Matias Alvo

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I am a fifth-year Ph.D. student in the Decision, Risk, and Operations division at Columbia Business School, focusing on sequential decision-making and reinforcement learning, with a particular interest in developing deep RL applications for operations problems. In 2013, I achieved the highest nationwide score in Chile's standardized university admission tests, out of over 270,000 test-takers.

Education

Columbia Business School (DRO Division)
Ph.D. candidate in Decision, Risk and Operations. GPA 9.92/10.   *2021 – 2026 (Expected)*
○ **Honors:** Columbia GSB Doctoral Fellowship, Paul and Sandra Montrone Fellowship, Deming Doctoral Fellowship.
○ **Teaching Assistant:** Foundations of Stochastic Modeling (Ph.D.), Managerial Statistics (MBA).
○ **Coursework:** Dynamic Programming, Machine Learning, Reinforcement Learning with Human Feedback, Stochastic Modeling, Optimization.

Pontificia Universidad Católica de Chile (PUC)
Industrial Engineering Professional Title with a Mathematical Engineering Diploma. Ranked in the top 8%.   *2013 – 2018*
○ **Additional degrees:** B.S. in Operations Research, Minor in Programming.
○ **Honors:** Beca PSU (Full scholarship for the top score nationwide in the standardized university admission tests).

Publications and Submissions

Deep Reinforcement Learning for Inventory Networks: Toward Reliable Policy Optimization (with Yash Kanoria and Dan Russo). *RL4SN workshop, 2024. Amazon NYRL workshop, 2025. Submitted for journal publication.* **[PAPER] [REPO]**
○ We explore the reliable use of deep RL in inventory control and study Hindsight Differentiable Policy Optimization, which uses stochastic gradient descent to optimize policy performance without requiring repeated deployment of randomized policies.
○ We outperform SOTA model-free RL algorithms by up to 6.7% and common heuristics by up to 22% on problems with real data.
○ We propose a Graph Neural Network architecture, reducing the number of required samples by up to 64 times.

An Exact Solution Approach for an Electric Bus Dispatch Problem (with Mathias Klapp and Gustavo Angulo). *Transportation Research Part E: Logistics and Transportation Review.* **[PAPER]**
○ We propose a two-stage decomposition approach to plan the dispatch operations of an electric bus fleet, considering energy and time constraints due to limited battery ranges and charging times.
○ Can optimally solve problems over 10 times larger than a direct approach (up to 250 trips and 27 buses).

Additional Research Experience

Hybrid Policy Optimization in Discontinuous MDPs: Combining Pathwise and Model-Free Gradient Estimators. **[REPO]**
○ We combine differentiable simulation with model-free RL methods (e.g., PPO) to efficiently solve discontinuous MDPs.
On the shortcomings of Lagrangian-based policies for weakly-coupled RL (with Dan Russo and Yash Kanoria).
○ We study a class of multi-agent problems where each agent operates within its own sub-MDP but is coupled by an aggregate action constraint. We highlight the limitations of policies that 'price' shared resources for coordination among agents.
An Integrated Bin-Packing and Aircraft Routing Approach for Air Cargo Operation: Mathematical Modeling, Insights, and Challenges (*with Alessandro Bombelli, Felipe Delgado, Gustavo Angulo and Bruno F. Santos*).
○ We propose matheuristics to solve a problem considering aircraft routing, Unit Load Device (ULD) routing, and cargo assignment.

Professional Experience

Research Scientist Intern
Etsy   *June 2025 – September 2025*
Improved ad ranking for marketplace auction system. Field experiments showed 1.2% increase in expected value of impressed listings.

Applied Scientist Intern
Amazon   *June 2023 – September 2023*
Developed deep RL algorithms to optimize inventory management and fulfillment decisions.

Associate
Boston Consulting Group   *June 2019 – December 2019*
Developed management consulting projects for major companies in the banking and energy sectors.

Additional Information

Programming Skills: Advanced programming skills in Python, with extensive experience using PyTorch, NumPy, Pandas, and Gurobi in research projects. Familiarity with Scikit-learn and Keras. Extensive experience with LaTeX.
Languages: Spanish (native) and English (bilingual proficiency; TOEFL score: 108/120).