

Patrick Emami

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Research Interests

My PhD research is motivated by a curiosity about what a computational visual framework would look like that mimics how we use mental models of the world to reason about alternative futures while taking into account multiple interacting objects. An example of where this could have an immense impact is in intelligent transportation systems; in a crowded roadway containing many pedestrians, a self-driving vehicle needs the ability to consider the relative safety of various possible sequences of actions. This has lead me to research deep generative models for multi-object spatiotemporal visual data, multi-object tracking, and the intersection of these two areas. I am also passionate about interdisciplinary machine learning research with a positive social impact and have collaborated on projects in both transportation systems and cybersecurity.

Education

[†] *Indicates expected*

2016–2021 [†]	University of Florida , Gainesville, FL Ph.D., Computer Science	Advisor: Dr. Sanjay Ranka
2012–2016	University of Florida , Gainesville, FL B.Sc., Computer Engineering	Cum Laude, GPA: 3.74/4.0

Research and Industry Experience

2016–present	MALT Lab , Graduate Research Assistant Researching novel deep generative models for multi-object video representation learning
2016–present	UF Transportation Institute (UFTI) , Graduate Research Assistant Algorithm design and field deployment of real-time multi-sensor multi-object tracking for urban traffic intersection optimization [UFTI news article]
2015–2016	Machine Intelligence Lab (MIL) , Undergraduate Research Assistant Motion planning for Subjugator, an AUV with 6 DOF
Summer 2015	Amazon.com, Inc. , Software Development Engineering Intern Developed an Android image processing library for scanning PDF417 barcodes during driver registration in the Prime Now app
2013–2015	Center for Intelligent Machines and Robotics (CIMAR) Undergraduate Research Assistant Developed a Python framework for implementing Partially Observable Markov Decision Processes

Selected Honors and Awards

2020	Student of the Year USDOT STRIDE Center (10 universities) (\$1,000)
2016–present	McKnight Doctoral Fellowship (\$65,000)
2016–present	CISE Department Graduate Research Fellowship (\$150,000)
2016	President’s Honor Roll
2015–2016	Northrop Grumman Engineering Scholarship (\$1,000)
2014–2015	University Scholars Program Research Grant (\$1,750)
2014	IROS’14 Best Entertainment Robots and Systems Paper Finalist

Summer Schools

Summer 2019	Machine Learning Summer School (MLSS) London
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Teaching

Summer 2018	UF Student Science Training Program Intro to Machine Learning — Curriculum Design and Course Instructor
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Mentoring

Fall 2018–present	Kevin Chow (B.Sc.)	University of Florida
Fall-Summer 2018	Anuran Rouchowdhury (M.Sc)	University of Florida
Summer 2018	Ian Pelakh (B.Sc.)	University of Florida
Fall 2017	Shalaka Naik (M.Sc), Individual Study	University of Florida
Fall 2017	Vivek Gade (M.Sc), Individual Study	University of Florida
Summer 2017	Jabari Wilson (B.Sc.), Summer Und. Research Fellow	University of Alabama

Volunteering

2017–2018	UF Teaching Youth Programming Essentials , Curriculum Lead Responsible for designing and improving the UF TYPE programming curriculum
2016–2017	UF Teaching Youth Programming Essentials , Instructor Teach an after school Intro to Programming course at local high schools
2014–2015	UF Association of Computer Engineers , Co-Founder and Project Manager Organized and presented at technical and professional development workshops for undergraduate computer engineering students

Professional Activities

2020	NeurIPS Workshop on Interp. Inductive Biases and Phys. , Reviewer
2020	Transportation Research Board Annual Meeting (TRBAM) , Reviewer
2020	Optimization Letters , Reviewer
2019	UF Informatics Institute Student Data Analysis Seminar , Co-Organizer
2018	UF Informatics Institute Student Data Analysis Seminar , Co-Organizer
2018	International Conference on Machine Learning and Data Science , Reviewer
2018	IEEE Intelligent Transportation Systems Conference , Special Session Chair
2018	IEEE Intelligent Transportation Systems Conference , Reviewer
2017	International Conference on Machine Learning and Data Science , Reviewer
2017	UF Informatics Institute Student Data Analysis Seminar , Co-Organizer
2016–2018	UF Machine Learning Reading Group , Organizer

Professional Societies

2018–present	Alpha Epsilon Lambda Graduate Honor Society, member
2017–present	ACM, student member
2016–present	IEEE, student member
2014–present	IEEE Eta Kappa Knu Honor Society, member

Publications

Peer-Reviewed Journals

- [1] **Emami, P.**, & Elefteriadou, L., & Ranka, S. Long-range Tracking of Vehicles at Traffic Intersections Without a GPU. Transactions on Intelligent Transportation Systems. 2020. *Submitted*.
- [2] **Emami, P.**, & Panos M. P., & Elefteriadou, L., & Ranka, S. Machine Learning Methods for Data Association in Multi-Object Tracking. ACM Computing Surveys, 53, 4, Article 69. 2020.
- [3] Pourmehrab, M., **Emami, P.**, Martin-Gasulla, M., Wilson, J., Elefteriadou, L., Ranka, S. Signalized Intersection Performance with Automated and Conventional Vehicles: A Comparative Study. Journal of Transportation Engineering, Part A: Systems 146.9. 2020.

Peer-Reviewed Conferences and Workshops

- [1] **Emami, P.**, He, P., Rangarajan, A., Ranka, S. A Symmetric and Object-Centric World Model for Stochastic Environments. 34th Conference on Neural Information Processing Systems Workshop on Object Representations for Learning and Reasoning. 2020. *Accepted as Spotlight*.
- [2] **Emami, P.**, He, P., Rangarajan, A., Ranka, S. Efficient and Symmetry-Preserving Variational Inference for Multi-Object Representation Learning. 2020. *In preparation*.
- [3] **Emami, P.***, Vargas, L.*, Traynor, P. CCSW 2020: The ACM Cloud Computing Security Workshop. 2020. **Equal contribution*

- [4] **Emami, P.**, Pourmehrab, M., Martin-Gasulla, M., Ranka, S., Elefteriadou, L. A Comparison of Intelligent Signalized Intersection Controllers Under Mixed Traffic. IEEE Intelligent Transportation Systems Conference, 2018.
- [5] Omidvar, A., Pourmehrab, M., **Emami, P.**, Kiriazes, R., Esposito, J., Letter, C., Elefteriadou, L., Ranka, S., Crane, C. Deployment and Testing of Optimized Autonomous and Connected Vehicle Trajectories at a Closed-Course Signalized Intersection. Transportation Research Board's 97th, 2018.
- [6] **Emami, P.**, Elefteriadou, L., Ranka, S. Tracking Vehicles Equipped with Dedicated Short-Range Communication at Traffic Intersections. 7th ACM International Symposium on Design and Analysis of Intelligent Vehicular Networks and Applications (DIVANet'17), 2017.
- [7] Hamlet, A., **Emami, P.**, Crane, C. The Cognitive Driving Framework: Joint Inference for Collision Prediction and Avoidance in Autonomous Vehicles. In the 15th International Conference on Control, Automation and Systems (ICCAS), pp. 1714-1719. IEEE, 2015.
- [8] Hamlet, A., **Emami, P.**, Crane, C. A Gesture Recognition System for Mobile Robots That Learns Online. In the 2014 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS'14), pp. 2114-2119. IEEE, 2014.

Preprints

- [1] **Emami, P.**, & Ranka, S. Learning Permutations with Sinkhorn Policy Gradient. arXiv:1805.07010 [cs.LG], 2018.
- [2] **Emami, P.**, & Panos M. P., & Elefteriadou, L., & Ranka, S. Machine Learning Methods for Solving Assignment Problems in Multi-Target Tracking. Under review at ACM Computing Surveys. arXiv:1802.06897 [cs.CV], 2018.

Posters

- [1] **Emami, P.**, & Pourmehrab, M., & Elefteriadou, L., & Ranka, S., & Crane, C. A Demonstration of Fusing DSRC and Radar for Optimizing Intersection Performance. Automated Vehicles Symposium (AVS'17), 2017.

Blog Posts

- [1] **Emami, P.** Deep Deterministic Policy Gradients in Tensorflow. <http://pemami4911.github.io/blog/2016/08/21/ddpg-rl.html>. 2016. > 100K unique views (Google Analytics).