

Ankit Shah

Research Interests

Machine learning for robotics; Algorithmic human-machine interaction; Interactive robot learning; Transparency in decision systems; Probabilistic modeling and inference

Education

Sept 2021 **Massachusetts Institute of Technology, Ph.D.**
(Expected) Autonomous Systems

June 2016 **Massachusetts Institute of Technology, S.M.**
Aeronautics and Astronautics

August 2013 **Indian Institute of Technology Bombay, B. Tech.**
Aerospace Engineering

Work Experience

Jan 2020 – **Research Assistant, Interactive Robot Pedagogy for Non-Markov Tasks**, Interactive Robotics
Present Group, MIT.

- Developed a novel problem formulation and planning algorithm for decision-making with ambiguous Non-Markov tasks specifications
- Developed an active learning algorithm for robot learning leading to faster convergence to teacher's intended task

Jan 2017 – **Research Assistant, Intelligent Mission Analysis and Review Systems**, Interactive Robotics
Jan 2020 Group, MIT.

- Developed data-driven models for supervised trajectory segmentation and mission phase annotation
- Developed a Bayesian inference framework to learn temporal logic specifications from mission demonstrations

Jan 2014 – **Research Assistant, Robotics in Final Assembly Tasks**, Interactive Robotics Group, MIT.

- Developed a task planning algorithm for installation of interlinked cables
- Developed a perception algorithm to estimate cable shape using depth images

May – Jul **Summer Intern, National Aerospace Laboratories**, Bengaluru, India.

- Developed software routines to compute aircraft drag polars given airframe geometry

May 2010 – **Pratham: IITB Student Satellite Project**, IIT-B.

- Lead the attitude determination and control system team
- Designed performance verification simulations for attitude control and power distribution systems

Technical Expertise

Languages Python (primary), Julia, C++, JavaScript

Frameworks TensorFlow, PyTorch, Gen, webppl, Pyro, pandas, scikit-learn, ROS, MATLAB

Teaching Experience

Fall 2013 **Teaching Assistant, 16.06 Principles of Automatic Control.**
Undergraduate control theory class

Fall 2020 **Kaufman Teaching Certification Program.**
Series of workshops on evidence-based teaching

Publications

Journal Articles

- [J1] A. Shah, S. Li, and J. Shah, "Planning with uncertain specifications (PUnS)," *IEEE Robotics and Automation Letters*, 2020
- [J2] A. Shah, P. Kamath, S. Li, P. Craven, K. Landers, K. Oden, and J. Shah, "Supervised Bayesian specification inference from demonstrations," *The International Journal of Robotics Research* (under review), 2019
- [J3] A. Shah, L. Blumberg, and J. Shah, "Planning for manipulation of interlinked deformable linear objects with applications to aircraft assembly," *IEEE Transactions on Automation Science and Engineering*, 2018

Conference Proceedings

- [C1] S. Li, N. Figueroa, A. Shah, and J. Shah, "Provably safe and efficient motion planning under uncertainty for human-robot collaboration," (under review), 2020
- [C2] S. Booth, Y. Zhou, A. Shah, and J. Shah, "Bayes-trex: a bayesian sampling approach to model transparency by example," in *Proceedings of the AAAI Conference on Artificial Intelligence* (Accepted for publication), 2021
- [C3] A. Shah, S. Wadhwan, and J. Shah, "Interactive robot training for non-Markov tasks," *arXiv preprint arXiv:2003.02232* (under review), 2020
- [C4] J. Kim, C. Muise, A. Shah, S. Agarwal, and J. Shah, "Bayesian inference of linear temporal logic specifications for contrastive explanations," in *Proceedings of the Twenty-Eighth International Joint Conference on Artificial Intelligence*, 2019
- [C5] P. Craven, K. Oden, K. Landers, A. Shah, and J. Shah, "Man-machine interoperation in training for large force exercise air missions," in *Interservice/Industry Training, Simulation and Education Conference*, 2019
- [C6] A. Shah, P. Kamath, J. A. Shah, and S. Li, "Bayesian inference of temporal task specifications from demonstrations," in *Advances in Neural Information Processing Systems*, 2018
- [C7] P. Craven, K. Oden, K. Landers, A. Shah, and J. Shah, "Man-machine interoperation in training for offensive counter air missions," in *Interservice/Industry Training, Simulation and Education Conference*, 2018
- [C8] A. J. Shah and J. A. Shah, "Towards manipulation planning for multiple interlinked deformable linear objects," in *IEEE International Conference on Robotics and Automation*, 2016

Workshops and Symposia

- [W1] A. Shah and J. Shah, "Interactive robot training for temporal tasks," in *HRI Pioneers, Companion of the 2020 ACM/IEEE International Conference on Human-Robot Interaction*, 2018
- [W2] S. Booth*, A. Shah*, Y. Zhou*, and J. Shah, "Sampling prediction-matching examples in neural networks: a probabilistic programming approach," in *AAAI Workshop on Statistical Relational AI*, 2019
- [W3] A. Shah and J. Shah, "Planning with uncertain specifications (PUnS)," in *RSS Workshop on Combining Learning and Reasoning – Towards Human-Level Robot Intelligence*, 2019
- [W4] J. Kim, C. Muise, A. Shah, S. Agarwal, and J. Shah, "Bayesian inference of temporal specifications to explain how plans differ," in *ICAPS 2019 Workshop on explainable AI in planning*, 2019
- [W5] A. Shah and J. Shah, "Towards specification learning from demonstrations," in *RSS Workshop on Learning From Demonstrations for High-Level Robotics Tasks*, 2018
- [W6] M. Gombolay and A. Shah, "Appraisal of statistical practices in HRI vis-a-vis the t-test for Likert items/scales," in *2016 AAAI Fall Symposium Series*, 2016

Thesis

- [T1] A. Shah, "Planning for manipulation of interlinked deformable linear objects with applications to aircraft assembly," Master's thesis, Massachusetts Institute of Technology, 2016

Invited Talks

- October 2018 Brown University Robotics
March 2019 University of Colorado Boulder
May 2019 University of Washington
Jan 2020 MIT Aeronautics and Astronautics: Symposium on Humans Interacting with Autonomy
Feb 2020 Brown University Robotics
Feb 2020 Georgia Institute of Technology

Academic Service

- Reviewer IEEE Robotics and Automation Letters
Autonomous Agents and Multi-Agent Systems
Conference on Neural Information Processing Systems
AAAI Conference on Artificial Intelligence
IEEE International Conference on Robotics and Automation
Robotics: Science and Systems
International Conference on Machine Learning
ACM/IEEE International Conference on Human Robot Interaction
IEEE/RSJ International Conference on Intelligent Robots and Systems
IEEE Conference of Decision and Control
IEEE Conference on Robot and Human Interactive Communication
- Program Committee 2021 International Joint Conference on Artificial Intelligence (Senior Program Committee)
2021 HRI Pioneers

Award and Honors

- 2020 HRI Pioneers
NeurIPS 2020 Reviewer Award
2013 IIT-B Institute Silver Medal for the best academic performance in Aerospace Engineering
IIT-B Boeing Academic Award (2009)
IIT-B Institute Academic Award (2009, 2010, 2011)
Gold Medal at the Indian National Physics Olympiads 2009 (Top-35 students across the country)

Mentorship

Undergraduate Researchers

- Jan 2016 – **Pravina Samaratunga**, MIT, S.B. 2019, now at Square Robot
Jan 2017 ◦ Estimation of deformable object shape from depth images.
May 2016 – **Niyati Desai**, MIT, S.B. 2019, Caltech, Ph.D. (in progress)
Sep 2016 ◦ Robot software framework for manipulation planning for cables.
May 2017 – **Lotta Blumberg**, MIT, S.B. 2018, M.Eng. 2019, now at Draper Laboratory
Jan 2018 ◦ Simulation and evaluations of task planning algorithms for deformable object manipulation.
◦ Supervised learning for mission trajectory segmentation.

- Feb 2018 – **David Amirault**, *MIT, S.B. (in progress)*
- Jun 2018 ○ Recovering interpretable data structures from temporal logic formulas.
 - Design of priors over temporal logic formulas as probabilistic programs.
- Feb 2018 – **Ali Zartash**, *MIT, S.B. 2019*, now at Cerebras
- Jun 2018 ○ Deep sequence classification for trajectory segmentation.
- Sep 2018 – **Josh Rosenkranz**, *MIT, S.B. 2019*, now at Xwing
- March 2019 ○ Comparison of Seq-2-Seq learning with Bayesian specification inference for simulated air-combat exercise assessment.