Shagun Gupta

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SUMMARY

- Research Scientist specializing in optimization algorithms for large-scale optimization and AI training algorithms.
- Major Areas: Machine Learning, Numerical Optimization, Simulations, Optimal Control, Mathematical Modeling
- Proficient in Distributed computing, Object-Oriented programming, Python and associated libraries.
- More information on publications, talks, seminars, and open-source projects is available on my website.

EDUCATION

- **Ph.D. The University of Texas at Austin, Austin, TX** *Aug 2020 - July 2025*
  - Operations Research and Industrial Engineering, GPA: 4.0/4.0
  - Supervised by Prof Raghu Bollapragada
  - Thesis title : Methods for Large-Scale Constrained Optimization
- **B.Tech. Indian Institute of Technology Delhi, Delhi, India** *Jul 2016 - May 2020*
  - Production and Industrial Engineering, GPA: 9.067/10

WORK EXPERIENCE

- **Meta - Research Scientist, ML SW/HW Co-Design** *July 2025 - Present*
  - Designing optimization algorithms for large-scale AI training, with a focus on **large-batch training**.
  - Developing **model–algorithm co-design** approaches to improve training efficiency and stability.
  - Supporting **Ads and Generative AI** teams with scalable training-time optimization methods.
- **Optilogic - Operations Research Scientist Intern** *Jun 2024 - Aug 2024*
  - Developed a solver engine to solve **facility location problems, integrating multi-stop delivery routes.**
  - Achieved up to **5% reduction in transportation costs** in facility location problems.
  - **Refactored existing codebases** for compatibility with the latest versions of Pandas, NumPy, and Pandera.
- **Argonne National Lab - MCS Givens Associate** *Jun 2023 - Aug 2023*
  Supervised by Jeffery Larson and Matt Menickelly
  - Built a solver in Python (NumPy, SciPy) for **noisy derivative-free optimization** for quantum computing.
  - Improved existing deterministic trust region methods by incorporating adaptive estimation of noise..
  - Achieved up to a **30% reduction** in operating costs to reach desired solution accuracy in quantum simulations.
- **MD Anderson Cancer Center - Financial Planning and Analysis** *Jan 2022 - May 2022*
  Graduate Student Intern in Department of Financial Planning and Analysis
  - Simulated clinic activities by modeling patient data using Gaussian Mixture models to analyze doctor schedules.
  - Demonstrated a 10% reduction in overall wait times with recommended countermeasures.
- **NTU India Connect Scholarship - Data Interface for Smart Manufacturing** *May 2019 - Jul 2019*
  Prof. Yeo Swee Hock at Nanyang Technological University, Singapore
  - Built a data collection system for a traditional CNC lathe machine using sensors such as dynamometer, temperature probe, acoustic emissions sensor connected to an OPC-UA server to enable smart machining features.

AWARDS

- **University Graduate Continuing Fellowship** from the University of Texas at austin *2024 - 2025*
- **Reimagining Professional Development Award** from the Texas Career Engagement at UT Austin *2024*
- **Professional Development Award** for Informs optimization conference presentation *2024*
- **Travel Award** for support to present my research at the 2023 Midwest Optimization Meeting *2023*
- **NTU India-Connect Scholarship:** Awarded opportunity to pursue junior year internship in Singapore *2019*

JOURNAL REVIEWING

- **Reviewer,** Operations Research
- **Reviewer,** Computational Optimization and Applications (COAP)

RESEARCH PROJECTS

- **Accelerated Proximal Gradient Methods under Adaptive Gradient Estimation** *Jan 2025 - July 2025*
  Prof. Raghu Bollapragada at University of Texas, Austin
  - Developed accelerated proximal gradient optimization algorithms that **adaptively adjust gradient accuracy** and accommodate noisy and **biased gradient information** to efficiently solve large-scale optimization problems.
  - Proved optimal theoretical performance and validated through empirical results.
- **Retrospective Approximation based Constrained Stochastic Optimization** *Aug 2023 - May 2025*
  Prof. Raghu Bollapragada at University of Texas, Austin
  - Designed an algorithm for stochastic constrained optimization by building sequential deterministic approximations, each solved using **Sequential Quadratic Programming** for a tuning-free second-order stochastic algorithm.
  - Showed improved performance for applications in physics informed machine learning and optimal powerflow.
- **Decentralized Optimization over Networks** *Jan 2022 - Dec 2023*
  Prof. Raghu Bollapragada at University of Texas, Austin
  - Designed a flexible framework for **gradient tracking methods in decentralized optimization** to accommodate varying communication and computation costs in distributed applications and improve overall efficiency.
  - Provided theoretical and empirical evidence of reducing overall cost in synthetic and machine learning problems.
- **Extreme Weather Electric Grid Resilience** *Apr 2021 - Sep 2021*
  Prof. Erhan Kutanoglu and Prof. John Hasenbein at University of Texas, Austin
  - Analyzed preparedness decisions from **stochastic and robust optimization** models (Pyomo, Gurobi) for flooding mitigation for the Texas electric grid under hurricanes Harvey and Imelda using pre-hurricane flooding forecasts.
  - Displayed **discontinuity and unfairness in decisions** from standard load loss minimization objective models.
- **Disaster Resilience Planning Under Uncertainty - A Nexus Approach** *Apr 2021 - Jan 2022*
  Prof. Benjamin Leibowicz at University of Texas, Austin
  - Developed a **two stage stochastic optimization model** for utility resilience planning to extreme weather events incorporating interdependence of water and power utility infrastructures via pumps and water treatment plants.
  - Displayed novelty of modeling interdependence using a case study of Guayama city in Puerto Rico.

PUBLICATIONS

- Under Review
  - R. Bollapragada, **S. Gupta**, *On the Convergence and Complexity of Proximal Gradient and Accelerated Proximal Gradient Methods under Adaptive Gradient Estimation,* 2025, https://arxiv.org/abs/2507.14479
  - A. Berahas, R. Bollapragada, **S. Gupta**, *Retrospective Approximation Sequential Quadratic Programming for Stochastic Optimization with General Deterministic Nonlinear Constraints,* 2024, https://arxiv.org/abs/2505.19382
- Conference and Journal Publications
  - A. Berahas, R. Bollapragada, **S. Gupta**, *A Flexible Gradient Tracking Algorithmic Framework for Decentralized Optimization,* 2025, Computational Optimization and Applications, https://link.springer.com/article/10.1007/s10589-025-00685-w
  - A. Berahas, R. Bollapragada, **S. Gupta**, *Balancing Communication and Computation in Gradient Tracking Algorithms for Decentralized Optimization,* 2024, Journal of Optimization Theory and Applications, https://link.springer.com/article/10.1007/s10957-024-02554-8
  - R. Moglen, J. Barth, **S. Gupta**, E. Kawai, K. Klise, B. Leibowicz, *A Nexus Approach to Infrastructure Resilience Planning under Uncertainty,*, 2023, Reliability Engineering and System Safety, https://www.sciencedirect.com/science/article/abs/pii/S0951832022005464
  - B. Austgen, **S. Gupta**, E. Kutanoglu, J. Hasenbein, *Stochastic Hurricane Flood Mitigation for Power Grid Resilience, Best Paper Session*, 2022 IEEE Power and Energy Society General Meeting (PESGM), https://ieeexplore.ieee.org/document/9916992
- Conference and Journal Publications
  - **S. Gupta**, *Methods for large-scale constrained optimization, PhD Thesis*, https://repositories.lib.utexas.edu/items/82227dbb-0a4a-4692-a761-bd91a693053f

PRESENTATIONS

- Invited Talks
  - **International Conference On Continuous Optimization - 2025 (Los Angeles, CA, USA)** *Retrospective Approximation for Stochastic Constrained Problems Using Sequential Quadratic Programming*
  - **Informs Annual Meeting 2024 (Oct, 2024):** *Retrospective Approximation for Stochastic Constrained Problems Using Sequential Quadratic Programming*
  - **Informs Optimization Society Conference 2024 (March, 2024):** *Retrospective Approximation for Stochastic Constrained Problems Using Sequential Quadratic Programming*
  - **Midwest Optimization Meeting (Oct, 2023):** *Balancing Communications and Computations in Gradient Tracking Algorithms*
  - **Informs Annual Meeting 2023 (Oct, 2023):** *Balancing Communications and Computations in Gradient Tracking Algorithms*
  - **SIAMS Optimization Conference (May, 2023):** *Balancing Communications and Computations in Gradient Tracking Algorithms*
  - **Informs Annual Meeting 2022 (Oct, 2022):** *Balancing Communications and Computations in Gradient Tracking Algorithms*
- Seminars
  - **Reimagining Professional Development, TCE, UT Austin (Feb, 2024):** *A Guide to Using AI Tools in Daily Workflows*

SOFTWARE

- **Optimization Problems**
  - A collection of problems for testing various optimization algorithms.
  - Synthetic and real world problems for unconstrained and constrained, and determinsitic and stochastic problems.
- **Gradient Tracking Algorithmic Framework**
  - Implementation for optimization algorithms for the Manuscript for testing and result recreation.

OTHER ACTIVITIES

- **Student Organizations : University of Texas at Austin**
  - Treasurer for Informs Student Chapter *Fall 2022 - Spring 2024*
  - Treasurer for Mechanical Engineering Graduate Student Board *Fall 2022 - Spring 2023*
  - Member of Informs Student Chapter *Fall 2020 - Spring 2022*
  - Member of Mechanical Engineering Graduate Student Board *Fall 2020 - Spring 2022*
- **Graduate Teaching Assistant, UT Austin**
  - CE 311S: Probability and Statistics for Civil Engineers *Fall 2021*
  - ME 353: Engineering Finance *Summer 2021*
  - ME 335: Engineering Statistics *Spring 2021*