

Thomas Breloff

breloff.com

More than 15 years experience across quantitative research, software development, trading strategy development and portfolio management. Deep experience across several domains including NLP, HFT, AI/ML. Experience building distributed low-latency systems. Managed teams and high-risk trading operations.

SKILLS

- **Code:** Julia, Python, Java, C/C++, Typescript, Javascript, Git, Linux, SQL
- **Math/ML:** Stochastic Optimization, Constrained Optimization, Deep Learning, Reinforcement Learning, Applied Statistics, Distributed Algorithms, Dimensionality Reduction, Genetic Algorithms, Spiking Neural Networks, Logical Deduction and Abduction, Attention-Based Neural Architectures, Multi-Task and Transfer Learning
- **Quantitative Finance:** Statistical Arbitrage, Econometrics, Stochastic Differential Equations, Principal Components Analysis, Market Microstructure, Impact Modeling, Alpha Modeling, Portfolio Optimization, Equity Derivative Pricing, Feed Handlers, Index Rebalancing, Risk Models, Factor Analysis
- **Other:** NLP, Visualization, Distributed Systems, Messaging Patterns, Data Pipelines, Microservices

EXPERIENCE

Elemental Cognition - Senior Researcher, Engineer

Apr 2017 - PRESENT

Natural Language Understanding and Deep Learning for Logical Reasoning

- Deep Learning for NLP (Python, PyTorch, Transformers, Docker, Linux)
 - ◆ Developed experimentation framework for multi-task modelling based on Transformer architectures;
 - ◆ Implemented multi-label word sense prediction model for accurate hierarchical prediction;
 - ◆ Research into non-Euclidean/hyperbolic geometries and integration of manifold-aware neural layers.
- Hybrid Statistical / Logical Reasoning (Java, ASP)
 - ◆ Designed and implemented a reasoning engine supporting cluster-distributed best-first logic graph expansion;
 - ◆ Developed algorithms for incorporating statistical rule generators into logical back-chainers;
 - ◆ Implemented and improved a framework for constraint management and propagation.
- Distributed Systems (Java, ZeroMQ, Protobuf)
 - ◆ Redesigned core dialog engine for asynchronous interactions between users and the reasoning engine;
 - ◆ Designed an event-based transaction system to enable analytics and dialog rewind capabilities.
- Applications / Visualization (Javascript, Typescript, D3, Websockets, MongoDB)
 - ◆ Created web framework for quick iteration of in-house applications: UI components and helper functionality;
 - ◆ Extended D3 force simulations in a generic way to support many different graph visualization applications;
 - ◆ Developed in-house tools for parse analysis, visualizations of the internal state of our reasoning engines, experiment analysis, ontology management, and more.

Cointegrated Technologies - Researcher, Developer, Consultant

Aug 2013 - Apr 2017

- Collaboration with svlsResearch, a currency-focused HFT fund (Matlab, Java, Mathematica, Linux)
 - ◆ Investigated pricing and alpha models for automated market making strategies.
 - ◆ Modelled the distributional effects of data projections from clock-time into volume-time.
 - ◆ Developed analytic approximations to dynamic programming problems for optimal trade placement accounting for non-linear market impact.
 - ◆ Analyzed broker and data offerings to reduce trading and research costs.
 - ◆ Designed and built a simulation environment for testing optimal order execution;
 - ◆ Optimized existing codebase to enable faster round trip latency.
- Trading Research (Julia, Linux)
 - ◆ Created a flexible trading backtest environment for short term trading strategies;
 - ◆ Accounted for order book dynamics to simulate the market impact on order placement;
 - ◆ Investigated how one could use reinforcement learning agents to optimize the control problem of alpha capture.
- Open Source Development in Julia (github.com/tbreloff):
 - ◆ Creator of **Plots** and the novel recipes framework, which is one of the most-starred Julia packages used by thousands of students and researchers;
 - ◆ Creator and Core Contributor to many machine learning libraries: Reinforce, OnlineAI, OnlineStats, Learn, etc.
- Machine Learning and Artificial Intelligence R&D (www.breloff.com/blog):
 - ◆ Biologically plausible neural approaches: spiking networks, dendritic functions, etc;
 - ◆ Backprop-free neural network training: Feedback Alignment and variants.
- Consulting: Trading systems, Data science, Visualization.

Yottabit - Founder, CEO

May 2011 - July 2013

HFT Fund, Focused on ETF relative value

- Quantitative Research (Python, C/C++, Cuda, Linux)
 - ◆ High-frequency statistical arbitrage research using cross-asset ETF trading;
 - ◆ Portfolio Optimization using novel GPU-Accelerated Evolutionary Algorithms;
 - ◆ Order fill prediction models and pre-hedging strategies;
 - ◆ Simulated exchange dynamics for realistic strategy testing.
- Trading Systems (C/C++, Python, Qt, ZeroMQ, Infiniband, SQL, Linux)
 - ◆ Low latency feed handlers and order book management;
 - ◆ Custom shared memory framework for low overhead logging and analytics of trading activity;
 - ◆ Distributed risk management system for dynamic reallocation of trading limits across strategies.
- Portfolio Management
 - ◆ Managed day-to-day operations of many factor-neutral portfolios;
 - ◆ Handled rolls and rebalances due to corporate actions.
- Business Development: Investor relations, Legal/Operations, Vendor Research

Credit Suisse - Portfolio Manager, Desk Head

June 2008 - March 2011

Founded HFT Desk within Global Arbitrage Trading

- Quantitative Research (Python, C/C++, Linux)
 - ◆ Optimal portfolio allocation of high-frequency ETF arbitrage strategies;
 - ◆ Arbitrage around daily close rebalancing of leveraged index funds;
 - ◆ $O(n)$ algorithms to approximate $O(n^2)$ risk calculations in real time;
 - ◆ Statistical prediction of OTC futures trading levels.
- Trading Systems (C/C++, Python, Qt, Linux)
 - ◆ Built low latency feed handlers and order management framework;
 - ◆ Custom DSL and parser for dynamic trade strategy control;
 - ◆ Distributed risk management of asynchronously shared trading limits;
 - ◆ Integration of human-guided hyperparameters for gray-box strategies.
- Business Development
 - ◆ Founded the High Frequency Trading Desk in New York;
 - ◆ Expanded to London and simultaneously managed trading in the US and Europe;
 - ◆ Traded up to 200M shares a day across thousands of products with complex overnight risk;
 - ◆ High sharpe ratio (>10)

BNP Paribas - Portfolio Manager, Quantitative Researcher

Sep 2006 - May 2008

Index Arbitrage Trading Group

- Built and managed automated market making and index arbitrage portfolios;
- Day to day management of futures arbitrage strategies, including rolls, rebalances, and OTC dealings;
- Developed new approaches to trading leveraged ETFs and became a major player in those markets;
- Managed closing rebalancing operations of all leveraged ETF holdings;
- Developed Python scripts and GUIs for portfolio analysis;
- Statistical modelling for verification of non-spurious alpha signals.

OPEN SOURCE DEVELOPMENT

- **Visualization:** Plots, RecipesBase, StatPlots, GraphRecipes
- **Machine Learning:** OnlineStats, Reinforce, StochasticOptimization, OnlineAI, OpenAIGym, Transformations

EDUCATION

NYU Courant Institute - MS Mathematics

Sep 2004 - Dec 2005

University of Rochester - BA Mathematics & BS Economics

Sep 1999 - May 2003