

## Academic Background

### University of Southern California (USC)

Master of Science in Mathematical Finance, USC Dornsife College

GPA: 4.0/4.0

Sep.2024 - May.2026 (Expected)

Los Angeles, CA

### Nanchang University - Project 211

Bachelor of Economics in Mathematical Finance, School of Mathematics and Computer Science

GPA: 3.62/4.0; 87.02/100

Sep.2020 - Jul.2024

Nan Chang, CN

## Research Experience

### Research Assistant

Supervisor: Guang Cheng, Prof of Statistics and Data Sciences, Graduate Vice Chair (UCLA)

Jun.2025-Sep.2025

- ✓ Engineered an automated data pipeline using Python scripts to continuously extract, transform, and load over **5 million** minute-level data from **Polymarket** and **Deribit APIs** into a **PostgreSQL** database, which served as the foundation for developing trading framework.
- ✓ Developed and backtested **High-Frequency cross-market arbitrage strategies** for crypto options (Deribit) and prediction markets (Polymarket), based on **digital-option replication**, yielding an **84.9% win rate** (206 trades) and **+0.051 Unit-ROI** over a 3-month backtest window.
- ✓ **Built, live-tested, and optimized** an in-play **MLB microstructure strategy** by engineering a factor library from 600+ signals, delivering a **consistent +30% ROI** over 65 live trades and 300+ games.

### Direct Research

Supervisor: Bowen Gang, Prof of Statistics (Fudan University)

Mar.2025-Sep.2025

- ✓ **Addressed the critical challenge** of controlling the False Discovery Rate (FDR) in contaminated models where standard methods often fail.
- ✓ **Proposed** a single-split, hold-out framework ('envelope-p') and **proved** a rigorous, **non-asymptotic**, and **implementable finite-sample FDR bound** for the **Benjamini-Hochberg** procedure.
- ✓ **Validated** the theoretical bound's tightness by conducting extensive **simulations** to quantify the gap to realized FDR.

### Dynamic Pricing of ETF Options Based on Recurrent Neural Networks

--- [github.com/TenghanZhong/GRU-Heston](https://github.com/TenghanZhong/GRU-Heston)

Supervisor: Lidan Liao, Professor of Mathematics(Nanchang University)

Dec.2023-Feb.2024

- ✓ Processed **2,001,232** one-minute ETF option datas points (HUATAI-PB HS300 and AMC SSE 50, Aug - Oct, 2023), conducted rigorous filtering (European call options; fixed maturity & strike price), applied interpolation for precise interest rate estimation, and computed implied dividends using Put-Call Parity to enhance model accuracy.
- ✓ Conducted statistical tests on pricing error to confirm time dependency, validated RNNs for correcting deviations, and utilized **GRU & LSTM** models to refine pricing errors in **Black-Scholes** and **Heston** model.
- ✓ Calibrated Heston model using high-frequency option data via **Trust Region Reflective (TRR)** algorithm for enhanced parameter boundary handling and model stability.
- ✓ Conducted empirical researches and concluded that the pricing accuracy (MSE & MAPE values) of the **Heston-GRU** and the **Heston-LSTM** model outperform benchmarks by at least **70%**.

## Project Experience

### Hybrid Approaches to Crypto Volatility Prediction Using GARCH and GRU Model

--- [github.com/TenghanZhong/Crypto\\_Volatility\\_prediction](https://github.com/TenghanZhong/Crypto_Volatility_prediction)

Supervisor: Ratika Narag, Professor of Economics(USC)

Sep. 2024-Dec.2024

- ✓ Processed **830,000+** 5-min crypto data points (Coinbase, Jan 2024–Oct 2024), converted to hourly log returns and volumes, computed 24-hour rolling realized variance, conducted statistical tests to confirm volatility clustering and validate GARCH-type models' feasibility. Implemented rolling-based forecasting to ensure consistent predictions.
- ✓ Developed two types of hybrid models (**GRU-GARCH**, **GRU-GARCH-Error**) which combine multiple GARCH Family Models and GRU to enhance the accuracy of cryptocurrency volatility prediction.
- ✓ Compared multiple models and demonstrated that the **GRU-AVARCH** model outperforms traditional GARCH-type models (by at least **15.04%**) and standalone GRU (by at least **11.74%**) across different horizons (T+1 to T+6). Visualizations further illustrate that hybrid models better capture jumps and volatility clustering in crypto markets.
- ✓ Identified sensitivity and estimation challenges in **Four** types of GARCH Family models through convexity analysis. Demonstrated that EGARCH is the hardest to optimize due to its complex curvature, while AVARCH converges more easily by smoothing extreme values.

**Calibration of Power-Type Derivatives for Rough Volatility with Jumps**[---github.com/TenghanZhong/GPU-NN-Option-Calibration](https://github.com/TenghanZhong/GPU-NN-Option-Calibration)

Supervisor: Weixuan Xia, Assistant Professor of Mathematics(USC)

Feb.2025-May.2025

- ✓ Developed a **GPU-based calibration pipeline** with two-stage GA→L-BFGS-B to fit **power-type VIX options** under a rough-OU + tempered-stable jump model (Wang–Xia, 2022), **cutting runtime by >98%** (>24h→<20 min) and **improving fit accuracy**.
- ✓ Validated and constrained the model via a high-frequency activity-index estimator (power variation + Brent), reducing the parameter search space and improving cross-maturity fit.

**Analysis of Economic Cycle Based on MS-MIDAS Model**

Mar. 2023-Jun.2023

- ✓ Collected and processed 80 quarters (2003Q2–2023Q1) of GDP data and monthly freight & passenger volume data, filtering missing values and ensuring data consistency.
- ✓ Applied the **MS-MIDAS** model to regress quarterly GDP growth on high-frequency transportation data, classifying economic phases into recession, stability, and expansion based on regime transition probabilities.
- ✓ Identified major economic cycle transitions. Achieved standardized RMSE values of 0.0629 (recession), 0.0718 (stability), and 0.1522 (expansion) and demonstrated strong short-term predictive accuracy.

**Working Experience****USC Dornsife College of Letters, Arts and Sciences./Grader**

Sep.2025-Dec.2025 / Los Angeles, CA

- ✓ Department of Mathematics: MATH 125g: Calculus I (Fall 2025)

**Vanho Securities Co. Ltd./Asset Management Department**

Sep. 2023-Nov.2023 / Shenzhen, CN

- ✓ Reproduced Everbright Securities' Market Time Based on Resistance Support Relative Strength and Huatai Securities' FFscore Model for Value Stock Selection, utilizing Tushare data and Python for analysis.
- ✓ Optimized parameters through sensitivity testing and enhanced the original strategy by adding constrained variables, achieving a 200% excess return in backtesting and reducing the maximum drawdown rate by 20%.
- ✓ Designed and developed the backtesting framework for timing and stock selection strategies, which included compiling various quantitative strategy metrics, enhancing data visualization and conducting statistical tests to assess the strategy's robustness.
- ✓ Assisted the supervisor in tracking and analyzing the performance of quantitative investment strategies, processing and evaluating the key factors, preparing comprehensive evaluation reports and providing decision support.

**Ping An Securities Co., Ltd./Brokerage Division**

Jul. 2022-Aug.2022 / Shenzhen, CN

- ✓ Processed the income data of the private equity firms via Excel and Python, including data verification, calculation, addition, and modification.
- ✓ Completed weekly and monthly reports based on the data of private equity products, and analyze and summarized the operation and performance of each product.
- ✓ Analyzed the pros and cons of Ping An Securities' private equity system, compared it with other systems, and provided advice on the private equity system.

**Skills and Certifications**

- ✓ Programming: Python, SQL, Latex, R, Microsoft
- ✓ Languages: Chinese (native), English (proficient)
- ✓ Extracurricular: Basketball

**Graduate-Level Courses**

- ✓ Stochastic Calculus and Mathematical Finance A
- ✓ Stochastic Calculus and Mathematical Finance B
- ✓ Introduction to Mathematical Statistics (PhD Level)
- ✓ Linear Programming (PhD Level)
- ✓ Machine Learning in Quantitative Finance
- ✓ Financial Informatics and Simulation
- ✓ Time Series Analysis
- ✓ Big Data Econometrics
- ✓ Investment Analysis and Portfolio Management