# 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), 3.95/4.00 (Cumulative) · **GRE: 336** (V168, Q168; AW3.5)
- **Honors: 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*                                                          *Graduated Jun 2022*
- IB Score: 42/42 (Full Marks)

## Publications & Working Papers

**Rao, Peilin, and Randall R. Rojas. (2025). "From Prediction to Causal Interpretation: A DML Case Study in Financial Economics."**
*To appear in 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."**
*To appear in Proceedings of the NeurIPS 2025 Workshop on New Perspectives in Graph Machine Learning (NPGML).*

## RESEARCH PROPOSAL

**Rao, Peilin (2025). "A Bayesian HJB Framework for Robust Monetary Policy under Structural Uncertainty"**
- Develops a tractable, adaptive monetary policy framework in continuous time by solving the Bayesian HJB dual control problem (stabilization vs. learning) using Deep BSDE methods.

## 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*
*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.