

# Nicolás Astorga

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| Cambridge, UK

I'm a PhD researcher focusing on enhancing the reasoning capabilities of LLMs through post-training techniques. Initially, my doctoral work specialized in the intersection of LLMs with Bayesian experimental design and optimization. My research contributions have been published in leading conferences, including NeurIPS, ICML, ICLR (Spotlight), ECCV, and AISTATS.

## Education

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### University of Cambridge

Cambridge, United Kingdom

#### PH.D. IN MACHINE LEARNING

04/2023 – Present

- Research focus: Reasoning, Bayesian experimental design, and optimisation in the context of LLMs.
- Supervisor: Prof. Mihaela van der Schaar · Expected graduation 2027
- Fully-funded studentship: W.D. Armstrong Trust Fund award.

### University of Chile

Santiago, Chile

#### DUAL M.Sc. – ELECTRICAL ENGINEERING; COMPUTER SCIENCE

2020 – 2023

- EE (2020–2021): *Generative-Inference Models: Theory and Applications*
- CS (2022–2023): *Classification of Astronomical Objects*
- Coursework emphasis: Generative Models, Variational Inference, Information Theory.
- Ranked 1st out of 22 in EE MSc; Awarded ANID National Master's Scholarship (top ~10%) for CS MSc.

### University of Chile

Santiago, Chile

#### B.Sc. THREE MAJOR – COMPUTER, ELECTRICAL & MECHANICAL ENGINEERING

2013 – 2019

- Outstanding student (top 7 %).

### University of Chile

Santiago, Chile

#### P.E. – ELECTRICAL ENGINEERING

2021

- Professional Engineer (top 10%) accreditation enabling independent practice.

## Professional Experience

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### ALeRCE – Automatic Learning for the Rapid Classification of Events

Santiago, Chile

#### MACHINE LEARNING ENGINEER

02/2022 – 04/2023

- Deployed production-grade ML models via Kubernetes to classify LSST astronomical alerts in real time
- Built distributed PySpark pipelines to curate >30 M light-curve observations from multiple catalogues
- Collaborated in the international ELAsTiCC challenge, proposing and deploying a Transformer-based model for tabular data and time-series, resulting in a publication accepted by *Astronomy & Astrophysics*.

### Harvard University – Institute for Applied Computational Science

Cambridge, MA, USA

#### RESEARCH INTERN

01/2019 – 08/2019

- Proposed MPCC, a GAN-VAE hybrid clustering framework (ECCV 2020), which leverages forward KL divergence and extends the BigGAN implementation.

### University of Chile – Lab. of Computational Intelligence

Santiago, Chile

#### RESEARCH ASSISTANT

03/2016 – 04/2023

- Developed a clustering method based on VAE for astronomical transient detection (IJCNN 2018)
- Integrated normalising flows into variational embeddings, improving ELBO  $\geq 10\%$
- Achieved fully supervised performance using Gaussian processes in a semi-supervised setting with only 10% labeled data.

## Recent research

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- **Reasoning at scale:** Currently working on synthetic data framework to improve reasoning capabilities of LLMs via a curriculum-style pipeline.
- **Autoformulation (ICML 2025)** Integrated MCTS with LLMs for automated formulation of optimization-modeling problems.
- **Efficient Q&A with LLMs (ICLR 2025):** Implemented active task-disambiguation in LLMs using BED acquisition metrics.
- **LLMs for acquisition of features and labels (NeurIPS 2024):** Combined LLMs within an active-learning framework for joint acquisition of labels and features, using LLMs as surrogate models for data generation trained with SFT.
- **LLMs and BO (ICLR 2024):** Contributed to LLAMBO, a technique leveraging LLMs to improve Bayesian optimization.

## Skills

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**Programming & DevOps:** Python, C, C++, Java, Kubernetes, Docker, GitHub Actions, Terraform

**ML Frameworks:** PyTorch, Verl, TensorFlow, scikit-learn, matplotlib

## Conference Publications

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- N. Astorga\***, T. Liu\*, Y. Xiao, M. van der Schaar (2025). *Auto-formulation of Mathematical Optimisation Models Using Large Language Models*. 42nd International Conference on Machine Learning (ICML) \*Equal contribution.
- N. Astorga\***, K. Kobalczyk\*, T. Liu, M. van der Schaar (2025). *Active Task Disambiguation with Large Language Models*. 13th International Conference on Learning Representations (ICLR, Spotlight) \*Equal contribution.
- N. Astorga**, T. Liu, N. Seedat, M. van der Schaar (2024). *Active Learning with LLMs for Partially Observed and Cost-Aware Scenarios*. The Thirty-Eighth Annual Conference on Neural Information Processing Systems (NeurIPS).
- N. Astorga\***, T. Liu\*, N. Seedat, M. van der Schaar (2024). *Large Language Models to Enhance Bayesian Optimisation*. International Conference on Learning Representations (ICLR) \*Equal contribution.
- S. Ruhrberg, **N. Astorga**, M. van der Schaar (2025). *Timely Clinical Diagnosis through Active Test Selection*. The Thirty-Ninth Annual Conference on Neural Information Processing Systems (NeurIPS).
- H. Amad, **N. Astorga**, M. van der Schaar (2025). *Continuously Updating Digital Twins Using Large Language Models*. 28th International Conference on Artificial Intelligence and Statistics (AISTATS).
- J. Piskorz, **N. Astorga**, J. Berrevoets, M. van der Schaar (2025). *Active Feature Acquisition for Personalised Treatment Assignment*. 42nd International Conference on Machine Learning (ICML).
- N. Astorga**, P. Huijse, P. Protopapas, P. Estévez (2020). *MPCC: Matching Priors and Conditionals for Clustering*. European Conference on Computer Vision (ECCV), Glasgow.
- N. Astorga**, P. Huijse, P. A. Estévez, F. Förster (2018). *Clustering of Astronomical Transient Candidates Using Deep Variational Embedding*. International Joint Conference on Neural Networks (IJCNN), Rio de Janeiro.
- N. Astorga**, E. López, V. Meruane (2018). *Computer Vision for Structural Damage Quantification: A Novel Residual Deep Learning Based Approach*. European Safety and Reliability Conference (ESREL).
- L. Guarda, **N. Astorga**, E. Droguett, M. Moura, M. R. Martins (2018). *Drowsiness Detection Using Electroencephalography Signals: A Deep Learning Based Model*. Probabilistic Safety Assessment & Management (PSAM).

## Journal Publications

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- G. Cabrera-Vives, D. Moreno-Cartagena, **N. Astorga**, I. Reyes-Jainaga, et al. (2024). *ATAT: Astronomical Transformer for Time Series and Tabular Data*. Astronomy & Astrophysics.
- M. Pérez-Carrasco, G. Cabrera-Vives, L. Hernández-García, F. Förster, ..., **N. Astorga**, et al. (2023). *Alert Classification for the ALeRCE Broker System: The Anomaly Detector*. The Astronomical Journal.
- F. Förster, G. Cabrera-Vives, E. Castillo-Navarrete, P. A. Estévez, ..., **N. Astorga**, et al. (2021). *The Automatic Learning for the Rapid Classification of Events (ALeRCE) Alert Broker*. The Astronomical Journal.
- C. Modarres, **N. Astorga**, E. Droguett, V. Meruane (2018). *Convolutional Neural Networks for Automated Damage Recognition and Damage Type Identification*. Structural Control and Health Monitoring.

## Workshop Publications

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- H. Sun, T. Pouplin, **N. Astorga**, T. Liu, M. van der Schaar (2024). *Improving LLM Generation with Inverse and Forward Alignment: Reward Modelling, Prompting, Fine-Tuning, and Inference-Time Optimisation*. NeurIPS 2024 Workshop on System-2 Reasoning at Scale.