Shagun Gupta

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SUMMARY

- Research Scientist passionate about designing **nonlinear optimization algorithms**
- Proficient Libraries: Pandas, NumPy, Gurobi, TensorFlow, PyTorch, Pyomo, CPLEX, Scikit-learn, cvxpy
- Coding Skills: Python, R, Object-Oriented Programming, MATLAB, Bash, Linux
- Major Areas: Numerical Optimization, Stochastic Simulations, Optimal Control, Mathematical Modeling

EDUCATION

- **Ph.D. The University of Texas at Austin, Austin, TX** *Aug 2020 - May 2025*
  - Operations Research and Industrial Engineering, GPA: 4.0/4.0
  - Supervised by Prof Raghu Bollapragada
  - Thesis title : Methods for Large-Scale Constrained Optimization
- **M.S.E. The University of Texas at Austin, Austin, TX** *Aug 2020 - Dec 2023*
  - Operations Research and Industrial Engineering, GPA: 4.0/4.0
- **B.Tech. Indian Institute of Technology Delhi, Delhi, India** *Jul 2016 - May 2020*
  - Production and Industrial Engineering, GPA: 9.067/10

WORK EXPERIENCE

- **Argonne National Lab - MCS Givens Associate** *Jun 2023 - Aug 2023*
  Supervised by Jeffery Larson and Matt Menickelly
  - Built solver in Python (NumPy, SciPy) for **noisy derivative free optimization** for quantum computing.
  - Improved upon existing deterministic trust region methods by incorporating adaptive estimation of noise.
  - Achieved up to a **30% reduction in operating cost** to reach desired accuracy in Qiskit quantum simulations.
- **MD Anderson Cancer Center - Financial Planning and Analysis** *Jan 2022 - May 2022*
  Graduate Student Intern in Department of Financial Planning and Analysis
  - Modeled medical clinics as a stochastic simulation using Python (NumPy) to analyze doctor schedules.
  - Cleaned and refined patient data to model appointment characteristics such as duration, intervals, cancellations using Gaussian Mixture models (SciPy) for each category of patient, appointment and doctor.
  - Provided evidence for increasing proportion of new patient appointments in schedules to reduce overall wait times.
- **NTU India Connect Scholarship - Data Interface for Smart Manufacturing** *May 2019 - Jul 2019*
  Prof. Yeo Swee Hock at Nanyang Technological University, Singapore
  - Awarded a scholarship to pursue research 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 - 25*
- **Reimagining Professional Development Award** from the Texas Career Engagement at UT Austin *2024*
- **Travel Award** for support to present my research at the 2023 Midwest Optimization Meeting *2023*
- **NTU India-Connect Scholarship:** Awarded opportunity to pursue pre-final year internship in Singapore *2019*
- **Awarded Certificate of Appreciation** for development of Smart Manufacturing Modules, Industry Day, IITD *2018*
- **IITD Semester Merit Award** for being among the top 7% academic performers of the institute twice *2017 - 2018*

RESEARCH PROJECTS

- **Retrospective Approximation based Tuning-Free Contrained Stochastic Optimization** *Aug 2023 - Present*
  Prof. Raghu Bollapragada at University of Texas, Austin
  - Designing 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.
- **Tuning-Free SVRG Optimization Algorithm** *March 2023 - Present*
  Prof. Raghu Bollapragada at University of Texas, Austin
  - Designing policies for **adaptive selection** of hyperparameters (step size and inner loop length) in Stochastic Variance Reduced Gradient (SVRG) for **tuning-free stochastic optimization in machine learning.**
  - Illustrated close to tuned parameter performance for initial progress on the algorithm.
- **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.
- **Reducing Delays in Supreme Court of India** *Jul 2019 - Jul 2020*
  Prof. Ramandeep Randhawa at USC and Prof. Nitin Bakshi at The University of Utah
  - Developed a simulation of the Supreme Court of India and **quantified effects of remedial policies** for delays
  - Modeled duration of hearings using **mixture of Gaussian and Weibull distributions**
  - Designed **queuing network and decision tree** for daily scheduling and processing of cases

PUBLICATIONS

- Working Papers
  - A. Berahas, R. Bollapragada, **S. Gupta**, *Retrospective Approximation for Stochastic Constrained Problems Using Sequential Quadratic Programming,* 2024
  - J. Larson, M. Menickelly, **S. Gupta**, *A practical Noisy DFO solver for expensive function oracles,* 2024
  - A. Berahas, R. Bollapragada, **S. Gupta**, J.Shi, *Adatpive SVRG : Tuning Free Stochastic Optimization with Variance Reduction,* 2024
- Under Review
  - A. Berahas, R. Bollapragada, **S. Gupta**, *A Flexible Gradient Tracking Algorithmic Framework for Decentralized Optimization,* 2023, Under Review, http://arxiv.org/abs/2312.06814
  - A. Berahas, R. Bollapragada, **S. Gupta**, *Balancing Communications and Computations in Gradient Tracking Algorithms,* 2023, Under Review, https://arxiv.org/pdf/2303.14289
- Conference and Journal Publications
  - 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

PRESENTATIONS

- Invited Talks
  - **25th International Symposium on Mathematical Programming (July, 2024):** *Retrospective Approximation for Stochastic Constrained Problems Using Sequential Quadratic Programming,* (Upcoming)
  - **Informs Optimization Society Conference 2024 (March, 2024):** *Retrospective Approximation for Stochastic Constrained Problems Using Sequential Quadratic Programming,* (Upcoming)
  - **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*
- Conference Presentations
  - **Midwest Optimization Meeting (Oct, 2023):** *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,* (Upcoming)

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 - Present*
  - 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*