# Mavank Sharma

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## Education

**Indian Institute of Technology Jodhpur** — Jodhpur, India
*B-Tech in Engineering Science - Majors in Computer Science & Electrical Engineering* — *Aug 2023 – May 2027*

## Research Experience

**Undergraduate Researcher** — May 2025 – Present
*University of Birmingham (Dubai Campus) Advisor: Prof. Monita Baruah*

- Developed a leakage-controlled **out-of-fold (OOF)** sentiment feature pipeline using **teacher–student distillation** (FinBERT → RATAT) with embargoed time-series splits, producing daily sentiment signals for **AAPL, NVDA, BTC-USD**.
- Evaluated price-only vs sentiment-augmented forecasting and trading using **purged CV**, **Diebold–Mariano / Clark–West** tests, and cost-aware backtests; observed strong asset dependence (modest uplift on NVDA, degradation on BTC and AAPL) under strict protocol.

**Undergraduate Researcher - Reinforcement Learning Optimization** — Jan 2026 – Present
*North Carolina State University (Remote) Advisor: Prof. Aritra Mitra* — *Raleigh, NC*

- Initiated research on **Reinforcement Learning (RL)** for optimization in uncertain environments, with a focus on reward design in control settings.
- Analyzing policy optimization under stochastic dynamics and reward misspecification, including stability and performance sensitivity to reward perturbations.

**Undergraduate Researcher - Deep Learning (Test-Time Adaptation)** — Dec 2025 – Present
*Indian Institute of Technology Jodhpur Advisor: Prof. Pratik Mazumder* — *Jodhpur, India*

- Studying **Fully Test-Time Adaptation (FTAT)** techniques to allow pre-trained models to adapt to new data during deployment.
- Analyzing methods to improve model performance on shifting data distributions without needing access to the original training data.

**Graph Theory & Algorithms - Researcher (Feedback Vertex Set)** — Aug 2024 – Nov 2024
*Indian Institute of Technology Jodhpur Advisor: Prof. Lawqueen Kanesh* — *Jodhpur, India*

- Analyzed NP-hard graph **optimization** problems; derived formal proofs for time complexity bounds in large-scale **network topologies**.
- Implemented Fixed-Parameter Tractable **(FPT)** algorithms including kernelization; conducted empirical benchmarking against greedy baselines.

## Experience

**Quantitative Data Engineering Intern** — May 2025 – Jul 2025
*Detachmint Ventures Pvt. Ltd.* — *Hybrid, India*

- Optimized **signal processing algorithms** for time-series data by implementing noise filtering (seasonality/liquidity filters), resulting in improved predictive stability on out-of-sample data.
- Designed volatility-adaptive statistical models (EWMA, GARCH) to minimize **tail risk** in stochastic systems, validating performance through extensive historical simulation.
- Engineered a high-throughput simulation pipeline processing **80+ parallel high-frequency data streams** (1-min resolution) using Python and Pandas, optimizing for memory efficiency and processing latency.
- Deployed automated execution scripts via REST APIs, implementing real-time latency monitoring and error-handling protocols for high-volume transaction systems.

**BRAIN Research Consultant** — Dec 2023 – Sep 2025
*WorldQuant* — *Remote, Old Greenwich, CT*

- Built algorithmic models using **statistical** and **ML-driven** techniques for time-series prediction, achieving high statistical significance (Sharpe ratio $> 6$) across 10 years of data.
- Ran **2000+ simulations** and implemented strategies that, after backtesting on **10+ years** of historical data, demonstrated robust performance on out-of-sample datasets.

## Projects

**Stochastic Optimal Control Simulation & PDE Solving** Nov 2024

*Independent Project (Python, NumPy, Matplotlib)* *Jodhpur, India*

- Simulated stochastic inventory dynamics and boundary controls under Brownian Motion constraints using Python (NumPy) to model complex system states.
- Developed a numerical solver for the **Hamilton–Jacobi–Bellman (HJB)** Partial Differential Equation (PDE) to derive optimal control policies for dynamic systems.
- Extended the simulation environment with adaptive variance parameters to analyze stability tradeoffs under varying stochastic conditions.

**Blockchain Supply Chain Management System** Apr 2025

*IIT Jodhpur*

- Architected a **secure distributed logging system** using **C++** and OpenSSL; implemented high-performance C++ core logic with Python bindings (**Pybind11**) for rapid scripting and data visualization.
- Built REST services and a Streamlit dashboard for real-time visualization of product flows.

**AmplifyME Finance Accelerator (Morgan Stanley & UBS Partnered)** Aug 2025

*Remote*

- Ranked top 22% in Sales & Trading simulations; managed a simulated USD 20M client portfolio under volatile market regimes.

**Short-Term Energy Load Forecasting using LSTM Networks** Oct 2024

*Independent ML Project (PyTorch, Time Series Modeling)* *Jodhpur, India*

- Developed an **LSTM-based forecasting model** to predict hourly energy consumption using historical load and meteorological data.
- Performed **temporal feature engineering** with lag variables, rolling window statistics, and Fourier-transformed seasonal components.
- Benchmarked performance against ARIMA and Gradient Boosting models, achieving a **22% RMSE reduction** and superior short-horizon stability.

## Achievements

- **ICPC 2025 Online Winter Challenge (Huawei)**: **Global Rank 192** - Designed heuristic algorithms for dynamic topology control and traffic load balancing in large-scale optical networks.
- **Baruch Pre-MFE (Linear Algebra)**: Selected among **40** worldwide (**Distinction**) - Advanced Linear Algebra & Numerical Methods.
- **JEE Advanced 2023**: Top 6.8% among 200,000+ candidates
- **JEE Main 2023**: Top 2.1% among 1.1M+ candidates
- **IIT Roorkee Trading Heist 2025**: Placed 6th among 631 teams nationwide (Algorithmic Strategy)
- **Competitive Programming**: Expert in Codeforces rating: **1736**

## Skills

- **Programming**: C++ (STL, Memory Management), Python (NumPy, PyTorch, Pybind11), SQL, Bash Scripting
- **Scientific Computing & Modeling**: Time-Series Analysis (ARIMA, LSTM), Stochastic Processes, Numerical Optimization, PDE Solving, Monte Carlo Simulation
- **ML & Statistics**: PyTorch, scikit-learn, XGBoost, pandas, NumPy, statsmodels, arch, TA-Lib
- **Tools**: Git, Linux, Jupyter, Backtrader, Streamlit, REST APIs, Pybind11, OpenSSL

## Coursework

- Data Structures and Algorithms, Design and Analysis of Algorithms, **Operating Systems**, **Computer Architecture**, Database Systems, Signals and Systems, Probability, Statistics & Stochastic Process, Machine Learning, Communication Systems, Embedded Systems, Deep Learning, Computer Vision**(700)**, Statistical Inference**(700)**
- **Upcoming**: Time Series Analysis, Optimization, Autonomous Systems