# Marcos Jaen

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## Technical Skills

**Languages**: KDB+/Q, Python, R, SQL (Postgres, MySQL), JavaScript, TypeScript, HTML/CSS, VBA
**Frameworks**: React, Node.js, Bun, Express.js, Next.js, FastAPI, Prisma, Hono, Drizzle, TailwindCSS, Shadcn UI
**Developer Tools**: GitHub Actions, Jenkins, Docker, Azure, AWS, MongoDB, Supabase, Neon, Linux, KX Analyst
**Libraries**: pandas, NumPy, Matplotlib, TensorFlow, PyTorch, scikit-learn

## Education

**University of Toronto - Trinity College** Toronto, ON
*Mathematics; Minor in Statistics & Economics* *Jan. 2020 – Nov. 2022*

- **Relevant Coursework:** Numerical Methods, Statistics, Probability, Stochastic Processes, Risk Management, Option Pricing, Time Series Analysis, Partial Differential Equations, Financial Engineering.

## Experience

**KDB+ Programmer** Jan. 2023 – Present
*Ontario Securities Commission — Market & Economic Analysis* *Toronto, ON*

- Led real-time analysis of tick-level data in KDB+/Q, conducting collaborative research and analysis on market microstructures and sector trends.
- Developed and maintained internal KDB+ library, featuring over 50 functions for market quality, surveillance, and statistical analysis, enabling cross-jurisdictional use without KDB+/Q expertise.
- Authored and maintained full-stack market quality dashboard for enterprise use with advanced authentication features, interactive visualizations, and role-based access control, using Supabase and Drizzle for backend, Shadcn UI components, Tailwind CSS for styling, React and Next.js 14 with TypeScript for frontend.
- Initiated a study on pump-and-dump schemes, analyzing +100GB of account-level data in KDB+/Q with T-SNE and UMAP for signal analysis and visualization of PnL. Employed Monte Carlo simulations to refine unsupervised density-based clustering model (HDBSCAN) for anomaly detection, improving the efficacy of prior similar models.
- Co-led the CSA's ETF review research, analyzing +150 billion rows of data, using SVM for Authorized Participants' (AP) identification. Designed and implemented fixed-effects regressions to assess the influence of APs on liquidity metrics; results contributed to new regulatory framework, with analysis pending publication.
- Collaborated with TMX group and trading specialists to assess the impact of Alpha's new order books, order types, and changes in speed bumps on execution quality on Alpha and other marketplaces. Created models in KDB+/Q to assess execution quality across four dimensions: liquidity, execution costs, price discovery, and market stability.
- Currently developing a trading engine that models order book levels and types, as well as the interactions between various orders, to enhance the understanding of order dynamics and simulate realistic market conditions using KDB+ for a staff paper.
- Streamlined data pipelines, reducing processing times by 50%, in addition to sourcing external data and engineering ETL processes using KDB+, Python, and R for data preparation and analysis.
- Designed business intelligence (BI) reports and slide decks, and presented analyses to high-profile stakeholders including BlackRock, BMO Nesbitt Burns, and executive management.

## Projects

**ETF Pair Trading** | *KDB+/Q, IPC, Algorithmic Trading, Database Design* June 2024 – Present

- Developed a high-frequency trading system in KDB+ for cointegrated ETF pairs, utilizing the Tick Architecture to ensure efficient IPC between components. This architecture integrated a tickerplant for real-time data processing, a real-time database for quick access, and a historical database for long-term analysis, to maximize efficiency.
- Implemented a Kalman Filter for calculating dynamic hedge ratios, leveraging parallel computing for performance. The system included a Model Server that analyzed cointegration and ranked pairs based on Sharpe ratio and depth, allowing for trading decisions based on statistical analysis of price relationships and optimal execution.

**Predicting Realized Volatility** | *Python, Machine Learning, Optimization, Time Series* June 2024 – Sep. 2024

- Engineered and optimized LightGBM, LSTM, and GBM models for predicting stock volatility, achieving 85% out-of-sample performance with LightGBM by utilizing a comprehensive dataset from 2014 to 2024 and incorporating over 50 unique features, including novel factors like bank overnight rates and disease proxies.
- Enhanced model precision and addressed challenges in forecasting volatility for highly volatile stocks through advanced data processing, hyperparameter optimization, and strategic industry grouping.