

Matteo GUARRERA, PhD student @ Berkeley AI Research



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Researcher specializing in Machine Learning, with a focus on deep learning solutions for physics simulations and amortized inference. My research sits at the intersection of deep learning, simulations, and ML systems, and builds upon prior exploration of diverse areas such as robotics, medical imaging and anomaly detection. Currently deepening my expertise in deep unsupervised learning, generative models, and fine-tuning LLMs for long context understanding. Expected graduation: Spring 2027. Proficient in **Python, PyTorch, C, MATLAB, and Git**, with ongoing development in **Jax and Equinox**. Fluent in Italian and English, and currently learning French. *Sailing Instructor from 2014. Competitive Dinghy sailing.*

Education

[2022–today] **CS PhD Student @ Berkeley AI Research**

GPA: 4.0 UC, Berkeley

- **CLASSES:** Machine Learning System, Physics-Inspired Machine Learning, Deep Learning, Deep Unsupervised Learning, Statistical Learning, Natural Language Processing, Deep Reinforcement Learning, Convex Optimization.
- **ADVISOR:** Alberto Sangiovanni-Vincentelli
- **TEACHING:** TA for 227A optimization class (400+ students), and for 16B circuits and robotic (400+ students)

Double MSc Electronic Engineering

Politecnico di Torino - EURECOM - Télécom Paris

- **SCORE:** 110/110 cum laude (max), top 5%
- **ADVISORS:** Maria A. Zuluaga, Luciano Lavagno
- **TEACHING:** *MathWorks Ambassador*, created the biggest MATLAB community of students in the world (2000+), conducted seminars about control and learning. *HKN-IEEE Honor Society*, organized workshops and tutored undergrads.

Projects

2024 **Neural Operators Surrogates**, @Lawrence Berkeley Lab Developed neural operators and spectral methods for learning "physics videos", aka physics simulations. Numerical solutions of PDEs, learnt through Neural Spectral Methods and Fourier Neural Operators. Learnt a Resolution Invariant Representation.

Retrieval Augmented Generation for Time Series Forecasting, Forecast of robotic time-series with a custom DL pipeline using TS2VEC and transformer. Leveraged RAG to improve forecasting accuracy. Bench-marked with foundation models for time-series. Supervising 5 grads students.

Diffusion for Motion Planning, Designed a latent state-based policy to enhance motion planning speed, in a receding horizon control framework. Work based on encoding the observations with a VAE and performing latent diffusion with DDPM, and using an Inverse Dynamic Model to predict the actions.

2023 **Long sequence Q&A**, funded by Meta-AI (15k\$), Supervised Fine Tuning of LLM with LoRA/QLoRA for question-answering on books was tested against RAG. On a resource constraint server I bench-marked efficient attention transformers, quantized models, and RAG for Q&A.

2022 **Knowledge Distillation for Autonomous Agent**, Distilled vision model for autonomous driving applications. Measured trust-worthiness of the students using system level specification. 90% reduction in model size, introducing 7% of safety violations.

Generative Modeling in Healthcare, @EURECOM designed a medical image segmentation algorithm using normalizing flows. Won Young Researcher Grant, by *Fondazione CEUR* 15k\$

2021 **Robust Anomaly Detection** I proposed a simple yet effective way to improve the robustness of several popular OoD detection methods against label shift. 20% TPR improvement. This work was my Mather Thesis and it was the backbone of *Design Automation of OoD Image Data Detectors* proposal, that was granted 100k\$.

Awards

Over the years I have been supported through several grants and awards. In Berkeley I won multiple Departmental Awards (30k), and during my undergrad I was selected as a *Young Talent (top 5%)* for three years in a row (24k\$). In 2015 I have been enrolled into the *Italian National Register of Outstanding Students*, due to an outstanding high-school final project. I have designed and built the first drone in my town.

Publications

Cohen, Viviano, Bertin, Morrison, Torabian, **Guarrera, M.**, ... Hashir et al. (2022). Torchxrayvision: A library of chest x-ray datasets and models. International Conference on Medical Imaging with Deep Learning.

Guarrera, M., Jin, Lin, Zuluaga, Chen, & Sangiovanni-Vincentelli. (2022). Class-wise thresholding for robust out of distribution detection. FADETRCV 2022, IEEE CVPR 2nd Workshop on Fair, Data-efficient, and Trusted Computer Vision.