

Anand Balakrishnan

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EDUCATION

- **Ph.D. Computer Science** Aug 2019 — Ongoing
University of Southern California
Advisor: *Jyotirmoy V. Deshmukh*
- **B.S. Computer Engineering** May 2018
University at Buffalo
Distinction: *Magna Cum Laude*

EXPERIENCE

- **Research Assistant** Aug 2018 — Ongoing
CPS-VIDA Group, University of Southern California
Advisor: *Jyotirmoy V. Deshmukh*
- **Research Intern** May 2020 — Aug 2020
Toyota Research Institute, North America
- **Undergraduate Researcher** Feb 2016 — May 2018
Distributed Robotics and Networked Embedded Systems Lab, University at Buffalo
Advisor: *Karthik Dantu*
- **Undergraduate Teaching Assistant** Fall 2017
CSE331: Algorithm Analysis and Design, University at Buffalo
Supervisor: *Atri Rudra*

PUBLICATIONS

Journals and Conferences

- Z. S. Hashemifar, C. Adhivarahan, A. Balakrishnan, and K. Dantu, “Augmenting visual SLAM with wi-fi sensing for indoor applications,” *Autonomous Robots*, vol. 43, no. 8, pp. 2245–2260, Dec. 2019, ISSN: 1573-7527. DOI: 10.1007/s10514-019-09874-z. [Online]. Available: <https://doi.org/10.1007/s10514-019-09874-z>.
- A. Balakrishnan and J. V. Deshmukh, “Structured reward shaping using signal temporal logic specifications,” in *2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, ISSN: 2153-0858, Nov. 2019, pp. 3481–3486. DOI: 10.1109/IR0S40897.2019.8968254.
- K. Nottingham, A. Balakrishnan, J. Deshmukh, C. Christopherson, and D. Wingate, “Using logical specifications of objectives in multi-objective reinforcement learning,” *arXiv:1910.01723 [cs, stat]*, Oct. 2019. arXiv: 1910.01723. [Online]. Available: <http://arxiv.org/abs/1910.01723>.
- A. Balakrishnan and J. V. Deshmukh, “Structured reward functions using STL: Poster abstract,” in *Proceedings of the 22nd ACM international conference on hybrid systems: Computation and control*, ser. HSCC '19, Place: Montreal, Quebec, Canada tex.numpages: 2, New York, NY, USA: Association for Computing Machinery, Apr. 2019, pp. 270–271, ISBN: 978-1-4503-6282-5. DOI: 10.1145/3302504.3313355. [Online]. Available: <https://doi.org/10.1145/3302504.3313355>.
- A. Balakrishnan, A. G. Puranic, X. Qin, A. Dokhanchi, J. V. Deshmukh, H. Ben Amor, and G. Fainekos, “Specifying and evaluating quality metrics for vision-based perception systems,” in *2019 Design, Automation Test in Europe Conference Exhibition (DATE)*, ISSN: 1530-1591, Mar. 2019, pp. 1433–1438. DOI: 10.23919/DATE.2019.8715114.

Preprints

- K. Nottingham, A. Balakrishnan, J. V. Deshmukh, C. Christopherson, and D. Wingate, “Using logical specifications of objectives in multi-objective reinforcement learning,” *CoRR*, vol. abs/1910.01723, Oct. 2019. arXiv: 1910.01723.

Posters and Presentations

- A. Balakrishnan and J. V. Deshmukh, “Structured Reward Functions Using STL: Poster Abstract,” in *Proceedings of the 22nd ACM International Conference on Hybrid Systems: Computation and Control*, ser. HSCC '19, Poster, Montreal, Quebec, Canada: ACM, Apr. 2019, pp. 270–271. DOI: 10.1145/3302504.3313355.
- A. Balakrishnan, P. Behara, Z. Hashemifar, and K. Dantu, “Poster: Dataset for Experimental Validation of Wi-Fi Sensing,” in *6th Annual Northeastern Robotics Colloquium*, ser. NERC '17, Poster, Boston, MA, USA, Oct. 2017.

VOLUNTEERING AND SERVICES

- 59th IEEE Conference on Decision and Control, 2020
Reviewer
- 2020 IEEE/RSJ International Conference on Intelligent Robots and Systems
Reviewer
- 2020 ACM International Conference on Hybrid Systems: Computation and Control
Repeatability Evaluation Committee member
- 2019 SURE Program: Summer Research for Undergraduates
Graduate Student Mentor
- 2019 ACM/IEEE International Conference on Cyber-Physical Systems
Sub-reviewer

RESEARCH

Safety evaluation and monitoring of perception algorithms

CPS-VIDA Group, University of Southern California

Toyota Research Institute, North America

- Develop monitoring algorithms for data streams that are generated by perception algorithms like object tracking and object detection.
- Developed a toolbox to specify logical specifications on perception algorithms and monitor their output when run on various datasets.
- Develop algorithm and tool to efficiently monitor perception algorithms at runtime.

Logical Specification-Guided Reinforcement Learning

CPS-VIDA Group, University of Southern California

- Investigate use of Temporal Logics in the training and validation of safe reinforcement learning agents.
- Developed a method of using Signal Temporal Logic formulas and a choice of quantitative semantics to produce rewards for reinforcement learning agents from finite length signal traces.
- Extend this for use in reinforcement learning scenarios with multiple objectives.

Dataset for WiFi Augmented Sensing

Distributed Robotics and Networked Embedded Systems Lab, University at Buffalo

- Compile a dataset that incorporates streams of depth images (RGB-D) along with WiFi data for development of simultaneous localization and mapping algorithms that are augmented with WiFi.

RELATED PROJECTS

Signal Temporal Logic Library

[GitHub.com/anand-bala/signal-temporal-logic](https://github.com/anand-bala/signal-temporal-logic)

- Using: C++, Python
- A library for efficiently working with Signal Temporal Logic (STL) and its quantitative semantics.

Probabilistic Timed Automata Library [GitHub.com/anand-bala/probabilistic-timed-automata](https://github.com/anand-bala/probabilistic-timed-automata)

- Using: Python
- Python library for building and simulating probabilistic timed automata.

Persephone

[GitHub.com/cps-vida/Persephone](https://github.com/cps-vida/Persephone)

- Using: Matlab, C
- A MATLAB toolbox to monitor data streams generated by perception systems.
- Uses Timed Quality Temporal Logic specifications to build monitors for perception algorithms, including object tracking, bounding box detection, etc.