Kishor Jothimurugan

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Research Interests

My areas of interest include *Deep Reinforcement Learning*, *Formal Methods* and *Machine Learning*. In particular, I am interested in applying formal methods to improve reinforcement learning, verification of neural networks, and machine learning for program synthesis and analysis.

Education

University of Pennsylvania **Philadelphia, USA**
PhD candidate in Computer and Information Science, Current GPA 4.0/4.0 *2017–present*
Thesis Topic: Specification-guided Reinforcement Learning
Advised by Prof. Rajeev Alur

Chennai Mathematical Institute **Chennai, India**
B.Sc. (Honors) Mathematics and Computer Science, CGPA 9.77/10 *2014–2017*
Ranked among top 3 students

All Publications

* equal contribution, † authors in alphabetical order

Refereed Conference Publications

- **K. Jothimurugan**, S. Bansal, O. Bastani and R. Alur. Specification-Guided Learning of Nash Equilibria with High Social Welfare. *International Conference on Computer Aided Verification (CAV), 2022.*
- R. Alur, S. Bansal, O. Bastani and **K. Jothimurugan**†. A Framework for Transforming Specifications in Reinforcement Learning. *Henzinger-60 (Invited Contribution), 2022.*
- **K. Jothimurugan**, S. Bansal, O. Bastani and R. Alur. Compositional Reinforcement Learning from Logical Specifications. *Neural Information Processing Systems (NeurIPS), 2021.*
- R. Ivanov*, **K. Jothimurugan***, S. Hsu, S. Vaidya, R. Alur and O. Bastani. Compositional Learning and Verification of Neural Network Controllers. *International Conference on Embedded Software (EMSOFT), 2021.*
- **K. Jothimurugan**, O. Bastani and R. Alur. Abstract Value Iteration for Hierarchical Reinforcement Learning. *Artificial Intelligence and Statistics (AISTATS), 2021.*
- R. Alur, Y. Chen, **K. Jothimurugan**† and S. Khanna. Space-efficient Query Evaluation over Probabilistic Event Streams. *Logic in Computer Science (LICS), 2020.*
- **K. Jothimurugan**, R. Alur and O. Bastani. A Composable Specification Language for Reinforcement Learning Tasks. *Neural Information Processing Systems (NeurIPS), 2019.*

Refereed Workshop Papers and Posters

- **K. Jothimurugan**, S. Bansal, O. Bastani and R. Alur. A Framework for Transforming Specifications in Reinforcement Learning. *Workshop on Synthesis (SYNT), co-located with CAV 2022*.
- **K. Jothimurugan**, S. Bansal, O. Bastani and R. Alur. Specification-Guided Learning of Nash Equilibria with High Social Welfare. *Workshop on Safe and Robust Control of Uncertain Systems, NeurIPS 2021*.
- **K. Jothimurugan**, S. Bansal, O. Bastani and R. Alur. Compositional Reinforcement Learning from Logical Specifications. *Workshop on Synthesis (SYNT), co-located with CAV 2021*.
- **K. Jothimurugan**, O. Bastani and R. Alur. Abstract Value Iteration for Hierarchical Reinforcement Learning. *Deep RL Workshop, NeurIPS 2020*.

Unpublished Work

- **K. Jothimurugan**, S. Hsu, O. Bastani and R. Alur. Robust Option Learning for Adversarial Generalization. *Under review*.
- **K. Jothimurugan**, M. Andrews, J. Lee and L. Maggi. Learning Algorithms for Regenerative Stopping problems with Applications to Shipping Consolidation in Logistics. *Intern research report*.

Teaching Experience

Guest Lecturer

- Computer-Aided Verification (CIS 673) *Fall 2021*

Teaching Assistant

- Principles of Embedded Systems (CIS 540) *Spring 2019*
- Automata, Computability and Complexity (CIS 262) *Fall 2018*
- Discrete Mathematics (Undergraduate) *Spring 2017*
- Design and Analysis of Algorithms (NPTEL MOOC) *Fall 2016*

Mentoring

Graduate Student Mentoring
Steve Hsu, Masters Student, University of Pennsylvania *2020–2022*
Topic: Compositional reinforcement learning for multi-task generalization

UPenn Mentorship Program
Participated as a mentor for first-year PhD students *2022*

Awards

CTL Teaching Certificate *Spring 2022*
Awarded by Center for Teaching and Learning, University of Pennsylvania

CMI Undergraduate Scholarship *2014–2017*
Awarded by CMI to undergraduate students for excellence in academics

Invited Talks

IST Austria *Fall 2021*
Title: Reinforcement Learning from Logical Specifications

Simons Institute (UC Berkeley) *Spring 2021*
Workshop on Games and Equilibria in System Design and Analysis
Title: Abstract Value Iteration for Hierarchical Reinforcement Learning

Internships

Amazon Web Services
Applied Scientist Intern, AI Labs *Summer 2022*
Topic: Incorporating execution semantics in transformer-based code generation models

Nokia Bell Labs
Research Intern *Summer 2020*
Topic: An application of deep reinforcement learning to regenerative stopping problems

Amazon Web Services
Software Development Engineer Intern, Automated Reasoning Group *Summer 2019*
Topic: Using machine learning to improve usability of taint analysis

ENS Cachan
Research Intern *Summer 2017*
Topic: Models for distributed reactive synthesis

Review Service

Conferences: NeurIPS 2022.

Journals: IEEE TCAD.

Other Achievements

- Placed among **top 3 students** in CMI
- Qualified for **ACM ICPC India Regionals** 2016 (Chennai and Coimbatore)

Technical skills

Programming Languages: C++, Python, Java, Coq, MATLAB.

Tools: LaTeX, Git, Linux Utilities, VSCode, Matplotlib.

Frameworks: Tensorflow, Pytorch, HuggingFace, StableBaselines, OpenAI Gym, Pandas, Soot, Flow*.

Languages

Fluent: English, Hindi.
Native: Tamil.