Juan A. Serratos

Contact Information

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Education

University of Pennsylvania, Philadelphia, USA
Ph.D. in Mathematics
Advised by Florian Pop
December 2028 (expected)

University of Southern California (USC), Los Angeles, USA
B.A. in Mathematics, May 2024

Honors and Awards

Graduate Fellowship, University of Pennsylvania
Research Fellowship, Computer Science and Artificial Intelligence Laboratory, MIT
Departmental Honors in Mathematics, USC
Magna Cum Laude, USC

Employment and Experience

Goldman Sachs — New York, NY
Incoming Quantitative Strategist Intern — June 2025 – August 2025

- Expected to develop and optimize quantitative models to support trading strategies in the Synthetic Product Group (SPG), Equities.
- Anticipated focus on developing risk analytics and optimization tools to enhance trading desk risk management and profitability.
- Will collaborate with traders, quants, and engineers to refine risk measurement methodologies and capital efficiency strategies.

University of Southern California — Los Angeles, CA
Teaching and Managing Assistant — August 2023 – May 2024

- Managed a large mathematics tutoring center with 50 teaching assistants and 500+ students involved per week, overseeing both in-person and online tutoring.
- Tutored/TA'd core mathematics USC courses, including probability, calculus 1-3, differential equations, linear algebra, real analysis, topology, and abstract algebra.

Research

Massachusetts Institute of Technology (MIT) — Cambridge, MA
(Machine Learning) Research Intern — July 2024 – August 2024

- Evaluated and compared various machine learning models in generative geometry AI, integrating statistical learning techniques to optimize loss functions and architectures. Reviewed cutting-edge research to implement innovative modifications of the ambient computation space, lowering training time and costs. Project completed under the mentorship of `BackflipAI`.
- Further developed an existing deformable Graph2NeRF architecture, using Graph Convolutional Networks (GCNs) for color feature aggregation and deformation fields for spatial transformation, synthesizing 3D head models for facial expression analysis.
- Implemented BD-Tree algorithm based on work of James and Pai for efficient collision detection in reduced deformable models, achieving performance comparable to rigid objects in real-time and complex simulations.

National Security Agency (NSA) — Los Angeles, CA
Mathematics Research Intern — June 2023 – August 2023

- Selected as 1 of 6 research fellows in a 10-week research project in mathematics, focused on a problem in theoretical computer science at Occidental College. Fully funded by the NSA.
- Conducted original research in (algebraic) coding theory, utilizing algebraic number theory to prove new theorems that provide significant evidence towards resolving a key problem in theoretical computer science.
- Drafted and implemented a computational method to count the number of solutions to specific Diophantine equations.
- Our paper was accepted for presentation at JMM 2024 and is currently being prepared for publication.

University of Southern California Los Angeles, CA
Undergraduate Researcher August 2022 – Dec. 2022,
August 2023 – Dec. 2023

- Semester-long directed research project with Anne Dranowski focusing on representation theory, an introduction to the geometric Langlands program, Galois representations, and perverse sheaves. Final project focused on Fontaine's p-adic period ring B_{dR}.
- Semester-long directed research project with Aravind Asok studying the modern algebraic geometry required for the Weil Conjectures and étale cohomology.

Projects

Hierarchical Reinforcement Learning System for Multi-Asset Portfolio Optimization

- Designed and implemented a hierarchical deep RL portfolio optimization framework with dual-stream transformer architecture, formulating the problem as a POMDP with two-level action decomposition (strategic asset class/tactical security selection)
- Engineered composite reward function and developed specialized hierarchical PPO algorithm with off-policy correction, reducing exploration complexity from $\mathcal{O}(N)$ to $\mathcal{O}(\sqrt{N})$ and achieving 62% faster convergence than traditional approaches
- Achieved good risk-adjusted performance metrics in out-of-sample testing: Sharpe ratio of 1.5+, Sortino ratio of 2.40, Calmar ratio of 1.70, with maximum drawdown limited to 25.9% and 95% CVaR of -3.74%

ML and NLP for Oil & Gas Market Prediction

- Scraped a big data set of oil and gas news articles and fine-tuned FinBERT for sentiment analysis, integrating sentiment scores with technical indicators to build an XGBoost classifier. Developed portfolio optimization strategies using Mean-Variance Optimization to enhance the classifier-based trading model, resulting in a 12% improvement in risk-adjusted returns.
- Implemented Brent crude trading strategies based on the XGBoost model, incorporating portfolio optimization techniques that achieved a high Sharpe ratio while backtesting.

Papers

Lattices and their associated theta series for linear codes defined over $\mathbf{F}_8$, Jim Brown, Juan Serratos, Uma Tikekar, Johnthan Webb

On the prime spectrum of the p-adic integer polynomial ring with a depiction, Juan Serratos, `arXiv:2304.03523`

Talks

Algebraic Curves: Genus and Diophantine Geometry, July 2023.
Occidental College

Childrens pictures of Spec A, June 2023.
Occidental College

Étale Cohomology, as motivated by the Weil Conjectures, December 2022.
University of Southern California

Arithmetic Schemes: David Mumford's depiction of Spec $\mathbb{Z}[T]$, May 2022.
University of Southern California

Technologies

Python, SQL, Sage, HTML/CSS, LaTeX, Excel, MS Office, PowerPoint