Chu Kai Le

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Education

National University of Singapore (NUS) — Singapore
B.Eng. Mechanical Engineering, Double Major in Computing (Incoming) — *Aug. 2026 – TBC*

- **Awards:** NUS CDE Engineering Scholars Programme (Full Scholarship, valued over 75,000 SGD)

NUS High School of Mathematics and Science — Singapore
NUS High Diploma (High Distinction) — *Jan. 2018 – Nov. 2023*

- Overall CAP: 4.5/5.0 (A-) – Mathematics: 4.9 (A+), Chemistry: 4.9 (A+), Physics: 4.6 (A)
- Relevant Coursework: Linear Algebra (Vectors & Matrices), Multivariable Calculus, Probability, Statistics

Projects

C++-Accelerated Walk Forward Analysis | *Python, C++, Pandas, NumPy, Numba*

- Engineered a Walk-Forward Analysis (WFA) backtesting framework to rigorously validate mean-reversion strategies, utilizing rolling windows to eliminate look-ahead bias and overfitting.
- Implemented dynamic signal generation using **Kalman Filters** for hedge ratio estimation, coupled with empirically optimized statistical filters (ADF p-value ≤ 0.1, Hurst $H \leq 0.8$) to enforce stationarity and anti-persistence.
- Modeled realistic **market microstructure** (transaction costs, slippage, liquidity constraints) to critically assess "theoretical alpha," concluding that financial friction consumes profitability on 15-minute bars.
- Identified Python execution bottlenecks and implemented a C++ extension via PyBind11 to accelerate the backtesting loop, achieving a 1.30x speedup over Numba-based WFA.
- **Systematically screened** a universe of pairs across 4+ years of data, validating the top 25 stationary pair-models for subsequent paper trading based on robust out-of-sample performance.

Pairs Trading Paper Trading Engine | *Python, Alpaca API, Multiprocessing*

- Orchestrated a concurrent live trading system using a Controller-Worker architecture to simultaneously manage 20+ pairs, leveraging **Python Multiprocessing** for isolated fault tolerance and independent execution cycles.
- Engineered a self-healing data pipeline with **Pickle-based state persistence** and robust error handling to recover trading states automatically after API disconnects or system interrupts.
- Developed a bi-weekly automated optimization module that recalibrates Z-score entry/exit parameters and stop-losses based on recent volatility regimes, ensuring strategy adaptability.
- Integrated a real-time telemetry system to push trade signals, system heartbeats, and immediate risk alerts for PnL drawdowns ($> \$2,500$ stop-loss) or stationarity breakdowns.

Online Marketplace Ventures | *Digital Assets, Inventory Management*

- Executed systematic arbitrage strategies across fragmented secondary markets (digital assets and specialized equipment), using domain expertise to exploit high information asymmetry and transient pricing inefficiencies.
- Achieved a **24x return on invested capital (ROIC)** over 19 months, growing an initial \$150 stake into \$3,700 in total equity (\$2,500 realized profit + \$1,200 inventory).

Experience

Republic of Singapore Air Force — Singapore
Air Force Electro-Armament Technician (3rd Sergeant) — *Aug. 2024 – Present*

- Managed a team of armament technicians, ensuring safety protocols and operational readiness of munitions.
- Spearheaded the digitalization of 3,000+ physical stock cards, and used **Excel Macros (VBA)** to create stock cards, reducing creation time by 85%.

Technical Skills

Languages: Python (Proficient), SQL, VBA, JavaScript, HTML/CSS
Libraries/Tools: Pandas, NumPy, C++ (Pybind11), Git, Docker, Excel Macros, Multiprocessing, AsyncIO
Concepts: Algorithmic Trading, Statistical Analysis (ADF, Hurst, Kalman Filters), Backtesting Infrastucture
Interests: Valorant (Peaked Top 0.5%), Trackmania (Peaked Top 1% Asia, Top 3 SG), Motorcycling, Bouldering