Parth K. Thaker

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Education

Arizona State University   Phoenix, US
M.S. & Ph.D. in Electrical Engineering   Aug. 2017 – Present

Indian Institute of Technology, Madras   Chennai, IN
B.Tech. & M.Tech. in Electrical Engineering;   Aug. 2011 – Aug. 2016

Research Experience

Bandits with graph structure
- Proposed a novel algorithm **GRUB**(**GR**aph **UCB** based Action Elimination) capable of capitalizing on structural graph information in Best-arm identification in stochastic bandits.
- Established rigorous theoretical complexity guarantees for GRUB showcasing the dependence of a graph-based speedup factor (scales as Ω(clusters)).
- Modular python implementation of GRUB is available at this Git repository with accompanying evidence of performance boost compared to baseline algorithm.

Solving for Quadratic feasibility
- Identified a subclass of Quadratically constrained quadratic programs (QCQPs), generally non-convex and NP-hard to solve, which can be tackled in a computationally efficient manner by first-order gradient descent methods.
- Theoretically established, under sufficiency conditions, that a non-convex loss function surrogate for the said QCQP satisfy *all local minima are in-fact global minima* and *all saddle points have strict negative curvature* property to guarantee success. Provided order-optimal sample complexity bounds in terms of the number of measurements for solving quadratic feasibility problems.
- *(unpublished)* Established necessary conditions required to be satisfied by any contending QCQPs to ensure the existence of a first-order gradient descent algorithm that can solve it.

Differential programming using hyperspectral unmixing
- Hyperspectral unmixing is an important problem with applications like material identification and analysis. Incorporated a physics-based spectral variation model into a spectral unmixing pipeline to obtain superior performance.
- Part of a multi-departmental team to draw insights from optimization theory, physics and Deep learning methodology to propose a sequence of experiments to be performed for tackling the spectral unmixing problem.
- Provided conditions for initialization and theoretical convergence of alternate minimization approaches for spectral unmixing.

Sensor Fusion
- Developed module to determine the deviation of the real-time orientation of mounted devices as well as detecting aggressive driving patterns (Hard acceleration, Hard braking, heavy swirling, etc.) using inertial sensor data.
- Worked on end-to-end implementation of the inertial modules including implementation of data acquisition algorithms from onboard inertial sensors, analysis of acquired data and notifying alerts on mobile and web applications.

Factored gradient descent
- In most real-world applications, projection is generally a computationally intensive operation. Proposed a cost-efficient variant of projected gradient descent by splitting the gradient step and projection step into two timescale update algorithms. Performed experimental evaluation of trade-off for the proposed method.
- Extended factored gradient descent methods to tackle the problem of low rank estimation in fat and tall matrices using alternate minimization routines.

Work Experience

Mitsubishi Electric Research Laboratories | Intern   Boston | May 2022 - Aug 2022
- Developed bandit algorithms for the task of resource monitoring with experimental validation.

Netradyne | Systems Engineer   Bangalore | Aug 2016 - May 2017
- Worked on data pipelineing (acquisition, cleaning and analytics) for reckless driving alerts using inertial sensors.

Securifi Systems | Intern   Hyderabad | May 2014 - Aug 2014
- Worked on server infrastructure automation and management using Puppet master slave architecture.
- Evaluated test metrics for comparing performance of Cassandra, MongoDB and MySQL on specific data formats.

Cisco Systems Pvt. Ltd | Intern   Bangalore | May 2013 - Aug 2013
- Worked on python scripts for testing and overloading new proposed routers models using fake IP creation and bit-level manipulation of network signals.

Publications

Published
- **Parth Thaker**, Mohit Malu, Nikhil Rao, Gautam Dasarathy. "Maximizing and Satisficing in Multi-armed Bandits with Graph Information", Neural Information Processing Systems (NeurIPS), 2022.
- John Janiczek, **Parth Thaker**, Gautam Dasarathy, Christopher Edwards, Philip Christensen, and Suren Jayasuriya. "Differentiable Programming for Hyperspectral Unmixing using a Physics-based Dispersion Model." In 16th European Conference on Computer Vision (ECCV), 2020. Springer International Publishing.
- **Parth Thaker**, Gautam Dasarathy, and Angelia Nedić. "On the sample complexity and optimization landscape for quadratic feasibility problems." In IEEE International Symposium on Information Theory (ISIT), 2020.
- **Parth Thaker**, Aditya Gopalan, and Rahul Vaze. "When to arrive in a congested system: Achieving equilibrium via learning algorithm." In the 15th International Symposium on Modeling and Optimization in Mobile, Ad Hoc, and Wireless Networks (WiOpt). IEEE, 2017.

Preprint
- **Parth Thaker**, Gautam Dasarathy, and Angelia Nedić. "On the sample complexity and optimization landscape for quadratic feasibility problems." arXiv preprint 2002.01066.

Thesis
- **Parth Thaker**, Radha Krishna Ganti. Master's Thesis, Indian Institute of Technology, 2016.

Skill Summary

Coursework
- Real Analysis, Functional Analysis, Applied Probability, Large-scale Optimization, Graph Theory.
- Statistical Machine learning, Process optimization, Computation methods in EE, Multivariate Data Analysis.

Skills & Tools:
- Python, Bash scripting, MySQL, Cassandra, OpenCV.