Lei Fan

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Education

- **University of Illinois at Urbana-Champaign** — Urbana, IL
  Ph.D. in Industrial Engineering, Minor in Machine Learning for Finance, GPA: 3.84/4.00 — Aug. 2016 – Dec. 2021
  Advisor: Prof. Justin Sirignano (https://www.maths.ox.ac.uk/people/justin.sirignano)
- **Kyoto University** — Kyoto, Japan
  Master of Science in Economics, GPA: 3.94/4.00, Advisor: Prof. Masahiko Egami. — Apr. 2014 – Feb. 2016
- **Zhejiang University** — Hangzhou, China
  Bachelor of Engineering in Electronic Science and Technology, GPA: 3.72/4.00 — Aug. 2009 – July 2013

Work Experience

- **Millennium Management** — New York, NY
  Data Scientist Intern, Advisor: Prem Melville — June 2021 – Aug. 2021
  - Used NLP techniques on internal conversations and emails for insider trading detection. Implemented various transformer models (Roberta, Albert, Electra, etc.) with Huggingface and AWS. Significantly improved the model performance (precision-recall, recall1, etc).
  - Utilized structured and unstructured hedge funds data to help making investment decisions. Used information extraction, clustering and multi-label classification for generating the criterion for possible rejection reasons.
- **J.P. Morgan** — New York, NY
  AI & ML Summer Associate, Advisor: Virgile Mison — July 2020 – Aug. 2020
  - Collaborated with the Automatic Trading Strategies (ATS) group and used deep learning models to predict the aggregated mid-price in limit order books on Forex data.
  - Generated two sets for feature selection, including VWAP features and raw features. Generated sequential ticks and moving ticks data. Implemented candidate deep learning models, including LSTM, CNN+LSTM, Dilated CNN, Attention and Transformer. Performed a comparison among these models.
  - Significantly improved the model performance in terms of R-square and Sharpe Ratio. Specifically, R square was improved from 0.068 to 0.191. Coded the selected model in Java and integrated into the trading system.
- **Ant Financial, Alibaba Group** — Hangzhou, China
  Research Scientist Intern, Advisor: James Zhang — June 2019 – Aug. 2019
  - Modeled Alipay users' sequential behaviors data with Attentive Exponential Hawkes Network (AEHN). Predicted users' borrowing/payment time and amount, action type, etc. Implemented the model in estimating future cash flow structure for Alipay.

Relative Research Experience & Projects

- **Neural SDEs and PDEs for Option Pricing and Hedging** — Jan. 2019 - Present
  - Integrated neural-network based models to local volatility and stochastic volatility models.
  - Built a faster and more accurate deep learning framework for pricing and hedging European and American options.
  - Explored the delta hedging performance of the Neural SDEs and PDEs on over 100 stock and index options.
- **Deep Learning for Limit Order Books** — Jan. 2017 - Jan. 2019
  - Selected 1200 stocks and preprocessed over 27 TB limit order book data originated from NASDAQ.
  - Designed single-scale and multi-scale Deep CNN and LSTM models for 1 second and 0.1 second dataset. Achieved about 80% conditional accuracy for predicting mid-price movements.
  - Implemented bagging and ensembling for multi-scale LSTM neural networks. Combined over 20 multi-scale LSTMs. Improved conditional accuracy by more than 2%, from 81% to 83% for AMD.

Research Publications in Preparation

- PhD Thesis: ”Machine Learning Methods for Pricing and Hedging Financial Derivatives.”
- Draft: ”Neural SDEs for Option Pricing and Hedging.” (with J. Sirignano)
- Draft: ”Deep Learning for Limit Order Books.” (with J. Sirignano and X. Dong)

Qualifications & Skills

- **Programming** Python, C/C++, SQL, R, MATLAB, MongoDB, Neo4j, Java, PHP, HTML
- **Frameworks** TensorFlow, PyTorch, CUDA, Numpy, Pandas, Sklearn
- **Certifications** AWS Certified Solutions Architect - Associate, AWS Certified Cloud Practitioner