

# MAHIMN PATEL

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## EDUCATION

**University of Toronto — Faculty of Arts & Science** Class of 2030

Bachelor of Arts, Social Sciences stream · intended Mathematics & Economics Specialist

**Central Peel Secondary School, Brampton, ON** Graduating June 2026

Grade 11–12 average: 97% · AP Macroeconomics 5, AP Psychology 5, AP Calculus AB 5 · Independent: MIT OCW Math for CS, Yale Financial Markets

## SELECTED PROJECTS

**trading-algo — Multi-Strategy Quantitative Trading System** 2024 — present

github.com/mahimn01/trading-algo · production-deployed, CI-gated on every push

- 15 equity strategy adapters + 9 crypto edges: pairs / stat-arb, momentum, regime-transition (3-state HMM), cross-asset divergence, opening-range breakout, funding-rate momentum, liquidation-cascade prediction, perpetual basis
- Production IBKR integration via `ib_async`: bracket orders, options chains, market scanner, news, Flex Web Service; LRU contract cache; adaptive rate-limited circuit-breaker connection layer
- 4-layer risk management (per-order limits; multi-strategy controller with Moreira–Muir 2017 vol targeting; escalating risk controller; hardcoded broker safety gates) with circuit breakers, daily-loss halts, drawdown-triggered scaling
- 10-yr walk-forward, hard IS/OOS split (round-trip costs + slippage modeled); deflated Sharpe (Bailey & López de Prado) significant at  $p < 0.001$ ; **OOS Sharpe 0.55 > IS Sharpe 0.21**, consistent with no in-sample overfit; annualized  $\alpha$  +4.06% vs SPY at  $\beta = 0.12$ , 18.5% max DD; report enumerates 12 disclosed limitations (survivorship, slippage, regime ex-post)
- LLM-agent trading layer (function calling, web grounding, sandboxed code execution; 12 tools); LLM-proposed orders gated by the same risk controller as systematic strategies

**ATLAS — Deep Reinforcement Learning Trading Agent** 2024 — present

- Hybrid **Mamba-2 SSM** + **cross-attention** policy network (~84M params) for sequential market data; trained with PPO and behavioral-cloning warm-start; curriculum across crash / uptrend / high-IV regimes
- Ablations across SSM block depth, state dim, and BC-coefficient annealing; parallel Apple-MLX inference path alongside PyTorch training backbone

**worldmonitor-mcp — Agent-Tooling Layer for Open-Source Intelligence** TypeScript, MCP

- MCP server + CLI exposing 112 tools across 33 OSINT services (BIS, FRED, SEC EDGAR, ACLED, AIS vessel tracking, GDELT, Polymarket, USGS, internet outages, military flight tracking) of the open-source `koala73/worldmonitor` platform to LLM agents; research substrate for the trading system's LLM workflows

**Quirio (“Liora”) — AI Assistant for Texas Real Estate Agents** 2023 — 2026

quirio.io · React, TypeScript, Python · archived April 2026

- Shipped a production AI assistant connected to large-scale Texas residential real estate data — listing discovery, comparative market analysis, client management, document drafting. Used by early-access agents from 2023; archived April 2026 after winding down to focus on quantitative research.

## OPEN SOURCE CONTRIBUTIONS

**nautilus\_trader — Rust/Python Algorithmic Trading Platform** 2026

5 merged PRs · 24.4k GitHub stars

- PR #4251 — Designed and implemented benchmark-relative performance statistics (Beta, Jensen's alpha, Information Ratio, Tracking Error, Treynor) in the Rust core with PyO3 bindings, extending the `PortfolioStatistic` trait with a benchmark-aware calculation path and wiring the metrics through the Python analyzer and tearsheet; design agreed with the maintainer via RFC issue before implementation, conventions validated against `empyrical`.
- PR #4354 — Added Up/Down Capture ratios as Rust-core `PortfolioStatistics` building on the benchmark-relative infrastructure from #4251, following `empyrical`'s up/down-capture convention (geometric annualized return over sign-filtered benchmark periods), with a shared capture-ratio helper across the two statistics and full PyO3 bindings and stubs; expected values cross-checked against `empyrical`.
- PR #4099 — Fixed a silent data-loss bug in the Interactive Brokers historical client where `request_instruments` returned the provider's entire cumulative instrument cache, leaking every prior call's results and masking contract-qualification failures behind stale cache hits. Replaced with explicit per-call resolution that surfaces unresolved contracts; a core contributor subsequently ported the fix to the Rust core (PR #4114).
- PR #4141 — Fixed intraday return aggregation in the analysis crate's `downsample_to_daily_bins` (Python + Rust paths): within-day returns were summed arithmetically instead of compounded geometrically via  $(1 + r_1)(1 + r_2) \cdots - 1$ , producing wrong Sharpe, Sortino, volatility, CAGR, and Calmar values for any non-daily-frequency input.

PR #214 (cherry-picked to next) · 1.7k GitHub stars

- Fixed missing contract propagation in the streaming-news event handler: `NewsTick` events were dispatched to subscribers without their `contract` field populated, leaving consumers unable to correlate news to the underlying symbol. Added a lookup against the request map keyed on `reqId` so contract metadata reaches every callback.

## AWARDS & COMPETITIONS

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**NSS Space Settlement Design Competition — Grand Prize Winner, 2026** · 4 consecutive years of competition. *Project Saoirse* (50-page report, 75-citation bibliography): **led the 11-person team** and authored the Politics, Philosophy & Economics chapter for a 10,000-resident Mars-Sun L2 settlement — exergy-denominated currency (Sciubba's Extended Exergy Accounting), FERC-745-style conservation market, and a tripartite executive (elected representative + appointed expert + sortition citizen) with time-horizon-weighted voting.

## TECHNICAL SKILLS

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**Languages:** Python, C++, TypeScript / JavaScript, SQL

**Quant & ML:** PyTorch (Mamba SSM, transformers, PPO, behavioral cloning, EWC), NumPy, pandas, statsmodels, scikit-learn, `ib_async`, CCXT, Kite Connect, Apple MLX

**Domains:** algorithmic trading, walk-forward validation, deflated Sharpe testing, factor modeling, market microstructure, options pricing