Preet Baxi

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SUMMARY

Ph.D. candidate in Physics and Scientific Computing at the University of Michigan with experience spanning software engineering, machine learning research, statistical modeling, and large-scale data analysis. Built scalable Python/C++ systems for simulation, monitoring, optimization, and ML-driven experimentation on noisy, high-dimensional datasets. Research and project work includes LLM evaluation, ranking robustness, anomaly detection, time-series modeling, stochastic optimization, and data-driven decision systems, with strong interest in SWE, AI/ML research, and data-focused roles.

EDUCATION

- ***M.S,*** and ***Ph.D., Physics and Scientific Computing,*** University of Michigan, Ann Arbor | 2022–2026 | GPA: 3.6/4
- ***B.E., Mechanical Engineering,*** University of Mumbai, India | 2017–2021 | GPA: 8.7/10

PROFESSIONAL EXPERIENCE

Physics Research Assistant, *University of Michigan* | July 2022-Present | Ann Arbor, MI

- Developed low-SNR signal extraction and parameter-estimation algorithms for noisy time-series data using matched filtering, frequency-domain segmentation, and variance-weighted estimation, improving statistical sensitivity by 50%.
- Built scalable Python/C++ simulation, inference, and monitoring pipelines using MPI/OpenMP, reducing runtime by 70% and enabling analysis of multi-terabyte, high-dimensional datasets.
- Designed Bayesian and frequentist methods for uncertainty quantification, drift monitoring, and robust amplitude/phase recovery, validating coherent signal reconstruction over 10^11 cycles across 18 reference signals.
- Automated data-processing and evaluation workflows for large-scale experiments, improving reproducibility, runtime efficiency, and research throughput.

AI Research Assistant, *University of Michigan* | December 2024 - Present | Ann Arbor, MI

- Built a bi-level LLM-guided simulation-optimization framework for stochastic inventory control, separating policy-structure search from parameter tuning and outperforming optimized base-stock benchmarks by ~22% across 10,064 out-of-sample instances.
- Designed controlled experiments and stress tests for LLM-based ranking systems, measuring the effects of prompt injection on ranking robustness, threshold errors, and competitive saturation under varying candidate-quality distributions.
- Developed automated evaluation pipelines for large-scale experimental runs, metric computation, comparative analysis, and reproducible benchmarking across models and prompting strategies.
- Applied statistical analysis and experimental design to evaluate model behavior, robustness, and decision quality under adversarial and noisy settings.

Visiting Research Fellow, *LIGO Hanford Laboratory, Caltech* | January 2024 - July 2024 | Richland, WA

- Built ML-based anomaly and drift detection systems across 200+ multivariate time-series channels, improving signal identification and noise isolation by 45%.
- Implemented scalable data-processing and monitoring workflows for large sensor streams, supporting automated detection of abnormal behavior and distribution shifts.

Student Research Assistant, *IIT Madras* | May 2019 - June 2022 | Chennai, TN, India

- Developed parameter-estimation models for weak-signal inference using Cramér–Rao bounds, likelihood optimization, and gradient-based estimators under low-SNR conditions.
- Built large-scale Monte Carlo pipelines with robustness and sensitivity-analysis frameworks to quantify variance, bias, and stability under noise shifts, sparse-data regimes, and distributional perturbations.

SELECTED PROJECTS

Macro Regime Research and Portfolio Stress Testing

- Built a macro regime-analysis framework using historical recession periods (2000, 2008) to study cross-market behavior, **macroeconomic indicators,** and **sentiment signals** under downturn conditions, with scenario analysis for potential recession-like environments in 2026.
- Applied rolling correlation analysis, volatility clustering diagnostics, factor sensitivity assessment, and scenario-based loss estimation to evaluate portfolio drawdowns, sentiment deterioration, and regime-dependent risk behavior.
- Measured portfolio sensitivity across stress environments using drawdown, volatility, and correlation diagnostics to compare sector and market behavior under adverse macro conditions.

Automated News-Driven Trading Pipeline

- Built and deployed an automated trading pipeline integrating real-time news ingestion, sentiment scoring, signal generation, and broker **API execution** across 30 U.S. equities in a live self-directed account.
- Designed event-driven signal logic using sentiment-derived position scoring, entry and exit thresholds, and profit-target rules while monitoring exposure, position-level risk, and signal quality across active holdings.
- Developed a portfolio analytics and risk-monitoring framework from realized trading activity to estimate monthly returns, benchmark-relative alpha, beta, Sharpe, information ratio, and max drawdown; observed approximately **1.88** annualized Sharpe, **17.8%** annualized alpha versus SPY, **1.43** information ratio and **13.1%** max drawdown over the evaluated period.

TECHNICAL SKILLS

- **Languages:** Python, C++, SQL, MATLAB, R
- **Libraries/Tools:** NumPy, Pandas, scikit-learn, CUDA, MPI, OpenMP
- **Methods:** Statistical inference, Bayesian estimation, Monte Carlo simulation, optimization, anomaly detection, signal processing, time-series analysis

AWARDS & HONORS

- **2nd Place Worldwide:** SAE Aero Design East Competition, USA, 2019
- **Top Tier Performance (238/300)**: Indian Airforce Aptitude Test (AFCAT)**,** 2021
- **Top 1% in India:** INSPIRE Scholarship National Academic Merit - ClassXII, 2017

INTERESTS

Private Pilot Training, Aeromodelling, Financial Markets, Entrepreneurship