Athindran Ramesh Kumar

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OUTLINE

Domain expertise in controls, machine learning and robotics. Focus of PhD is on safety certification using optimization, learning and control. TA for several courses on machine learning and data science.

EDUCATION

Princeton University — NJ, USA
MA + PhD, Electrical and Computer Engineering — *Sep.2018 - Sep 2023*
Advisor: Prof. Peter J. Ramadge — **GPA : 3.93/4.0**

- Key Courses: Machine learning and Pattern Recognition, Modern Control, Safe Robotics, Theoretical Machine Learning, Optimization for Machine Learning, Reinforcement Learning.
- M.A. degree in Electrical Engineering awarded.
- Ph.D. dissertation not complete. Other requirements met and retained candidacy.

University of Illinois at Urbana-Champaign — Illinois, USA
MS (fully funded by Dept.), Electrical and Computer Engineering — *Aug. 2013 - Aug 2015*
Advisor: Prof. Grace Gao — **GPA : 3.95/4.0**

Indian Institute of Technology, Madras — Chennai, India
B.Tech, Electrical Engineering — *Aug. 2009 - July 2013*
Advisor: Prof. Radhakrishna Ganti — **GPA : 9.27/10.0**

SELECT PUBLICATIONS

Journal Papers

- **A.R. Kumar**, K. -C. Hsu, P. J. Ramadge and J. F. Fisac, "Fast, Smooth, and Safe: Implicit Control Barrier Functions through Reach-Avoid Differential Dynamic Programming," in IEEE Control Systems Letters, doi: 10.1109/LCSYS.2023.3292132.
- Heng, Liang, A.R. Kumar, and Grace Gao. "Private proximity detection using partial GPS information." IEEE Transactions on Aerospace and Electronic Systems 52.6 (2016): 2873-2885.

Conference and Workshop Papers

- **S. Liu, A.R. Kumar**, Jaime F. Fisac, Ryan P. Adams, Peter J. Ramadge. "ProBF: Probabilistic Safety Certificates with Barrier Functions." Presented at SafeRL workshop at NeurIPS 2021.
- **A.R. Kumar** and Peter J. Ramadge. "Learning to Control Using a Convex Combination of Controllers." 2021 American Control Conference (ACC). IEEE, 2021.
- **A.R. Kumar** and Peter J. Ramadge, 2021, March. DiffLoop: "Tuning PID controllers by differentiating through the feedback loop." In 2021 55th Annual Conference on Information Sciences and Systems (CISS) (pp. 1-6). IEEE.
- **A.R. Kumar**, Balaraman Ravindran, and Anand Raghunathan. "Pack and detect: Fast object detection in videos using region-of-interest packing." Proceedings of the ACM India Joint International Conference on Data Science and Management of Data. 2019.
- **A.R. Kumar**, Liang Heng, and Grace X. Gao. "GPS privacy: Enabling proximity-based services while keeping GPS location private." Proceedings of the 27th International Technical Meeting of the Satellite Division of the Institute of Navigation (ION GNSS+ 2013),(Tampa, FL). 2014.

Patents

- **Athindran R,** Navinnath P, Klutto Milleth, Bhaskar Ramamurthi, "Frequency Assignment for SINR and Throughput Management in Battlefield Communication", India Patent granted 27th June 2024.

SELECT ACADEMIC ACHIEVEMENTS

- Awarded full-tuition waiver and stipend for MS degree program at University of Illinois, Urbana-Champaign.
- Received first-year fellowship at Princeton University for PhD program.
- Outstanding merit in Mathematics from Srinivas Ramanujan academy of Maths talent awarded in 2008.
- Ranked 294 out of 1,000,000 students in AIEEE and 1561 out of 800,000 students in JEE.
- Among Top 1% of the students in Zonal Informatics Olympiad 2009 and selected for Indian National Informatics Olympiad 2009
- Branch rank of 5/50 students in B.Tech cohort

PROFESSIONAL EXPERIENCE

- **Aurora Tech** — Pittsburgh, PA
  Software Engineer II - Behavior Planning and Control — *October 2023 - present*
  - Developed safety-critical software that is envisioned to run on a self-driving truck with no vehicle operator.
  - ML Software Engineer currently working on learned and engineered PyTorch models for scene understanding.
  - Contributed to machine learning models that run in production for self-driving.

- **Nokia Bell Labs** — Murray Hill, NJ
  Research Intern — *Jun - Aug 2021*
  - Reinforcement learning algorithms for a multi-link robotic arm in simulation.
  - Sample-efficient reinforcement learning with expert demonstrations.
  - Robotic arm control in simulation from image observations.
  - Adapting efficiently to re-configurable robotic arms using sequence neural networks.

- **Center of Excellence in Wireless Technology** — Chennai, India
  Research Engineer — *Apr 2016 - June 2018*
  - Path loss modeling with GIS satellite imagery from geo-platform of ISRO.
  - Developed frequency planning methods in a communication system that have been patented by the organization.

- **IIT Madras** — Chennai, India
  Project Associate — *Nov 2015 - Mar 2016, Jul 2017 - Jul 2018*
  - Worked on a proposal seeking funding for the 5G mmWave cellular project at IIT Madras.
  - Efficient deep learning for object detection in videos.

- **Google Inc.** — Mountain View, CA
  Software Intern - Street View — *May - Aug 2014*
  - Implemented ambiguity resolution algorithms in Python on GPS carrier phase data obtained from receivers installed on Street View cars to achieve sub-meter accurate positioning.

ACADEMIC SERVICE

Teaching Experience
- Three-time TA for ECE 435-535 (Machine learning course with strong math foundations)
- Assistantship in Teaching for 11 semesters

Reviewing Service
- Conferences: ICLR (2021, 2023, 2024), NeurIPS (2022-2024), ICML (2023-2025), CISS 2022, IJCAI 2024.
- Journals: IEEE Transactions on Control Systems Technology, IEEE Robotics and Automation Letters.
- Top reviewer for NeurIPS 2023.

SELECT PROJECTS

–Optimization and Learning methods for Safety-Critical Control– — Princeton University, NJ
Guide: Prof. Peter Ramadge — *Jul 2019 - Aug 2023*
- Safety certification for autonomous control systems.
- Learning residual dynamics using probabilistic models.

–Efficient Deep Learning for Videos– — IIT Madras, Chennai
Guide: Prof. B. Ravindran and Prof. Anand Raghunathan (Purdue University) — *Jul 2017 - Jul 2018*
- Novel inference time method to accelerate object detection in videos.
- Published **ACM India Joint International Conference on Data Science and Management of Data 2019.**

–Direct Position Tracking using the Vector Correlator– — University of Illinois, Urbana-Champaign
Guide: Prof. Grace Gao — *Aug 2014 - Aug 2015*
- Proposed a novel direct position tracking loop for GPS using the Unscented Kalman Filter (UKF).

PROGRAMMING SKILLS

- Python - PyTorch - JAX - C++ - Tensorflow - Matlab