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EXPERIENCE

Quantitative Trading Intern

Sep 2025 – Feb 2026

Proprietary Trading Firm (NDA), Gurgaon · Systematic Energy Futures Desk

- Owned end-to-end strategy research on WTI crude calendar spreads (1M/3M/6M/12M tenors): evaluated **46 alpha signals** across ~1,000 combinations on **18M+ bars** under purged walk-forward validation (8-fold, 500-bar embargo), shortlisting by **deflated Sharpe** with realistic execution assumptions (\$3.98/side, 1-tick slippage, trailing stops, EOD exits).
- Built and shipped the desk's production **C#/.NET execution gateway** connecting Python strategy engines to CME via the TT SDK — an async order-state machine handling partial fills, cancel/replace races and rejection states, over a thread-safe FIFO position book surfaced on a real-time SignalR dashboard.
- Implemented a 5-layer **pre-trade risk engine** (fat-finger, position limits, margin, price-band) with an automatic kill-switch on daily P&L breach — a low-latency control layer in the order path.
- Delivered **regime-adaptive allocation**: entropy-based and nonlinear time-series features classified market state (stable/transitional/chaotic), gating signals and setting volatility-targeted size; measurably more robust than static allocation. Reported 30+ metrics (Sharpe, Sortino, Calmar, VaR, CVaR) with attribution across trade, session and regime levels.
- Classified WTI tenors by **Hurst exponent** (mean-reverting $H < 0.45$ vs. trending $H > 0.55$) and designed session-aware windows across Asia/Europe/US, inside a 34K-LOC backtesting system.

SELECTED PROJECTS

MM-Lab — Market-Making Simulator & Adverse-Selection Study

[GitHub]

- Discrete-event simulator with a jump-diffusion fair value and a two-population flow model (uninformed vs. informed). Scorecard attributes P&L to **spread capture, inventory risk, adverse selection and liquidation**, with the accounting identity asserted to **1e-6** across 34 tests.
- Avellaneda–Stoikov** inventory-skewed quoting vs. naive symmetric quoting on identical seeded flow: Sharpe-like **0.03** → **3.00**, adverse-selection cost **404** → **171**, P&L **+0.37** → **+190.29**. The naive quoter earned *more* gross spread and kept none of it.
- Documented result: textbook A–S degrades under **jump-dominated variance** until σ and the horizon are estimated adaptively — full derivation in DEFENSE.md.

Corpus-to-Strategy Alpha Pipeline

Python, scikit-learn, XGBoost, LightGBM, SciPy

- 41 papers** → **5,703 provenance-tracked evidence sentences** → **41 alpha signals** across 6 families → 80 executable strategy specs. 84 models trained under 24-month walk-forward with 200-iteration bootstrap; survivors filtered on **deflated Sharpe, White's Reality Check p -values and FDR q -values** to control for the size of the search.

Exchange Market-Data Warehouse & Curve Research Platform

Python, SQLite, Databento

- Idempotent, resumable ETL from GLBX.MDP3 into a **3.7 GB indexed store**: **18,279,517** 1-minute bars, **422 instruments** (421 exchange-quoted calendar spreads + front-month continuous), 2018–2026, spanning the April-2020 negative print and the March-2022 high.
- Research layer on top: 3-factor **PCA decomposition of the term structure** (level/slope/curvature), mean-reversion screening across the full 421-spread universe, and butterfly/box/cash-and-carry structure analysis.

Cross-Sectional Stat-Arb & Prediction-Market Systems

[GitHub]

- Stat-arb**: PCA factor extraction with **Ornstein–Uhlenbeck** half-life estimation on residuals; volatility-targeted sizing under gross-exposure and concentration limits across 5/20/60-day signal horizons.
- Prediction markets**: self-evolving Polymarket bots with genetic mutation, **Kelly sizing** (25% cap, 5% minimum edge), a 10% daily loss limit and a 30% drawdown circuit breaker.

TECHNICAL SKILLS

Languages: Python, C#/.NET, C++, SQL, JavaScript, Bash

Trading & Microstructure: Market-making (Avellaneda–Stoikov, inventory & adverse-selection risk), calendar spreads & term structure, statistical arbitrage, mean reversion, regime detection, execution & pre-trade risk, Kelly criterion, VWAP/TWAP

Statistics: Purged/embargoed walk-forward CV, deflated Sharpe, White's Reality Check, FDR control, stationary bootstrap, Hurst exponent, Ornstein–Uhlenbeck processes, PCA, VaR/CVaR

ML & Infrastructure: scikit-learn, PyTorch, XGBoost, LightGBM, Stable-Baselines3, NumPy, Pandas, SciPy, Statsmodels, Numba, TT.NET SDK, SignalR, FastAPI, SQLite, ETL design, Git, Linux, Plotly/Dash, Streamlit

EDUCATION

Indian Institute of Technology Madras

May 2024 – Present

B.Sc. in Data Science & Applications

CGPA: 8.0

Priyadarshini College of Engineering (RTMNU), Nagpur

Aug 2023 – 2027

B.E. in Artificial Intelligence & Data Science

CGPA: 9.2

CERTIFICATIONS

Financial Engineering & Risk Management — Columbia University (Coursera)

Jul 2025

J.P. Morgan Quantitative Research — Forage Virtual Experience

Jul 2025