Joe Kurian Eappen

Electrical & Computer Engineering, Purdue University – West Lafayette – USA
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Research Interests

Safe Reinforcement Learning (RL) , Specification-guided Learning, Offline RL, Multi-agent Systems

Education

Purdue University **West Lafayette, USA**
PhD, ***GPA:*** *3.79/4.0* *2018– 12/2025*†
Major: **Electrical Electrical and Computer Engineering**
- Key Courses: *Computational Complexity, Causal Inference, Deep Learning, Robotics*

Indian Institute of Technology Madras **Chennai, India**
B.Tech (Hons.) & M.Tech, ***CGPA:*** *8.69/10* *2013 – 2018*
Major: **Electrical Engineering**, Minor Stream: **Systems Engineering**

Experience

Purdue University **West Lafayette, USA**
Graduate Research Assistant, Thesis Advisor: Prof. Suresh Jagannathan *Jan '19 – Present*
- Work in Safety, Robustness & Reinforcement Learning (RL) ranging from guiding Multi-agent RL systems using Temporal Logic specifications to adversarial robustness in observations in RL systems.
- Primary focus on Specification-guided learning (in Multi-agent systems and Robotic systems).
- Publications in **CoRL** (1), **IROS** (7) , **ICRA** (4), **ECML** (5, 6) and more (8).

JPMorgan Chase & Co. **New York City, USA**
AI Research Associate Intern, Guide(s): Sujay Bhatt and Alec Koppel. *Jun '23 – Aug '23*
- Developed algorithms for Offline Reinforcement Learning using novel discrepancy techniques (2, **ICML**).
- Contributed to journal paper on Online MCMC thinning using Stein methods (3, **SIAM SIMODS**).

Synopsys **(Remote) USA**
Technical Intern, Guide: Renato Hentschke *May '22 – Sept '22*
- Developed an ML framework to order circuits by a property from layout files without expensive simulations.
- Devised a GNN-based framework with 20% gains over a CNN-based method ($\sim 75\%$ ordering accuracy).

IBM Research **Bangalore, India**
Research Intern, Guide: Shajith Ikbal *May '17 – July '17*
- Formulated algorithm using standard NLP techniques like Dependency parsing for a system to **extract the relation** between two arbitrary text chunks.
- Adapted a recent Deep Learning model using Attention networks, built on **Tensorflow**, to solve the same problem.
- Created a **new dataset** using Wikipedia for training the model. Observed 25% gains in ROUGE scores. [REPORT]

Selected Publications

1. **J. Eappen**, Z. Xiong, D. Patel, A. Bera, and S. Jagannathan. Scaling Safe Multi-Agent Control for Signal Temporal Logic Specifications. In *8th Annual Conference on Robot Learning*, 2024 [PAPER]
2. A. Koppel, S. Bhatt, J. Guo, **J. Eappen**, M. Wang, and S. Ganesh. Information-Directed Pessimism for Offline RL. In *International Conference on Machine Learning (ICML)*, 2024a [PAPER]
3. A. Koppel, **J. Eappen**, S. Bhatt, C. Hawkins, and S. Ganesh. Online MCMC Thinning with Kernelized Stein Discrepancy. *SIAM Journal on Mathematics of Data Science*, 2024b [PAPER]
4. Z. Xiong, D. Lawson, **J. Eappen**, A. H. Qureshi, and S. Jagannathan. Co-learning Planning and Control Policies Constrained by Differentiable Logic Specifications. In *2024 IEEE International Conference on Robotics and Automation (ICRA)*, 2024 [CODE][PAPER]
5. **J. Eappen** and S. Jagannathan. DistSPECTRL: Distributing Specifications in Multi-Agent Reinforcement

Learning Systems. In *European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML-PKDD)*, 2022 [CODE][PAPER]

6. Z. Xiong, **J. Eappen**, H. Zhu, and S. Jagannathan. Defending Observation Attacks in Deep Reinforcement Learning via Detection and Denoising. In *European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML-PKDD)*, 2022a [CODE] [PAPER]
7. Z. Xiong, **J. Eappen**, A. H. Qureshi, and S. Jagannathan. Model-free Neural Lyapunov Control for Safe Robot Navigation. In *2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2022b [CODE], [PAPER]
8. Z. Xiong, **J. Eappen**, H. Zhu, and S. Jagannathan. Robustness to Adversarial Attacks in Learning-Enabled Controllers. In *Adaptive and Learning Agents Workshop at AAMAS 2021*, 2021 [PAPER]

Masters Thesis

Dual Degree Thesis, IIT Madras **Chennai, India**

Adaptive Policy Selection using Hierarchical Attention *Aug '17 – July '18*

Thesis Advisor: Prof. Ravindran B., Dept. of CS, IIT-M

Created a **novel Hard Attention based model** to switch between sub-policies and hierarchies of sub-policies inspired by studies on Transfer in Reinforcement Learning using Soft Attention.

- Developed simulation code in **Tensorflow** for simple grid environments. [CODE]
- Extended work for use with complex 3D environments with demonstrations in *Vizdoom*. [THESIS]

Academic Activities

Selected Coursework

Computer Sc./ ECE: Machine Learning, Deep Learning*, Computation Complexity & Languages*, Causal Inference*, Robotics*, Data Structures & Algorithms, Distributed Systems*, Comp. Network Systems*, Operating Systems*

Mathematics: Applied Linear Algebra; Probability, Statistics & Stochastic Processes

Academic Achievements

- CBSE national topper in Math and Physics and awarded certificate of merit for being in the **top 0.1%** in 2013.
- Secured All-India Rank **127 (among 1.3 million candidates)** in the JEE Mains and **915 (among 150 thousand candidates)** in the JEE Advanced in 2013.

Teaching

Purdue University **West Lafayette, USA**

Graduate Teaching Assistant *2018 – 2024*

- ECE39595/30864: Software Engineering Tools (**Instructor**, 2023; Lead TA, 2024) [SITE]
- ECE368: Data Structures (2018, 2022)

IIT Madras **Chennai, India**

Teaching Assistant *Aug '17 – May '18*

- EE4701: Advanced EE Lab - Responsible for the Communications Module of the final lab for 120+ Undergraduates.
- CS6700: Reinforcement Learning - Took lecture on model-based RL and created/evaluated assignments for 80 students taking the graduate level elective on Reinforcement Learning.

Service & Co-curricular Activities

Reviewer: ICML (2022-24), NeurIPS (2022-24), ICLR (2024-25), AAAI (2025), IROS (2023), ICRA (2023-24)

Shaastra & Saarang 2015

Mobile Operations Coordinator, Android Developer *May'14 – Jan'15*

Solely designed and developed the QMS and Analytics App for Shaastra and Saarang with total footfall of over 90K people. Served a team of 60+ collecting feedback for 400+ participants via a RESTful API with the main server.

Programming skills

Programming Languages: Python, C, C++ **Frameworks & Tools**: PyTorch, Tensorflow, Matlab

* - Courses taken at Purdue

† - Expected