# Shagun Gupta

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## SUMMARY

- Research Scientist passionate about designing **nonlinear optimization algorithms** taylored to applications
- Proficient Libraries: Pandas, NumPy, Gurobi, TensorFlow, PyTorch, Pyomo, CPLEX, Scikit-learn, cvxpy
- Coding Skills: Python, R, Object-Oriented Programming, MATLAB, Bash, Linux
- Modeling Skills: Mathematical Optimization, Stochastic Simulations, Optimal Control
- Open Source Libraries: Optimization Problems is a collection of problems for testing optimization algorithms

## 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

- **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*
  - Built solver in Python (numpy, scipy) for **noisy derivative free optimization** for quantum computing.
  - Improved up on existing determinitic trust region methods by incorporating and adaptively estimating the noise.
  - Achieved **up to 30% reduction in operating cost** to acheive desired accuracy in qiskit quantum simulations.

- **MD Anderson Cancer Center - Financial Planning and Analysis** *Jan 2022 - May 2022*
  - Modeled medicial 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*
  - Awarded 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, tempreature probe, acountic emissions sensor connected to an OPC-UA server to enable smart machining features.

## RESEARCH PROJECTS

- **Restrospective Approximation - Tuning Free Contrained Stochastic Optimization** *Aug 2023 - Present*
  - 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*
  - 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 - Mar 2023*
  - Designed a flexible framework for **gradient tracking methods in decentralized optimization** to accomodate 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.
  - Manuscript is under review and was *awarded travel award* to present at Midwest Optimization Meeting 2023

- **Extreme Weather Electric Grid Resilience** *Apr 2021 - Sep 2021*
  - Analysed preparedness decisions from **stochastic and robust optimization** models (Pyomo, Gurobi) for flooding mitigation for the Texas electric grid under hurricanes Harvey and Imelda using prehurricane flooding forecasts.
  - Displayed **discontinuity and unfairness in decisions** from standard load loss minimization objective models.
  - Manuscript accepted to the *Best Paper Session* at 2022 IEEE PESGM conference.

- **Disaster Resilience Planning Under Uncertainty - A Nexus Approach** *Apr 2021 - Jan 2022*
  - 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
  - Manuscript accepted at Reliability Engineering and System Safety, 2023.