Matteo Bonotto, Ph.D.

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About

I am a **ML research engineer** with deep expertise in **machine learning, scientific computing, nuclear fusion energy**. I have **several years of experience** as a research engineer in machine learning. I my duties, I have fun developing craft models, writing custom kernels to optimize speed/memory, and doing distributed training on GPU clusters. Prior to that, I've been a researcher in magnetic confinement fusion, where I developed FEM-based tools for plasma equilibrium computation and plasma control in tokamaks.

Skills

Topics: Machine Learning & Deep Learning (Transformers, Kernel optimization (Triton), NLP, Physics-Informed ML) - Distributed Training (FDSP/ZeRO)- Scientific Computing (FEM, electromagnetics, plasma control) - Software Engineering.

Languages: Python (excellent), MATLAB/Simulink (excellent), Fortran, SQL

Technologies/Tools: PyTorch, Triton, Transformers, TensorFlow, Jax/Flax, Git, Docker, GCP, OpenCV, MySQL

Methodologies: Agile, Scrum, CI/CD

Education

University of Padua — Padua, Italy
Ph.D in Magnetic Confinement Fusion; — *Sep 2016 – Mar. 2020*

Ph.D. 2nd best thesis prize: Thesis *Modeling of MHD instabilities in existing and future fusion devices in view of control*, at Hic-Labor prize (Vicenza Olympic Academy, 2021) .

University of Padua — Padua, Italy
M. Sc. in Electrical Engineering; ***GPA: 3.91/4.00*** — *Sep 2012 – Mar. 2015*

University of Padua — Padua, Italy
B. Sc. in Energy Engineering; ***GPA: 3.51/4.00*** — *Sep. 2009 – Sep. 2012*

Experience

Giotto.ai — Lausanne, Switzerland
Senior AI Research Scientist — *Apr. 2024 – Present*

- Core machine learning research focused on Transformers and LLMs. Contributed to solutions awarded the **gold medal** in the Kaggle ARC Prize (2024 and 2025).
- Implemented transformers models from scratch with custom internals. Optimized kernels (Triton), improving speed by **10×** and memory efficiency by **18×**.
- Conducted distributed training on **GPU clusters**.
- Led a team of 4 researchers.

Eni — Milan, Italy
AI Scientist — *Jan. 2023 – Mar. 2024*

- Designed and implemented custom AI solutions for R&D and industrial applications. Collaborated with MIT scientists to develop a tokamak disruption prediction algorithm that outperformed state-of-the-art approaches by **5%** in accuracy.
- Mentored junior teammates and shared ML best practices in a team of 30.

National Institute for Nuclear Physics — Padua, Italy
Research Scientist — *Jan. 2021 – Dec. 2022*

- Mathematical modeling for plasma physics, electromagnetics, and magnetic confinement fusion.
- **Developed and open-sourced** a physics-informed-ML-based model for plasma equilibrium achieving 10x speedup compared to SOTA.

RFX Consortium — Padua, Italy
Research Scientist — *Oct. 2019 – Dec. 2020*

- **Developed and open-sourced** a FEM-based tool for plasma equilibrium with novel formulation for boundary conditions.

General Atomics San Diego

Visiting Ph.D. Student *Sep. 2019 – Dec. 2019 and May 2020 – Aug. 2020 Dec. 2020*

- Advanced mathematical models for coupling MHD and electromagnetic phenomena. **Expanded modeling capabilities** of existing linear MHD code to model non-linear growth rates of Resistive Wall Modes plasma instrabilities.

Dep. of Information Engineering - Univ. of Padua Padua, Italy

Research Scientist *Jun. 2015 – May 2016*

- Model order reduction to large-scale electromagnetic simulations for control applications. **Expanded modeling capabilities** of existing static plasma state estimation tool to estimate plasma states dynamically along the entire plasma discharge.

Awards & Achievements

Ph.D. thesis prize: 2nd place for best Ph.D thesis at 2021 Hic-Labor by the Vicenza Olympic Academy. (Jul 2021)

High Honors Degree: Awarded to M.Sc. alumni who have graduated with a GPA $\geq$ **3.73/4.00** and a final graduation $>$ **113/110**. (Mar. 2015)

Outstanding M.Sc. GPA: Completed the M.Sc. degree with final GPA of **3.91/4.00**, among the highest of the cohort.

Projects

triton-optimizers | *GitHub*

- Fused implementations of common optimizers in Triton.

triton-gated-mlp | *GitHub*

- Fused implementation of the LLaMA gated-MLP layer implemented in Triton.

planet-equil | *GitHub*

- The official repository if the planet-equil package. It is a PyTorch implementation of PlaNet (PLAsma equilibrium reconstruction NETwork), a convolutional physics-informed neural operator for performing plasma equilibrium reconstruction using magnetic and non-magnetic measurements.

ITERlike-equilibrium-dataset | *GitHub*

- Collection of 81986 synthetic equilibria of an ITER-like device useful to develop Machine-Learning-based surrogate models of 2D plasma equilibrium reconstruction. It is the official dataset used in the development of the PlaNet model and planet-equil. The dataset is also available here on Huggingface.

Frida | *GitHub*

- Official repo of the FRIDA code. FRIDA (FRee-boundary Integro-Differential Axisymmetric) couples Finite Element Method and Boundary Element Method (FEM-BEM) to solve the free-boundary axisymmetric plasma equilibrium problem (i.e., the Grad–Shafranov equation in an open-boundary formulation).