

# Sergio Calvo Ordoñez

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## EDUCATION

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- **University of Oxford** Oxford, UK  
*DPhil in Mathematics - Machine Learning for Quantitative Finance* September 2023 - September 2026  
- **Funded by:** Oxford-Man Institute Scholarship through the CDT in Mathematics of Random Systems.  
- **Supervised by:** Prof Álvaro Cartea and Dr Mihai Cucuringu.  
- **PhD-Level Modules:** Advanced topics in Stochastic Processes and Stochastic Analysis, Stochastic Algorithms, High-frequency Trading, Random Matrix Theory, Deep Learning.
- **University of Cambridge** Cambridge, UK  
*MPhil in Machine Learning and Machine Intelligence; Grade: 74%* October 2022 - September 2023  
- **Dissertation topic:** Breaking the Limits of Diffusion Models via Continuous Dynamical Systems.  
\*Achieved a high distinction in my dissertation as well as two publications under review.  
- **Supervised by:** Prof Carola Bibiane Schönlieb and Dr Angélica Áviles-Rivero.  
- **Relevant Modules:** Advanced ML (A), Probabilistic ML (A), Reinforcement Learning (A), Advanced Robotics (A)
- **Queen Mary University of London** London, UK  
*BSc in Theoretical Physics; Grade: 88.4% (class rank 3/~200 students)* September 2019 - June 2022  
- **Dissertation topic:** Study of Generative Machine Learning methods for Particle Physics.  
- **Supervised by:** Prof Adrian Bevan.  
- **Relevant Modules:** Statistical Data Analysis (94.5%), Mathematics III (89.6%), Machine Learning (80.5%).

## PUBLICATIONS

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1. **Sergio Calvo-Ordoñez**, Jiahao Huang, Lipei Zhang, Guang Yang, Carola-Bibiane Schönlieb, Angelica I Aviles-Rivero. (2023). *Beyond U: A Faster & Lighter Diffusion Model*. Accepted at the NeurIPS 2023 Workshop on Diffusion Models.
2. **Sergio Calvo-Ordoñez**, Jiahao Huang, Lipei Zhang, Chun-Wun Cheng, Guang Yang, Carola-Bibiane Schönlieb, Angelica I Aviles-Rivero. (2023). *The Missing U for Faster, Smarter & Lighter Diffusion Models*. Submitted to Transactions on Machine Learning Research (TMLR). [**Status: Under Review**]

## EXPERIENCE

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- **Meta - Facebook** London, UK  
*AI Resident - Offer Holder* September 2023 - Cancelled
  - Received an offer for the competitive Meta AI Residency program. The program was cancelled due to a hiring freeze.
- **University of Cambridge** Cambridge, UK  
*Research Assistant* December 2022 - June 2023
  - Worked on an AI safety paper focusing on defining evaluation metrics for automated interpretability tools and developing an automated framework for the interpretability of large models.
  - The team consisted of 6 MPhil and 2 PhD students supervised by Dr David Krueger at the Computational and Biological Learning Lab (CBL) in the Machine Learning Group.
- **Moscow Institute of Physics and Technology (MIPT)** Remote  
*Research Assistant* December 2022 - February 2023
  - Collaborated with the Department of Machine Learning and Digital Humanities. Studying innovative Computer Vision solutions to apply in industrial settings and applied research.
- **BAE Systems** Bristol, UK  
*Research Engineer Intern* June 2022 - September 2022
  - Researched Neural Radiance Fields (NeRF) for representing complex scenes, generating novel views, and determining their suitability to the field of systems and control.
  - Explored the use of NeRF for online state updates in autonomous systems inside the same environment used for training.

- **Queen Mary University of London** London, UK  
*Research Assistant* *May 2022 - September 2022*

  - Carried out a theoretical analysis of a novel treatment of the Bayesian updating process in statistical inference as a continuous dynamical system to predict a function that governs the learning rate in terms of a time-like variable that denotes the quantity of data.
  - Built and tested models such as ResNet, different CNN architectures, and RNNs between others to compare the qualitative behaviour exhibited by Bayesian flows to the training of these NNs on benchmarked datasets.
- **Virtus Scientific Proofreading** London, UK  
*Machine Learning Consultant* *October 2021 - April 2022*

  - Reviewed and proofread scientific papers in the field of AI ensuring the quality of the technicalities together with the underlying mathematics.
  - The topics of these papers vary from computer vision to machine learning methods for signal processing and applications.
- **Redoptima** London, UK  
*Machine Learning and Data Engineer Intern* *August 2021 - October 2021*

  - Focused on the validation process of the output data, coming from a CNN state-of-the-art model against manually gathered data, aiming to solve computer vision problems and provide insights. These processes are direct, at scale, and in production.
  - Implemented UNet CNN model for image segmentation managing to increase the company's coverage by 30%.
- **TruLife Optics** London, UK  
*Data Scientist Intern* *May 2021 - August 2021*

  - Engineered a Python program that carries factory checks in an image processing project and deployed it internally within the company using Streamlit and Anvil.
  - Utilised packages such as Skimage, Pillow, Matplotlib, and OpenCV to develop a data pipeline that classifies hologram images with 92% accuracy.
  - This project increased the company's productivity by approximately 60% in projects involving holograms.

## SKILLS SUMMARY

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- **Programming Languages:** Python, R, SQL, Matlab, Unix.
- **Tools:** Kubernetes, Docker, AWS, GIT, JIRA, Tensorflow and Pytorch, PostgreSQL, Pandas & Geopandas, etc.
- **Languages:** Spanish (Native), English (Bilingual), French (Intermediate), Catalan (Native).

## RELEVANT RESEARCH PROJECTS

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- **InterpNet - An automated interpretability tool:** Self-supervised framework that leverages the capabilities of NNs to use them as an explainability tool. The goal was to develop a method for automating many mechanistic interpretability problems, which requires efficient and scalable function approximation with neural network weights as input.
- **Breaking the Limits of Diffusion Models via Continuous Dynamical Systems:** Leveraged deep implicit layers and Neural ODEs to decrease the computational complexity of current diffusion models. Provided a better reverse process and highlighted the capability of continuous versions of U-Nets for noise removal. Explored higher-order neural ODEs and their implications for diffusion models.
- **Uncertainty Quantification for Graph Contrastive Learning:** Explored different methods from Bayesian machine learning and ensembles to develop novel techniques for estimating and quantifying uncertainty in graph representations obtained through self-supervised learning.
- **InfoWGAN and InfoVAE - An extension of InfoGAN:** Extended the InfoGAN framework to WGANs and VAEs, requiring novel mathematical derivations and underpinnings. The innovation lies in applying information maximization techniques to improve the interpretability of generated samples in these generative models by generating interpretable latent codes.
- **Reinforcement Learning for 2D Drone Control:** The final deliverable is both a method for training a model and a simulation environment for a 2D drone. Practitioners will be able to quickly test and evaluate different algorithms without the need for long training times or expensive hardware that 3D experiments require. Provided baseline deep RL results for specific tasks as a motivator to explore further algorithms and use this problem as a 2D benchmark task.
- **Study of Generative Models in Particle Physics:** Investigated GANs and VAEs to generate large amounts of sythetic data that realistically represent particle collisions without the expensive computational cost required by the Monte Carlo methods being used nowadays.
- **Eye of the Storm:** Designed and constructed a storm damage detection algorithm for forests, with the use of satellite data, and presented this as a commercial service. Led a team of 4 physics students and researched the use of geospatial data for machine learning in Earth observation.