

Kishor Jothimurugan

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Research Interests

My areas of interest lie at the intersection of **Formal Methods**, **Machine Learning** and **Artificial Intelligence**. In particular, I have worked on applying formal methods to improve reinforcement learning (RL), verification of neural networks (NN), and machine learning (ML) for program synthesis and analysis.

Education

University of Pennsylvania

Philadelphia, USA

Ph.D. in Computer and Information Science, GPA 4.0/4.0

2017–2023

Thesis Topic: Specification-Guided Reinforcement Learning

Committee: Dr. Osbert Bastani, Dr. Thomas A. Henzinger, Dr. Sampath Kannan, and Dr. George J. Pappas

Advised by Dr. Rajeev Alur

Chennai Mathematical Institute

Chennai, India

B.Sc. (Honors) in Mathematics and Computer Science, CGPA 9.77/10

2014–2017

Ranked among top 3 students

Work Experience

Two Sigma Investments, LP

2023–Current

Quantitative Researcher

Machine learning for alpha modeling

Amazon Web Services

Summer 2022

Applied Scientist Intern, AI Labs

Incorporating program semantics in transformer-based code generation models

Mentors: Dr. Nathan Fulton, Dr. Siddhartha Jain and Dr. Baishakhi Ray (Columbia University)

Nokia Bell Labs

Summer 2020

Research Intern, Data and AI Lab

An application of deep RL to regenerative stopping problems

Mentors: Dr. Matthew Andrews, Dr. Jeongran Lee and Dr. Lorenzo Maggi

Amazon Web Services

Summer 2019

Software Development Engineering Intern, Automated Reasoning Group

Using machine learning to improve usability of taint analysis

Mentors: Dr. Andrew Gacek and Dr. Lee Pike

ENS Paris-Saclay

Summer 2017

Research Intern, Formal Methods Group

Mentor: Dr. Dietmar Berwanger

Publications

First (co)author in all publications; names are listed alphabetically in some papers

* equal contribution, † authors in alphabetical order

Refereed Conference Publications.....

[ICML 23] Robust Subtask Learning for Compositional Generalization

K. Jothimurugan, S. Hsu, O. Bastani and R. Alur

International Conference on Machine Learning, 2023

Acceptance rate: 27.9%

[CAV 23] Policy Synthesis and Reinforcement Learning for Discounted LTL

R. Alur, O. Bastani, K. Jothimurugan[†], M. Perez, F. Somenzi and A. Trivedi

International Conference on Computer Aided Verification, 2023

Acceptance rate: 26%

[Festschrift 22] A Framework for Transforming Specifications in Reinforcement Learning

R. Alur, S. Bansal, O. Bastani and K. Jothimurugan[†]

Springer Festschrift in honor of Prof. Tom Henzinger (Invited), 2022

[CAV 22] Specification-Guided Learning of Nash Equilibria with High Social Welfare

K. Jothimurugan, S. Bansal, O. Bastani and R. Alur

International Conference on Computer Aided Verification, 2022

Acceptance rate: 24.4%

[NeurIPS 21] Compositional Reinforcement Learning from Logical Specifications

K. Jothimurugan, S. Bansal, O. Bastani and R. Alur

Advances in Neural Information Processing Systems, 2021

Acceptance rate: 25.7%

[EMSOFT 21] Compositional Learning and Verification of Neural Network Controllers

R. Ivanov*, K. Jothimurugan*, S. Hsu, S. Vaidya, R. Alur and O. Bastani

International Conference on Embedded Software, 2021

Acceptance rate: 25.2%

[AISTATS 21] Abstract Value Iteration for Hierarchical Reinforcement Learning

K. Jothimurugan, O. Bastani and R. Alur

International Conference on Artificial Intelligence and Statistics, 2021

Acceptance rate: 29.8%

[LICS 20] Space-efficient Query Evaluation over Probabilistic Event Streams

R. Alur, Y. Chen, K. Jothimurugan[†] and S. Khanna

Symposium on Logic in Computer Science, 2020

Acceptance rate: 39.6%

[NeurIPS 19] A Composable Specification Language for Reinforcement Learning Tasks

K. Jothimurugan, R. Alur and O. Bastani

Advances in Neural Information Processing Systems, 2019

Acceptance rate: 21.1%

Preprints and Technical Reports.....

[Learning Algorithms for Regenerative Stopping Problems with Logistics Applications](#)

K. Jothimurugan, M. Andrews, J. Lee and L. Maggi

Nokia Bell Labs Intern Report

Tutorials

[AAAI 23] [Specification-Guided Reinforcement Learning](#)

Presenters: *K. Jothimurugan, S. Bansal, R. Alur and O. Bastani*

AAAI Conference on Artificial Intelligence, 2023

A comprehensive tutorial on RL algorithms for learning control policies from logical specifications

Open Source Tools

DIRL — [Github link](#)

Compositional RL algorithm for learning from temporal specifications

HIGH-NASH — [Github link](#) (CAV Artifact Evaluation Badge: Functional)

Multi-agent RL algorithm for learning Nash equilibria with high social welfare

SARL — [Github link](#)

Hierarchical RL algorithm leveraging user provided state abstractions

SPECTRL — [Github link](#)

Generating shaped rewards from temporal specifications

Teaching Experience

Guest Lecturer.....

Computer-Aided Verification, CIS 673 (Class of ~ 20)

Fall 2021

Graduate Course, University of Pennsylvania

Topic: Techniques for Verifying Robustness of Neural Networks

Teaching Assistant.....

Principles of Embedded Systems, CIS 540 (Class of ~ 20)

Spring 2019

Graduate Course, University of Pennsylvania

Automata, Computability and Complexity, CIS 262 (Class of ~ 150)

Fall 2018

Undergraduate Course, University of Pennsylvania

Discrete Mathematics (Class of ~ 30)

Spring 2017

Undergraduate Course, Chennai Mathematical Institute

Design and Analysis of Algorithms

Fall 2016

Online Course offered by Indian Institute of Technology, Madras

Mentoring and Outreach

Graduate Student Mentoring <i>Steve Hsu, Masters Student, University of Pennsylvania</i> Topic: Compositional reinforcement learning for multi-task generalization Co-authored two papers	2020–2022
Penn CIS Mentorship Program <i>Participated as a mentor</i> Department-wide effort to connect early career PhD students with senior PhD students Attracted participation from 34 first-year students	2022

Awards

CTL Teaching Certificate Awarded by Center for Teaching and Learning, University of Pennsylvania	Spring 2022
CMI Undergraduate Scholarship Awarded by CMI to undergraduate students for excellence in academics	2014–2017

Research Presentations

Invited Talks.....

IARCS Verification Seminar Series Title: Specification-Guided Reinforcement Learning	Summer 2023
University of Illinois Urbana-Champaign Title: Specification-Guided Reinforcement Learning	Spring 2023
University of Virginia Title: Specification-Guided Reinforcement Learning	Spring 2023
NYU Formal Methods Group Title: Specification-Guided Reinforcement Learning	Fall 2022
Microsoft PROSE Group Title: Specification-Guided Reinforcement Learning	Fall 2022
Thomas Henzinger's Group, IST Austria Title: Reinforcement Learning from Logical Specifications	Fall 2021
Simons Institute, UC Berkeley Workshop on Games and Equilibria in System Design and Analysis Title: Abstract Value Iteration for Hierarchical Reinforcement Learning	Spring 2021

Presentations and Posters (from publications).....

Conferences: NeurIPS 2019 and 2021, LICS 2020, AISTATS 2021, EMSOFT 2021, CAV 2022, ICML 2023.

Workshops: DeepRL @ NeurIPS 2020 and 2022, SafeRL @ NeurIPS 2021, SYNT @ CAV 2022.

Review Service

Conferences: NeurIPS 2022, AAI 2023, AISTATS 2023, ESOP 2023, L4DC 2023, ICML 2023, CAV 2023, NeurIPS 2023, ICLR 2024, ICML 2024, NeurIPS 2024, AAI 2025, ICML 2025.

Journals: IEEE TCAD, JAIR.