Peilin (Jack) Rao

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EDUCATION

University of California, Los Angeles (UCLA)   **Los Angeles, CA**
Bachelor of Science, Mathematics of Computation & Bachelor of Arts, Economics   *Sep 2022 – Jun 2026*
- **GPA: 3.98**/4.00 (Major), 3.941/4.00 (Cumulative) · **GRE: 336** (V168, Q168; AW3.5)
- **Honors:**
  - **Undergraduate Research Fellows Program (URFP)** (Selected for $3k grant, Winter 2026)
  - **Dean's Honors List** (**All eligible quarters**)
- **Selected Coursework:**
  - **Mathematics & Stats:** Real Analysis I &II, Linear Algebra, Probability Theory, Mathematical Statistics, Complex Analysis, Applied Numerical Methods, Optimization, Machine Learning.
  - **Economics & Finance:** Micro/Macro Theory, Intro/Advanced Econometrics (+Lab), Data Science for Econ (+Lab), Economic Forecasting, Finance (+Lab), Financial Markets (+Lab), Investments (+Lab).
  - **Computer Science:** Data Structures, Computer Organization, Natural Language Processing (NLP).

Nanjing Foreign Language School   **Nanjing, China**
International Baccalaureate (IB) Diploma (Full Marks)   *Graduated Jun 2022*

Publications & Working Papers

Rao, Peilin, and Randall R. Rojas. (2025). "From Prediction to Causal Interpretation: A DML Case Study in Financial Economics."
Proceedings of the NeurIPS 2025 Workshop on Causal Inference for Scientific Discovery (CauScien).
(**Extended version working paper**: "Market Troughs as Bifurcation Events: A Liquidity Spiral Framework and Empirical Validation")

Rao, Peilin. (2025). "The GNN as a Low-Pass Filter: A Spectral Perspective on Achieving Stability in Neural PDE Solvers."
Proceedings of the NeurIPS 2025 Workshop on New Perspectives in Graph Machine Learning (NPGML).

RESEARCH EXPERIENCE

Research Assistant, Computational Economics   **Remote (CUHK)**
Advisor: Prof. Ji Huang   *Jul 2025 – Present*
- Developed a JAX framework to solve for the farsighted equilibrium in a computationally intractable dynamic model of network formation and collective action in continuous time and discrete state.
- Made the governing local Hamilton-Jacobi-Bellman (HJB) loss equation tractable by architecting a vectorized training loop to evaluate all counterfactual states in a single pass.
- Improved model stability and convergence by designing a ResNet value function approximator that isolates the learned farsighted correction from the analytical myopic payoff.
- Engineered an importance-weighted Bellman error loss function to accelerate convergence by prioritizing training on strategically critical game states.

Research Assistant, Labor & Trade Economics   **Remote (Southeast University)**
Advisor: Prof. Xin Gu   *Jan 2024 – Present*
- Conducted literature reviews on the causal effects of trade policy on labor market outcomes, synthesizing findings from over 20 academic papers weekly.
- Performed empirical analysis using Python, implementing multilinear regression and Difference-in-Differences (DiD) models to test economic hypotheses.
- Presented and led weekly discussions on recent research papers from top-tier economics journals.

Research Mentorship on SPAC Viability   **Remote (University of Auckland)**
Advisor: Dr. Yeguang Chi   *Jul 2024 – Feb 2025*
- Investigated the viability of Special Purpose Acquisition Companies (SPACs) by collecting historical IPO and merger data from Capital IQ and formulating an initial microfoundational model for SPAC legitimacy.
- Concluded project after identifying critical limitations in data availability, honing ability to assess research feasibility and the importance of deep institutional knowledge.

Teaching Experience

Reader (Teaching Assistant)   **UCLA**
Department of Economics   *Sep 2025 – Present*
- Course: Econ 144: Economic Forecasting (Instructor: Prof. Randall R. Rojas).

ACADEMIC PROJECTS

AI Language Detector   **UCLA**
Course: Natural Language Processing   *Spring 2025*
- Developed a deep learning model to differentiate between AI-generated and human-written text by engineering features using semantic embeddings (Sentence-BERT) and stylometric analysis.
- Implemented and trained a Transformer-based architecture in PyTorch, achieving 0.90 AUC and 85% accuracy on a held-out test set.

Pet Image Segmentation   **UCLA**
Course: Machine Learning (Grade: A+)   *Winter 2025*
- Led a team of four to build and train a U-Net, a convolutional neural network (CNN) architecture, for semantic segmentation of pets in images from the Oxford-IIIT Pet Dataset.
- Implemented the full model pipeline in PyTorch, including data preprocessing, augmentation, and training.

TECHNICAL SKILLS

Computational & ML Methods: Dynamic Programming (HJB), Graph Neural Networks, Deep Learning Theory, Vectorized Computing (JAX).
Econometric & Causal Inference: Double/Debiased Machine Learning (DML), Time Series Analysis (GARCH, State-Space Models, MiniRocket), Panel Data Methods (DiD), Bayesian Econometrics.
Programming Languages: Python (4 yrs; NumPy, Pandas, PyTorch, JAX), R (3 yrs), C++ (3 yrs), Matlab (1 yr).
Data &Software: Capital IQ, FRED, CBOE, Databento (Options & Futures), LaTeX.
Languages: Mandarin (Native), English (Fluent).

LEADERSHIP EXPERIENCE

Financial Investment and Technology (FIT)   **UCLA**
UCLA's student-run quantitative finance and investment group
Vice President / Director of Data   *Mar 2024 – Present*
- Pioneered a departmental restructuring by separating the Data and Fund teams to enhance operational specialization and manage member workload, improving project focus and output quality.
- Designed and launched a novel research workshop modeled after academic conferences to foster independent inquiry, where members pitch, develop, and present research posters on quantitative topics.
- Mentor a team of three student analysts in applying machine learning to finance; oversee all member projects to ensure methodological rigor, addressing pitfalls like data leakage and non-stationarity.
- Developed a quantitative trading model and a robust backtesting pipeline, demonstrating a 12.6% CAGR (vs. 6.01% benchmark) and validated through out-of-sample and sensitivity analysis.