Aniruddh G. Puranic

January 2025

Institute for Systems Research (ISR)
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Research Highlights

- Neurosymbolic AI for control and decision-making in cyber-physical systems: reinforcement and imitation learning, temporal logic monitoring and reasoning, self-correction, behavior trees, multi-agent systems.
- Explainable AI (xAI) with formal methods: safety/risk-aware machine learning, temporal logical mining and monitoring for security.
- Modeling human factors: AI-enabled human assistance via interaction/feedback, preference modeling and adaptation.

Current Position

- **University of Maryland** — College Park, MD, USA
  Postdoctoral Associate — *Jun 2024 – Present*
  - Mentors: John S. Baras and Calin Belta
  - Research in Neurosymbolic AI and model-based systems engineering.
  - Mentoring researchers and Ph.D. students at UMD and Boston University

Education

- **University of Southern California** — Los Angeles, CA, USA
  Ph.D. Computer Science — *Aug 2019 – May 2024*
  - Advisors: Jyotirmoy V. Deshmukh and Stefanos Nikolaidis
  - Thesis: Sample-Efficient and Robust Neurosymbolic Learning From Demonstrations
    - Deep reinforcement learning and demonstration (imitation) learning with temporal logics.
    - Probabilistic modeling of human behaviors via neurosymbolic reward functions.
    - Inference of explainable performance metrics from human feedback and demonstrations.
- **University of Southern California** — Los Angeles, CA, USA
  M.S. Computer Science (Intelligent Robotics) — *Jan 2017 – Dec 2018*
- **Visvesvaraya Technological University** — India
  B.E. Computer Science and Engineering — *Sep 2012 – Aug 2016*
  - B.M.S. College of Engineering, Bangalore

Work Experience

- **SRI International** Princeton, NJ, USA
  Intern: Reinforcement Learning *May 2022 – Jul 2022*
  - Developed reinforcement learning algorithms for continual/lifelong learning in multi-agent systems to overcome catastrophic forgetting.

- **Toyota North America R&D - InfoTech Labs** Mountain View, CA, USA
  Researcher: Formal Methods for Connected Cars *Jan 2019 – Jul 2019*
  - Intelligent Connected Systems division.
  - Formal reasoning of edge computing configurations for connected vehicle applications (V2V and V2X).

- **USC Keck School of Medicine** Los Angeles, CA, USA
  Researcher *Jun 2018 – Dec 2018*
  - Center for Robotic Simulation and Education (CRSE).
  - Developed a tool using computer vision to estimate the deviation of surgical needle entry/exit points in dry-lab from images obtained from the Da Vinci surgical robot.
  - Inference of explainable performance metrics from human feedback and demonstrations.

- **SMERGERS Inc.** Bangalore, India
  Software Engineering Intern *Feb 2015 – May 2015*
  - Developed a user interaction system using Python/Django framework for the initial prototype of *'Sector Watch Feature'* which would provide a lot of insight about the businesses in a sector to the users in real time.

Publications

Journals

1. Puranic, A. G., Deshmukh, J. V. & Nikolaidis, S. Learning Performance Graphs From Demonstrations via Task-Based Evaluations. *IEEE Robotics and Automation Letters (RA-L); Oral presentation at ICRA 2023.* **8,** 336–343 (2023).
2. Puranic, A. G., Deshmukh, J. V. & Nikolaidis, S. Learning From Demonstrations Using Signal Temporal Logic in Stochastic and Continuous Domains. *IEEE Robotics and Automation Letters (RA-L); Presentation at IROS 2021.* **6,** 6250–6257 (2021).
3. Puranic, A. G., Deepak, K. & Umadevi, V. Vehicle Number Plate Recognition System: A Literature Review and Implementation using Template Matching. *International Journal of Computer Applications* **134,** 12–16 (2016).

Refereed Conferences

1. Matheu, R., Puranic, A. G., Baras, J. S. & Belta, C. *BT2Automata: Expressing Behavior Trees as Automata for Formal Control Synthesis* in *Proceedings of the 28th ACM International Conference on Hybrid Systems: Computation and Control (HSCC) – **To Appear*** (2025).
2. Puranic, A. G., Deshmukh, J. V. & Nikolaidis, S. *Signal Temporal Logic-Guided Apprenticeship Learning* in *2024 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)* (2024), 11147–11154.

3. Puranic, A., Deshmukh, J. & Nikolaidis, S. *Learning from Demonstrations using Signal Temporal Logic* in *Proceedings of the 2020 Conference on Robot Learning (CoRL)* **155** (PMLR, 2021), 2228–2242.
4. Mohammadinejad, S., Deshmukh, J. V. & Puranic, A. G. *Mining Environment Assumptions for Cyber-Physical System Models* in *2020 ACM/IEEE 11th International Conference on Cyber-Physical Systems (ICCPS)* (2020), 87–97.
5. Mohammadinejad, S., Deshmukh, J. V., Puranic, A. G., Vazquez-Chanlatte, M. & Donzé, A. *Interpretable Classification of Time-Series Data Using Efficient Enumerative Techniques* in *Proceedings of the 23rd International Conference on Hybrid Systems: Computation and Control* (Association for Computing Machinery, Sydney, New South Wales, Australia, 2020).
6. Balakrishnan, A., Puranic, A. G., Qin, X., Dokhanchi, A., Deshmukh, J. V., Ben Amor, H. & Fainekos, G. *Specifying and Evaluating Quality Metrics for Vision-based Perception Systems* in *2019 Design, Automation & Test in Europe Conference & Exhibition (DATE)* (2019), 1433–1438.

Posters

1. Puranic, A., Deshmukh, J. & Nikolaidis, S. *Poster Abstract: Learning from Demonstrations with Temporal Logics* in *25th ACM International Conference on Hybrid Systems: Computation and Control* (Association for Computing Machinery, Milan, Italy, 2022).
2. Puranic, A., Chen, J., Nguyen, J., Deshmukh, J. & Hung, A. MP35-04 Automated Evaluation of Instrument Force Sensitivity During Robotic Suturing Utilizing Vision-based Machine Learning. *Journal of Urology* **201,** e505–e506 (2019).

Ph.D. Thesis

. Puranic, A. G. *Sample-Efficient and Robust Neurosymbolic Learning From Demonstrations* Ph.D. Dissertation (University of Southern California, Los Angeles, CA, USA, May 2024).

US Patents and Applications

Status	*Title*	*Organization*
Granted (2025)	System and method for robot learning from human demonstrations with formal logic	USC
Granted (2022)	Distributed systems and extracting configurations for edge servers using driving scenario awareness.	Toyota
Pending	Methods and systems for processing traffic data from vehicles.	Toyota
Pending	Extracting temporal specifications of features for functional compatibility and integration with OEMs.	Toyota

Media/Press Appearances

- Learning-from-demonstrations using temporal logics featured in many of the major Computer Science news platforms:
  - The RISKS Digest by SRI's Peter G. Neumann
  - ACM TechNews
  - USC News

  - USC Viterbi News

- TQTL for vision-based perception systems in USC Viterbi News
- ACM SIGBED blog: Robot Learning meets Formal Specifications: Designing Safer Embedded Software in the age of AI

Academic Service and Professional Activities

- Chair of *Robot Learning* selected paper oral presentation session at IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2024.
- Invited talks: MIT AeroAstro/CSAIL, Galois Inc., CMU, UCSD, UPenn, Rice
- Program Committee member (Poster and Demos) for:
  - 16th ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS) 2025
  - 26th ACM International Conference on Hybrid Systems: Computation and Control (HSCC) 2023
- Review Editor for Frontiers in Robotics and AI: Human-Robot Interaction
- Volunteer for 32nd International Conference on Computer-Aided Verification (CAV) 2020
- Refereed papers (reviewer) for the following journals and conferences (alphabetical):
  - ACM/IEEE International Conference on Human Robot Interaction (HRI): 2024
  - ACM International Conference on Hybrid Systems: Computation and Control (HSCC): 2023
  - European Control Conference (ECC): 2025
  - Frontiers in Robotics and AI (section Human-Robot Interaction): 2025
  - IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS): 2021
  - IEEE International Conference on Robotics and Automation (ICRA): 2022, 2023, 2024
  - IEEE Robotics and Automation Lettes (RA-L): 2021, 2022, 2023, 2024
  - IEEE Transactions on Computers (IEEE Trans. Comput.): 2020
  - IEEE Transactions on Cybernetics (IEEE Trans. Cybern.): 2023
  - IEEE Transactions on Intelligent Transportation Systems (T-ITS): 2020
  - International Journal of Robotics Research (IJRR): 2025
  - Learning for Dynamics & Control Conference (L4DC): 2023, 2025
  - Springer Nature - Autonomous Robots (AURO): 2022, 2023
  - Subreviewer/Delegated Reviewer:
    * 2025: ICRA
    * 2024: RSS Pioneers
    * 2023: CAV, RSS, AAAI, EAAI
    * 2022: ISRR
    * 2021: ICRA, NeurIPS, DAC, ICCPS
    * 2020: HRI, CDC, CAV, DAC, ICRA
    * 2019: ICCPS, CLOUD

Teaching Experience

- **Autonomous Cyber-Physical Systems (CSCI 513)** University of Southern California
  Teaching Assistant *Fall 2022, Fall 2020*
  - Class instructor: Jyotirmoy V. Deshmukh
- **Introduction to Robotics (CSCI 445)** University of Southern California
  Course Producer *Fall 2018*
  - Class instructor: Nora Ayanian
- **Robotics (CSCI 545)** University of Southern California
  Course Producer *Spring 2018*
  - Class instructor: Stefan Schaal