

Yutong (Beeth) Xue

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RESEARCH INTERESTS

I am a dedicated researcher with a solid foundation in machine learning, deep learning, and statistical modeling, particularly within the context of finance and probability. My research focuses on applying advanced statistical methods and probabilistic models to develop predictive analytics and decision-making tools in financial markets. I am excited about leveraging ML and DL techniques to solve complex, data-driven problems in finance.

EDUCATION

Rice University – George R. Brown School of Engineering <i>Master of Computational Science and Engineering-Statistics (MCSE-STAT)</i> GPA: 3.72/4	Expected December 2024 Houston, TX
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Coursework: Probability, Quantitative Risk Management, Random Process, Optimization Theory, Python for Data Science, Machine Learning, Deep Learning, Reinforcement Learning, Statistical Inference

Shanghai University of Finance and Economics <i>Bachelor of Law</i> Coursework: Linear Algebra, Advanced Calculus, Analysis, Database, Object-oriented programming, Data Structure	06/2023 Shanghai, China
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RESEARCH EXPERIENCE

[Tradaverse] <i>[AI researcher Assistant]</i>	[Houston, TX] <i>[05/2024] – [08/2024]</i>
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- Developed a real-time market briefing tool using **Python, pandas, and Autogen**, with **Sequential Chats** and **integrated APIs (FMP, GPT-4o)** to automate data aggregation from multiple financial news sources, resulting in a 50% reduction in report generation time and 30% improvement in trading decision accuracy.
- Implemented **NLP-based sentiment analysis** to assess the impact of news on stock prices, performing **data mining, data preprocessing, and feature engineering**, leading to a 30% improvement in market sentiment analysis and more informed **decision-making**.
- Applied **prompt engineering** techniques and **hyperparameter tuning** to enhance the accuracy and relevance of AI-generated outputs, **boosting decision-making** tool efficiency across financial market applications. Used **data visualization** techniques (Matplotlib, Seaborn) to present insights to key stakeholders, enabling data-driven decision-making

[Rice University] <i>[Research Assistant]</i>	[Houston, TX] <i>[02/2024] – [05/2024]</i>
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- Focused on GPU **computational efficiency research**, utilizing **Mamba and CUDA** to accelerate natural language processing (NLP) tasks and large language model (LLM) training, leading to significant reductions in model training times and resource usage.
- Conducted performance **evaluations and optimizations on complex neural network architectures** specifically designed for NLP applications and LLMs, improving inference speeds and enabling real-time language understanding and generation.
- Implemented efficient **parallel computing techniques** for large-scale data processing and model training, enhancing the performance of NLP pipelines and LLMs, and facilitating the deployment of scalable and robust language models in production environments.

[Rice University] <i>[Research Assistant]</i>	[Houston, TX] <i>[12/2023] – [02/2024]</i>
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- Developed **numerical solutions** for the Black-Scholes-Merton equation using the Crank-Nicolson method, achieving an L2 error of 0.000891.
- Engineered and trained **ANN to solve non-linear Black-Scholes-Merton equations**, achieving an MSE of 0.03975

- Developed and **optimized Neural Networks and Random Forests in GPU using CUDA**, effectively handling class imbalances and enhancing balanced accuracy from 50% to 72.87%. With final predictive scores reaching up to 73.063% in test sets and 68.136% in practical sets.

[Wisdom Asset Management]

[Quantitative Researcher Assistant]

[Shanghai, China]

[03/2023] – [06/2023]

- Developed and implemented **multifaceted growth**, curve, rate, trend, mean reversion, and volatility factors using **advanced machine learning techniques**, including **LSTM networks and transformer-based models**. These factors were integrated with **asset allocation strategies** based on Investment Clock Theory to enhance predictive accuracy and decision-making.
- Applied the strategy to trade SPX futures and treasury futures, **leveraging large language models (LLMs)** for market sentiment analysis and **LSTM networks** for predictive modeling. This approach resulted in a robust annual **back-test**, yielding a return of 11.5%, a **Sharpe ratio of 1.15**, an annualized volatility of 10%, and a maximum drawdown (MDD) of -13.69%.
- Built a comprehensive total return index encompassing equities, commodity futures, and foreign exchange by employing **machine learning algorithms**. This index provided a multifaceted view of market dynamics and investment opportunities, enabling more informed and strategic investment decisions

TEACHING EXPERIENCE

[Rice University]

[Teaching Assistant]

[Houston, TX]

[2024 Fall]

- Level:** Postgraduate
- As a TA for **STAT649: Quantitative Finance and Risk Management**, I supported postgraduate students in mastering complex topics in derivative markets, including option theory, stochastic calculus, and risk management. My responsibilities included grading assignments, providing programming support in Python and R for financial analytics, and organizing review sessions. Additionally, I supervised students' projects, offering guidance on **empirical research methods** and ensuring they followed best practices in their quantitative analysis. My efforts **earned praise from students** for effectively clarifying challenging concepts.

SKILLS & CERTIFICATIONS

Programming: Python, C++, SQL, MATLAB

Machine Learning: Supervised/Unsupervised Learning, Deep Learning, Natural Language Processing (NLP), LLMs

Data Science: Data Preprocessing, Feature Engineering, Model Evaluation, Data Wrangling, Exploratory Data Analysis

Mathematics & Statistics: Stochastic Calculus, Probability, ODE, Measure Theory, Hypothesis Testing, Real Analysis, Numerical PDE, Optimization Theory, Mathematical Finance

Languages: English (fluent), Mandarin (Native), Japanese (Basic)

PROJECT AND PROFESSIONAL EXPERIENCE

[Rice University]

[Transformer for Named-Entity Recognition]

[Houston, TX]

[11/2023] – [12/2023]

- Developed a **transformer model from scratch** using TensorFlow, demonstrating a deep understanding of attention mechanisms and neural network architectures.
- Applied the custom-built transformer to perform **Named-Entity Recognition**, achieving high accuracy in identifying and classifying named entities in text.
- Explored the computational foundations of efficient language learning, investigating how neural networks can learn and generate **novel utterances from limited data**.
- Advanced the development of general-purpose intelligent systems that communicate effectively with humans and learn from human guidance, **bridging the gap** between current machine learning techniques and human language abilities.

[Core Value Capital]

[Northfield, IL]

[Quantitative Analysis Intern]

[08/2023] – [11/2023]

- Engineered and deployed **quantitative models using MetaTrader4** to process and analyze large-scale Forex market data, optimizing trading strategies through **statistical analysis**.
- Applied advanced machine learning algorithms, utilizing **hyperparameter tuning** to enhance model generalization and predictive accuracy.
- Executed comprehensive backtesting procedures to assess model performance under various market conditions, ensuring robust and reliable forecasting.
- Leveraged technical indicators such as MACD, RSI, ADX, Pivot Point, and Bollinger Bands, along with proprietary strategies, to predict currency market trends and volatility.
- Developed expertise in financial time series analysis, predictive analytics, and **algorithmic trading**, applying statistical techniques and machine learning to **optimize trading decisions** and improve model interpretability.

[Rice University]

[Houston, TX]

[Numerical Solutions to the Black-Scholes-Merton Equation]

- **Proficient in Numerical Methods for PDEs:** Applied the **Crank-Nicolson method** to solve the Black-Scholes-Merton (BSM) equation, demonstrating a strong grasp of numerical analysis techniques for **parabolic partial differential equations (PDEs)**. Achieved first-order convergence through careful discretization of the stock price domain.
- **Exploration of Deep Learning Approaches for Financial Models:** Developed and trained neural networks using **supervised learning** to approximate solutions for the BSM equation. Achieved high accuracy in modeling the relationship between stock prices and option prices, showing proficiency in advanced machine learning methodologies.
- **Innovative Use of Unsupervised Learning:** Explored the use of unsupervised learning models for solving complex PDEs, such as the **non-linear Leland volatility model**. Implemented a weighted loss function to balance PDE residuals and boundary conditions, demonstrating a deep understanding of machine learning's application to numerical problems.
- **Experience with Financial Mathematics and Derivative Pricing:** Extensively studied and applied numerical methods and machine learning techniques to solve the BSM equation for option pricing. This includes handling non-linear adjustments in volatility to account for transaction costs, providing a deeper insight into real-world financial markets.
- **Proven Computational Efficiency:** Optimized the Crank-Nicolson method using the **Newton-Raphson iteration** for solving non-linear PDEs, achieving efficient convergence with minimal computational resources. Demonstrated the ability to enhance computational models for high-performance applications in finance.

PUBLICATIONS AND CONFERENCES

[11th Eubank Conference on Real World Markets]

[Houston, TX]

- Attended presentations and discussions on the application of statistical methods and machine learning in real-world financial markets.

[Deep Learning Seminar]

[Houston, TX]

- Participated in a seminar focused on the latest advancements in deep learning, including transformer models and their applications to natural language processing and financial modeling.

[Seminar on Stochastic Processes 2024]

[Houston, TX]

- Attended a seminar exploring advanced topics in stochastic processes, with particular focus on applications in quantitative finance and option pricing models.

[Jumpstart Outcome Seminar 2024]

[Houston, TX]

- Attended a seminar hosted by the FDA Statistical Association (FDASA), focusing on career opportunities in biostatistics within the FDA. The event featured biostatistical directors and leadership from various sectors of the FDA, providing valuable insights into the role of statisticians in regulatory science and public health.

PROFESSIONAL MEMBERSHIPS

[Rice Artificial Intelligence Association]

[Houston, TX]

- Actively involved in **real-world AI/ML projects** for industry and startups as part of the Rice Nexus initiative. Collaborated with peers and industry professionals to address practical challenges using **cutting-edge AI** and machine learning techniques, such as natural language processing, computer vision, and predictive modeling. Worked on end-to-end project development, from problem formulation to model deployment, contributing to solutions that had tangible impacts on business operations. This experience provided valuable exposure to real-world data, cross-disciplinary teamwork, and scalable AI implementations, aligning academic knowledge with industry needs.

REFEREES / REFERENCES

- **Prof. Behnaam Aazhang**
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Director, Rice Neuroengineering Initiative
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- **Prof. Katherine B. Ensor**
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