

Parth K. Thaker

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Summary

Ph.D. in Electrical Engineering from Arizona State University (ASU) (advised by Dr. Gautam Dasarathy), specializing in structured bandit learning and non-convex optimization. Author of peer-reviewed papers at NeurIPS, ECCV, ICASSP, and ISIT, and co-inventor on a US patent for multi-agent search systems. Completed research internships at Mitsubishi Electric Research Laboratories (MERL) and Intuitive Surgical. Industry experience includes engineering roles at Netradyne, Securifi, and Cisco. Holds a dual B.Tech./M.Tech. from IIT Madras and M.S. from ASU.

Currently an AI Research Engineer at Intuitive Surgical, building secure, privacy-preserving large language model (LLM) workflows for healthcare and robotics applications, including document and vision-language chatbots, LLM security analysis, and CI/CD integration.

Research Interests

Robotics, Active Learning, Nonconvex Optimization, Graph Theory, Multi-Armed Bandits, Reinforcement Learning, Large Language Models, Retrieval-Augmented Generation, AI Agents.

Education

Arizona State University

M.S. & Ph.D. in Electrical Engineering

Phoenix, AZ

Aug. 2017 – May 2024

- **Topics:** Structured Bandit Learning, Non-Convex Optimization.
- **Advisor:** Dr. Gautam Dasarathy
- **GPA:** 3.79/4

Indian Institute of Technology, Madras

B.Tech. & M.Tech. in Electrical Engineering

Chennai, India

Aug. 2011 – Aug. 2016

Honors & Awards

- Engineering Graduate Fellowship, Ira A. Fulton Schools of Engineering, Arizona State University, 2019–2020.
- Travel Grant, Arizona State University Graduate & Professional Student Association, 2023–2024.

Patents

US Patent No. 12,393,191

- **Title:** Controlling Search Agents to Perform Search with Noisy Observations and Probabilistic Guarantees
- **Inventors:** Abraham P. Vinod, Stefano Di Cairano, Parth K. Thaker, Gautam Dasarathy
- **Issue Date:** 2024
- **Description:** Control system for multi-agent search in noisy environments providing probabilistic performance guarantees, with applications in resource monitoring and autonomous systems.
- Patent Link

Publications

Peer-Reviewed Conference Publications

- **Parth Thaker**, Vineet Gattani, Vignesh Tirukkonda, Pouria Saidi, Gautam Dasarathy. “Non-Stationary Bandits with Periodic Behavior: Harnessing Ramanujan Periodicity Transforms to Conquer Time-Varying Challenges.” IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP), 2024. (DOI: 10.1109/ICASSP48485.2024.10447243)

- **Parth Thaker**, Stefano Di Cairano, Abraham P. Vinod. “Bandit-Based Multi-Agent Search under Noisy Observations.” 22nd IFAC World Congress, 2023. (DOI: 10.1016/j.ifacol.2023.10.172)
- **Parth Thaker**, Mohit Malu, Nikhil Rao, Gautam Dasarathy. “Maximizing and Satisficing in Multi-Armed Bandits with Graph Information.” Neural Information Processing Systems (NeurIPS), 2022. (arXiv:2108.01152)
- John Janiczek, **Parth Thaker**, Gautam Dasarathy, Christopher Edwards, Philip Christensen, Suren Jayasuriya. “Differentiable Programming for Hyperspectral Unmixing using a Physics-Based Dispersion Model.” 16th European Conference on Computer Vision (ECCV), 2020. (DOI: 10.1007/978-3-030-58583-9_39)
- **Parth Thaker**, Gautam Dasarathy, Angelia Nedić. “On the Sample Complexity and Optimization Landscape for Quadratic Feasibility Problems.” IEEE International Symposium on Information Theory (ISIT), 2020. (DOI: 10.1109/ISIT44484.2020.9174368)
- **Parth Thaker**, Aditya Gopalan, Rahul Vaze. “When to Arrive in a Congested System: Achieving Equilibrium via Learning Algorithm.” 15th International Symposium on Modeling and Optimization in Mobile, Ad Hoc, and Wireless Networks (WiOpt), 2017. (DOI: 10.1109/WIOPT.2017.7959869)

Working Manuscripts and Preprints

- **Parth Thaker**, Gautam Dasarathy, Angelia Nedić. “The Nonconvex Optimization Landscape of Quadratic Feasibility.” arXiv preprint, 2020. (arXiv:2002.01066)
- **Parth Thaker**, Abraham Vinod, Gautam Dasarathy, Marcus Greiff, Stefano Di Cairano. “Multi-Armed Bandit-Based Adaptive Resource Monitoring with Constrained Mobile Robots.” In preparation.

Professional Service

Program & Technical Committee Member

- Program Committee Member, AAAI Conference on Artificial Intelligence (2025, 2026, 2027).
- Technical Program Committee Member, IEEE Information Theory Workshop (ITW 2026).
- Associate Editor and International Program Committee Member, IFAC Conference on Cyber-Physical & Human Systems (CPHS 2026).

Conference Reviewer

- NeurIPS (2023, 2024, 2025), ICML (2024, 2025), ICLR (2024, 2025, 2026).
- GenBio Workshop at ICML (2025), ADHS-RE (2024).

Journal Reviewer

- IEEE Transactions on Information Theory (2026), IEEE Transactions on Signal Processing (2025).

Work Experience

Intuitive Surgical | AI Research Engineer Sunnyvale, CA | Jul. 2024 – Present

- Built secure, privacy-preserving LLM workflows for regulated healthcare and robotics use cases, including document and vision-language chatbots, an internal LLM security analyzer, and evaluation pipelines integrated into existing CI/CD tooling.

Intuitive Surgical | Research Intern Sunnyvale, CA | May 2023 – Aug. 2023

- Improved a DINO-based video search system by introducing fine-grained objectives into the self-supervised training routine, raising retrieval quality under limited-label constraints.

Mitsubishi Electric Research Lab | Research Intern Cambridge, MA | May 2022 – Aug. 2022

- Designed multi-armed bandit algorithms for multi-agent resource monitoring with theoretical guarantees and experimental validation; work contributed to a published paper and an issued US patent.

Netradyne | Systems Engineer Bengaluru, India | Aug. 2016 – May 2017

- Built and maintained data pipelines for inertial-sensor-based reckless-driving detection, spanning data acquisition, cleaning, and analytics for real-time alerting.

Indian Institute of Science | Summer Research Intern Bengaluru, India | May 2015 – Aug. 2015

- Studied linear bandit algorithms under perturbations and developed learning algorithms for multi-user bandwidth allocation in shared systems.

Securifi Embedded Systems | Intern Hyderabad, India | May 2014 – Jul. 2014

- Benchmarked database performance across Cassandra, MongoDB, and MySQL, and automated cloud infrastructure provisioning with Cloud-init and Puppet.

Cisco Systems Pvt. Ltd. | Intern Bengaluru, India | May 2013 – Jul. 2013

- Developed Python automation for router testing at scale, including synthetic IP generation and network-signal manipulation across high-volume subscriber sessions.

Research Experience

Bandit-Based Multi-Agent Resource Monitoring

- Developed an algorithm integrating thresholding multi-armed bandits with grid-based search patterns, achieving successful termination with bounds on economic costs and completion times; published in the 22nd IFAC World Congress (link). Resulted in US Patent No. 12,393,191: “Controlling Search Agents to Perform Search with Noisy Observations and Probabilistic Guarantees” (link).
- Introduced metrics such as priority labeling time and economic cost to evaluate performance, demonstrating minimax-optimality.
- Incorporated coordination and physical constraints, validated through numerical simulations.

Bandits with Graph Structure

- Proposed the GRUB (Graph UCB-based Action Elimination) algorithm for best-arm identification in stochastic bandits, leveraging graph structural information; published in NeurIPS 2022 (arXiv, NeurIPS).
- Established theoretical complexity guarantees highlighting graph-based speedup factors scaling as $\Omega(\text{clusters})$.
- Implemented modular Python code available at GitHub, demonstrating performance improvements over baselines.

Nonconvex Landscape of Quadratic Feasibility

- Identified a subclass of non-convex, NP-hard quadratic programs solvable efficiently via first-order gradient descent; published in IEEE ISIT 2020 (DOI: 10.1109/ISIT44484.2020.9174368) and extended in arXiv preprint (arXiv:2002.01066).
- Proved that the non-convex surrogate loss satisfies global minima at all local minima and strict negative curvature at saddle points under sufficient conditions.
- Derived order-optimal sample complexity bounds for quadratic feasibility problems.

Differentiable Programming for Hyperspectral Unmixing

- Integrated physics-based spectral variation models into unmixing pipelines for superior performance; published in ECCV 2020 (DOI: 10.1007/978-3-030-58583-9_39).
- Collaborated in a multi-disciplinary team applying optimization, physics, and deep learning to design experiments for spectral unmixing.
- Established initialization conditions and theoretical convergence for alternating minimization approaches.

Enhancing DINO-Based Video Search

- Analyzed and identified shortcomings of DINO-based video search tools, leading to enhancements in fine-grained search capabilities through modified self-supervised training routines.
- Provided quality-based assessments under limited data constraints and outlined a roadmap for future evaluations and improvements.

Factored Gradient Descent

- Proposed a cost-efficient variant of projected gradient descent by separating gradient and projection steps into two-timescale updates, evaluating trade-offs experimentally.
- Extended methods to low-rank estimation in fat and tall matrices via alternating minimization.

Technical Skills

Programming & Scripting

- Python, Bash, Rust.

LLMs & Applied AI

- LLM application development: document and vision-language chatbots, RAGs, AI agents, LLM security analysis - Garak, Promptfoo, CI/CD-integrated continuous evals.

MLOps & Infrastructure

- Docker, ArgoCD, Cilium,

Databases

- Postgres, DuckDB, MongoDB, Cassandra,

Relevant Coursework

- Real Analysis, Functional Analysis, Applied Probability, Large-Scale Optimization, Graph Theory.
- Statistical Machine Learning, Process Optimization, Computational Methods in Electrical Engineering, Multivariate Data Analysis.