classification and Mapping Using Soft Tactile Sensors. *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*.
13. Hasani, R. M., Lechner, M., **Amini, A.**, Rus, D., Grosu, R. (2020). The natural lottery ticket winner: Reinforcement learning with ordinary neural circuits. *International Conference on Machine Learning (ICML)*.
14. **Amini, A.**, Rosman, G., Karaman, S., Rus, D. (2019). Variational end-to-end navigation and localization. *IEEE International Conference on Robotics and Automation (ICRA)* (pp. 8958-8964). *Best Paper Finalist: 0.1%*
15. **Amini, A.***, Soleimany, A.*, Schwarting, W., Bhatia, S., Rus, D. (2019). Uncovering and Mitigating Hidden Biases through Learned Latent Structure. *AAAI/ACM Conference on AI Ethics and Society (AIES)*.
16. Gilitschenski, I., Sahoo, R., Schwarting, W., **Amini, A.**, Karaman, S., Rus, D. (2019) Deep Orientation Uncertainty Learning based on a Bingham Loss. *International Conference on Learning Representations (ICLR)*.
17. Hasani, R. M.*, **Amini, A.***, Lechner, M., Naser, F., Grosu, R., Rus, D. (2018). Response Characterization for Auditing Cell Dynamics in Long Short-term Memory Networks. *International Joint Conference on Neural Networks (IJCNN)*. *Oral spotlight*

18. **Amini, A.**, Paull, L., Balch, T., Karaman, S., Rus, D. (2018). Learning steering bounds for parallel autonomous systems. *IEEE International Conference on Robotics and Automation (ICRA)* (pp. 1-8).
19. **Amini, A.** (2018). Robust end-to-end learning for autonomous vehicles. Masters (SM) dissertation, Massachusetts Institute of Technology.
20. **Amini, A.**, Schwarting, W., Rosman, G., Araki, B., Karaman, S., Daniela, R. (2018). Variational Autoencoder for End-to-End Control of Autonomous Driving with Novelty Detection and Training De-biasing. *IEEE/RSJ International Conference on Intelligent Robots and Systems*.
21. **Amini, A.**, Soleimany, A., Karaman, S., Rus, D. (2017). Spatial Uncertainty Sampling for End-to-End Control. *Bayesian Deep Learning at Neural Information Processing Systems (NIPS)*. *Travel award: 8% and Oral spotlight: 12%*
22. Yoshimura, Y., **Amini, A.**, Sobolevsky, S., Blat, J., Ratti, C. (2017). Analysis of pedestrian behaviors through non-invasive Bluetooth monitoring. *Applied geography*, 81, 43-51.
23. **Amini, A.**, Horn, B., Edelman, A. (2016). Accelerated Convolutions for Efficient Multi-Scale Time to Contact Computation in Julia. arXiv preprint arXiv:1612.08825.
24. Yoshimura, Y., **Amini, A.**, Sobolevsky, S., Blat, J., Ratti, C. (2016). Analysis of Customers Spatial Distribution Through Transaction Datasets. In *Transactions on Large-Scale Data-and Knowledge-Centered Systems XXVII* (pp. 177-189). Springer, Berlin, Heidelberg.
25. **Amini, A.**, Kung, K., Kang, C., Sobolevsky, S., Ratti, C. (2014). The impact of social segregation on human mobility in developing and industrialized regions. *EPJ Data Science*, 3(1), 6.
26. Pei, T., Sobolevsky, S., Ratti, C., **Amini, A.**, Zhou, C. (2014). Uncovering the directional heterogeneity of an aggregated mobile phone network. *Transactions in GIS*, 18, 126-142.
27. **Amini, A.**, Kung, K., Kang, C., Sobolevsky, S., Ratti, C. (2013). The differing tribal and infrastructural influences on mobility in developing and industrialized regions. *Mobile phone data for development-analysis of mobile phone datasets for the development of Ivory Coast*. Orange D4D challenge, 339. *Oral spotlight: 16%*
28. **Amini, A.** "System and method for adaptive delivery of game balls based on player-specific performance data analysis." U.S. Patent No. 8,419,560. 16 Apr. 2013.
29. **Amini, A.** "System and method for motion analysis and feedback with ongoing dynamic training orientation determination." U.S. Patent No. 13/183,306.

TEACHING AND MENTORSHIP

- **Lead organizer and lecturer** MIT
MIT Introduction to Deep Learning, 6.S191 *Jan 2018 - present*
 Developed, organized, and taught MIT's official introductory course on deep learning methods and applications. 2021 MIT enrollment of 700 students; enrollment of 300+ students per year in each of 2018, 2019, 2020. Over 30,000 registered students globally across 50 countries and over 5 million lecture views.
- **Masters (MEng) research advisor** CSAIL, MIT
Distributed Robotics Laboratory *Sep 2019 - present*
 Research mentor Master's students to create and complete their MEng thesis and degree work.
 1. **Jacob Phillips** (*present*): Unsupervised latent debiasing of time-series models.
 2. **Elaheh Ahmadi** (*2021*): Identifying and mitigating the bias in predicting drug development outcomes.
 3. **Matt Beveridge** (*2021*): Video-consistent depth estimation for data-driven simulation, joint with I. Gilitschenski.
 4. **Alex Knapp** (*2020*): AirGuardian: a parallel autonomy approach to self-flying planes.
- **Undergraduate research (UROP) advisor** CSAIL, MIT
Distributed Robotics Laboratory *Sep 2017 - present*
 Closely mentored 15 undergraduate students on a variety of research projects I proposed as part of my graduate thesis, ranging in themes from robotics, to machine learning, and computer vision. All students were awarded departmental or sponsored funding for their research.
 1. **Julia Moseyko** (*Sep 2018 - present*): Depth estimation and reinforcement learning in data-driven simulation
 2. **Shinjini Ghosh** (*Feb 2019 - present*): Automating the diagnosis of sepsis from only blood-based computer vision

3. **Catherine Zheng** (*Jan 2021 - present*): Model-based RL with transformers, joint with I. Gilitschenski, R. Hasani.
4. **Alvin Li** (*Jan 2021 - present*): Latent space visualization and optimization, joint with W. Schwarting.
5. **Selena Zheng** (*Jun 2021 - present*): Uncertainty-aware learning of deep neural networks
6. **Suraj Srinivasan** (*Sep 2021 - present*): The effect of temporal processing for vision-based detection
7. **Charlie Vorbach** (*Jan 2021 - Sep 2021*): Causal Navigation by Continuous-time NNs, joint with R. Hasani.
8. **Jordan Docter** (*Aug 2020 - Jun 2021*): Transformers for scalable robot learning, joint with R. Hasani.
9. **Natasha Maniar** (*Feb 2021 - Jun 2021*): UncOpt: uncertainty-guided optimization for robust learning
10. **Jacob Phillips** (*Jun 2018 - Feb 2021*): Photorealistic data-driven simulation for autonomous vehicles
11. **William Chen** (*Sep 2020 - Feb 2021*): Multi-agent autonomous drone policy learning, joint with R. Hasani.
12. **Roshni Sahoo** (*Sep 2019 - Oct 2020*): Deep orientation uncertainty, joint with I. Gilitschenski, W. Schwarting.
13. **Diana Voronin** (*May 2020 - Sep 2020*): Building an annotation engine for generation of blood-based kymography
14. **Daniela Velez** (*Feb 2020 - June 2020*): Detecting minor fabric defects with machine learning
15. **Baptiste Bouvier** (*Jan 2019 - Sep 2019*): Attention-based learning with event-based cameras and CT-RNNs
16. **Tom Dudzik** (*Sep 2017 - Jun 2018*): Data-driven simulation of perception for autonomous vehicles

CSAIL, MIT

MIT PRIMES research advisor

Distributed Robotics Laboratory

MIT PRIMES is a year-long program, in which high school students work on individual and group research projects and participate in reading groups under the guidance of academic mentors.

1. **Yuxuan Chen** (*2020*): Real world learning from event-based end-to-end autonomous driving

PRESENTATIONS

- **The Boeing Company**, Invited talk *Nov 2021*
- **CSAIL FinTech Seminar**, Invited talk *Oct 2021*
- **CVPR ROADS Workshop**, Invited talk *Oct 2021*
- **ICRA Conference**, Contributed talk *May 2021*
- **MIT Embodied Intelligence Seminar**, Contributed talk *Feb 2021*
- **NeurIPS Bayesian Deep Learning**, Poster *Dec 2020*
- **MIT Embodied Intelligence Seminar**, Contributed talk *Nov 2020*
- **NVIDIA GTC**, Invited talk *Sept 2020*
- **MIT Embodied Intelligence Seminar**, Contributed talk *Jul 2020*
- **MIT Airforce Accelerator Seminar**, Contributed talk *Jun 2020*
- **ICRA Conference**, Contributed talk *May 2020*
- **Toyota Research Institute Annual Conference**, Contributed talk, Poster *Jan 2020*
- **Machine Intelligence Community**, Invited talk *Nov 2019*
- **ICML Workshop on AI for Autonomous Driving**, Oral spotlight *Jun 2019*
- **ICML Workshop on Reinforcement Learning for Real Life Workshop**, Oral spotlight *Jun 2019*
- **ICRA Conference**, Oral spotlight for Best paper award *May 2019*
- **AAAI AIES Conference**, Oral spotlight *Jan 2019*
- **Toyota Research Institute Annual Conference**, Contributed talk, Poster *Jan 2019*
- **NeurIPS Bayesian Deep Learning**, Oral spotlight, Poster *Dec 2018*
- **IROS Conference**, Contributed talk *Nov 2018*
- **NVIDIA GTC**, Invited talk *Mar 2018*
- **Toyota Research Institute Annual Conference**, Contributed talk, Poster *Jan 2018*
- **Network Mobility Conference (NetMob)**, Oral spotlight *May 2013*
- **European Union Contest for Young Scientists**, Contributed talk, Poster *Sep 2011*
- **BT Young Scientist and Technologist Competition**, Poster *Jan 2011*

KEY SKILLS

- **Programming**: Python; Tensorflow; Pytorch; OpenCV; Robot Operating System (ROS); Matlab; Java; C/C++; Unix Scripting; OpenGL; Android/Mobile; SQL; HTML
- **Machine Learning/Data Analysis**: Deep Learning, including CNNs, RNNs, VAEs, GANs, Bayesian NNs, Transformers, NeRFs; Machine Learning including SVM, KNN, Fuzzy Rules, Decision Trees, Bayes

REFERENCES

- **Daniela Rus, rus@csail.mit.edu**
Director, CSAIL; Andrew and Erna Viterbi Professor of EECS; Deputy Dean of Research, Schwarzman College of Computing; MIT
- **Sertac Karaman, sertac@mit.edu**
Director, LIDS; Charles Stark Draper Associate Professor of Aeronautics and Astronautics; MIT
- **John Leonard, jleonard@mit.edu**
Samuel C. Collins Professor of Mechanical and Ocean Engineering; MIT
- **Larry Jackel, larry.jackel@north-c.com**
President, North-C Technologies
- **Igor Gilitschenski, gilitschenski@cs.toronto.edu**
Assistant Professor, Department of Computer Science; University of Toronto