# Yunian Pan

Curriculum Vitae

unionpan.github.io | pyn950@gmail.com | linkedin.com/in/unionpan | github.com/UnionPan | (646) 404-1857

## EDUCATION

**New York University (NYU)** *Sep. 2021 – May 2026*

Ph.D. in Electrical Engineering

Dissertation: *The Variational Foundations of Multi-Agent Learning: A Unified Theory on Non-Equilibrium Learning Dynamics in Cyber-Physical Systems*

Advisor: Quanyan Zhu; Committee: Elza Erkip and Sundeep Rangan

**New York University (NYU)** *Sep. 2018 – May 2020*

M.Sc. in Electrical Engineering

Thesis: *Urban Vaccination Site Coverage via Semi-Discrete Optimal Transport*

**Beijing University of Posts and Telecommunications (BUPT)** *Aug. 2014 – Jul. 2018*

B.Eng. in Communication Engineering

## WORK EXPERIENCE

**Research Scientist - Reinforcement Learning** *Oct. 2026 – Present*

*L2 Labs* *New York, NY*

- Develop multi-scale forecasting and anomaly-detection models for EDI integration using Bayesian inference, latent business-cycle modeling, and document-level features over 500,000+ historical transaction sets across trading partners.
- Fine-tune and benchmark natural-language query agents for MongoDB/PostgreSQL; develop online fine-tuning methods for ERP-to-X12 schema matching using reinforcement learning with feedback from EDI specialists.

**Graduate Research and Teaching Assistant** *2019 – 2026*

*New York University, Laboratory for Agile and Resilient Complex Systems* *New York, NY*

- Conducted research in multi-agent learning, stochastic and adversarial optimization, reinforcement learning, and resilient AI, with applications to network games, federated learning, transportation, cybersecurity, and market systems.
- Developed variational analyses and computational methods for learning under strategic interaction, partial information, non-stationarity, and adversarial manipulation.

**Research Assistant** *Sep. 2024 – Sep. 2025*

*NXP Semiconductors* *San Jose, CA*

- First-authored *A Game-Theoretic Approach for High-Resolution Automotive FMCW Radar Interference Avoidance* (IEEE International Radar Conference 2025) and the journal extension *Decentralized No-Regret Frequency-Time Scheduling for FMCW Radar Interference Avoidance*.
- Built and evaluated a vectorized 77 GHz multi-radar simulator and decentralized frequency-time scheduling policies, reaching near-zero interference within 76.8–92.1 ms and 10–15 dB SINR gains over random and conventional hopping baselines.

**Research Assistant** *Jun. 2024 – Aug. 2024*

*Augur Labs LLC* *New York, NY*

- Built spline yield curves and macroeconomic nowcasts across 36 sovereign markets; prototyped reinforcement-learning portfolio allocation against Markowitz and risk-parity baselines under rolling and stress-test evaluation.

## PUBLICATIONS

### Journal Articles

1. **Decentralized No-Regret Frequency-Time Scheduling for FMCW Radar Interference Avoidance** [arXiv]
   Y. Pan, J. Li, L. Xu, S. Sun, and Q. Zhu
   *IEEE Transactions on Aerospace and Electronic Systems*, 2026
2. **A Games-in-Games Paradigm for Strategic Hybrid Jump-Diffusions: Hamilton–Jacobi–Isaacs Hierarchy and Spectral Structure** [arXiv]
   Y. Pan and Q. Zhu
   *Nonlinear Analysis: Hybrid Systems*, 2026

3. **A Unified Variational Design of Predictive Mirror Descent in Convex Games under Stochastic Feedback** [arXiv]
   Y. Pan, T. Li, and Q. Zhu
   *IEEE Control Systems Letters*, 2026

4. **Model-Agnostic Hessian-Free Meta-Policy Optimization via Zeroth-Order Estimation: A Linear Quadratic Regulator Perspective** [DOI]
   Y. Pan, T. Li, and Q. Zhu
   *Dynamic Games and Applications*, 2025

**Peer-Reviewed Conference and Workshop Papers**

1. **Timing-Aware Two-Player Stochastic Games with Self-Triggered Control** [arXiv]
   Y. Pan and Q. Zhu
   *23rd IFAC World Congress*, 2026

2. **Bayesian Holonic Systems: Equilibrium, Uniqueness, and Computation** [arXiv]
   Y. Pan and Q. Zhu
   *2026 American Control Conference (ACC)*, 2026

3. **Preference-Centric Route Recommendation: Equilibrium, Learning, and Provable Efficiency** [arXiv]
   Y.-T. Yang, Y. Pan, and Q. Zhu
   *2026 IEEE 65th Conference on Decision and Control (CDC)*, 2026

4. **A Game-Theoretic Approach for High-Resolution Automotive FMCW Radar Interference Avoidance** [arXiv]
   Y. Pan, J. Li, L. Xu, S. Sun, and Q. Zhu
   *2025 IEEE International Radar Conference (RADAR)*, 2025

5. **Extending No-Regret Hopping in FMCW Radar Interference Avoidance** [DOI]
   Y. Pan and Q. Zhu
   *MAthematical Performance Modeling and Analysis (MAMA), ACM SIGMETRICS*, 2025, vol. 53(2), pp. 131–133

6. **On the Variational Interpretation of Mirror Play in Monotone Games** [DOI]
   Y. Pan, T. Li, and Q. Zhu
   *2024 IEEE 63rd Conference on Decision and Control (CDC)*, 2024, pp. 6799–6804

7. **Is Stochastic Mirror Descent Vulnerable to Adversarial Delay Attacks? A Traffic Assignment Resilience Study** [DOI]
   Y. Pan, T. Li, and Q. Zhu
   *2023 62nd IEEE Conference on Decision and Control (CDC)*, 2023, pp. 8328–8333

8. **On the Resilience of Traffic Networks under Non-Equilibrium Learning** [DOI]
   Y. Pan, T. Li, and Q. Zhu
   *2023 American Control Conference (ACC)*, 2023, pp. 3484–3489

9. **A First Order Meta Stackelberg Method for Robust Federated Learning** [link]
   Y. Pan, T. Li, H. Li, T. Xu, Q. Zhu, and Z. Zheng
   *ICML Workshop on New Frontiers in Adversarial Machine Learning*, 2023

10. **On Poisoned Wardrop Equilibrium in Congestion Games** [DOI]
    Y. Pan and Q. Zhu
    *Decision and Game Theory for Security (GameSec)*, 2022, pp. 191–211, Best Paper Award

11. **Efficient Episodic Learning of Nonstationary and Unknown Zero-Sum Games Using Expert Game Ensembles**
    Y. Pan and Q. Zhu
    *2021 60th IEEE Conference on Decision and Control (CDC)*, 2021, pp. 1669–1676

12. **MASAGE: Model-Agnostic Sequential and Adaptive Game Estimation**
    Y. Pan, G. Peng, J. Chen, and Q. Zhu
    *Decision and Game Theory for Security (GameSec)*, 2020, pp. 365–384

**Book Chapters**

1. **From Texts to Shields: Convergence of Large Language Models and Cybersecurity** [arXiv]
   T. Li, Y.-T. Yang, Y. Pan, and Q. Zhu
   Book chapter, 2025

2. **Decision-Dominant Strategic Defense against Lateral Movement for 5G Zero-Trust Multi-Domain Networks**
   T. Li, Y. Pan, and Q. Zhu
   *Network Security Empowered by Artificial Intelligence*, 2024, pp. 25–76

## PERSONAL PROJECTS

### Deep Hedging with Counterfactual Market Simulation *2025 – 2026*

- Built a vectorized JAX testbed spanning 27 derivative classes, 21 parametric dynamics, and signature/VAE generators; generated arbitrage-consistent derivative-chain trajectories with JIT-parallel pricing.
- Developed calibration and simulation pipelines for 1,000+ U.S. equities and trained actor-critic hedging policies with Transformer/VAE information states under transaction costs, liquidity stress, and model shift.

### Equity Forecasting and Adaptive Portfolio Allocation *2026 – Present*

- Developing multi-horizon equity return and volatility models using cross-sectional pooling, market/sector features, and nonlinear predictors; benchmarking against econometric baselines with purged walk-forward evaluation.
- Investigating estimation uncertainty and transaction costs in portfolio construction, comparing adaptive allocation and constrained optimization through realized risk, turnover, and net performance.

### Multimodal Temporal Representation Pretraining for Autonomous Driving *2026*

- Built a PyTorch multimodal-pretraining system over 12,522 training and 2,682 held-out six-camera nuScenes clips, adapting DINOv2, a temporal Transformer, and DistilBERT through video-text, masked-temporal, and ego-motion objectives.
- Ablated objectives, context, camera coverage, encoder adaptation, and kinematic priors; best configurations reached a video-to-text median rank of 49/2,682, 0.79 pedestrian-probe accuracy, and 1.22 m motion ADE.

### Semantic Quote Reconciliation for Prediction Markets *2026*

- Developed structural and semantic relation discovery with SentenceTransformer/FAISS retrieval and confidence/liquidity-weighted convex projection over 1,226 live Polymarket markets.
- Evaluated semantic exclusion detection on 9,058 structurally labeled pairs and reconciled 1,115 live constraints, reducing aggregate violation from 0.477 to numerical zero with millisecond-scale projection.

## TEACHING AND MENTORING

**Graduate Teaching Assistant and Research Mentor** *2019 – 2026*
*New York University, Department of Electrical and Computer Engineering* *New York, NY*

- Mentored graduate students in optimization, probability, game theory, and reinforcement learning through coursework and research projects.
- Supported projects in traffic-equilibrium resilience, LLM red-teaming, and cooperative-game-theoretic agent orchestration.

## HONORS AND AWARDS

*2023* **Dante Youla Award for Graduate Research Excellence**, New York University Tandon School of Engineering.
*2022* **Best Paper Award**, Conference on Decision and Game Theory for Security (GameSec).
*2020* **Merit Award for Outstanding Academic Performance**, NYU Department of Electrical and Computer Engineering.

## SELECTED PRESENTATIONS

*2025* **INFORMS Annual Meeting**, *Computational Foundations of Multi-Agent Learning*, Atlanta, GA.
*2025* **IEEE Conference on Decision and Control**, invited session on *Bounded Rationality in Human–AI Decision-Making*, Rio de Janeiro, Brazil.
*2025* **IEEE International Radar Conference**, session on *Automotive Radar Principles and Challenges*, Atlanta, GA.
*2024* **IEEE Conference on Decision and Control**, session on *Networks, Games, and Learning II*, Milan, Italy.
*2024* **SIAM Conference on Mathematics of Data Science**, Atlanta, GA.
*2023* **American Control Conference**, session on *Resiliency and Privacy in Networked Cyber-Physical Systems*, San Diego, CA.

## ACADEMIC SERVICE

*2025* **Technical Session Chair**, IEEE International Radar Conference.

*2025* **Session Co-Organizer**, *Digital Twin-Based Driver Risk-Aware Intelligent Mobility Analytics for Urban Transportation Management*.

*2022 – 2025* **Peer Reviewer**: *Automatica*; IEEE Control Systems Letters; *Annual Reviews in Control*; IEEE CDC; IEEE ACC; IEEE INFOCOM; IEEE TNSM; IEEE International Radar Conference; IFAC World Congress; and *Dynamic Games and Applications*.

## TECHNICAL SKILLS

*Methods* Probability and stochastic calculus; Bayesian inference; convex and stochastic optimization; algorithmic game theory; optimal control; reinforcement learning; bandits; variational methods; Kalman and particle filtering.

*Computing* Python; PyTorch; JAX/Flax/Optax; MATLAB; R; SQL; CVXPY; Git; Linux; Docker; PostgreSQL; AWS/GCP; Slurm; LaTeX.