

Francesco Scala

PHD STUDENT IN QUANTUM MACHINE LEARNING

Pavia, Italy

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Summary

I'm an eager **third-year PhD student in Quantum Machine Learning (QML)** at University of Pavia, focusing on both classical and quantum machine learning. I bring **strong foundations** in state-of-the-art **theoretical aspects of QML** as well as **proficiency in numerical simulations** of quantum computing systems and QML algorithms. Thanks to my collegiate and representative of PhD students experience, I am used to interdisciplinary and challenging environments. Apart from the academic side, I'm an outgoing and active person enjoying sports, gardening and travelling.

Work Experience

FULL-TIME

- Mar - May 2024 | **Reserach intern** IBM RESEARCH *Zurich - Switzerland*
Research internship focused on **overparametrization** of Quantum Neural Networks . My supervisors are Dr. **Ivano Tavernelli** and Dr. **Francesco Tacchino**, I closely work also with Dr. **Christa Zoufal**.
- 2021 - present | **PhD in Quantum Machine Learning** UNIVERSITÀ DEGLI STUDI DI PAVIA *Pavia - Italy*
My research deals with **QML algorithms**, with special focus on **overparametrization** and **regularization** properties of **Quantum Neural Networks**. Part of my studies are also devoted to simulations of quantum computing platforms. My supervisor is Prof. **Dario Gerace**.

PART-TIME

- Oct 2022-present | **Teaching assistant** UNIVERSITÀ DEGLI STUDI DI PAVIA *Pavia - Italy*
 - **Lectures on General Physics** at the degree program in Chemistry and Pharmaceutical Technologies
- Jul - Dec 2022 | **Intern** QUANTUM COMPUTING LAB - CINECA *Casalecchio di Reno (BO) - Italy*
 - Benchmarking of **HPC infrastructures** for quantum computing and **QML applications** (Python)

Education

- 2019 - 2021 | **Master degree in Physics of Quantum Technologies** UNIVERSITÀ DEGLI STUDI DI PAVIA *Pavia - Italy*
Graduation date: 23-09-2021
Thesis: "Witnessing Entanglement by Quantum Neural Networks"
- 2016 - 2019 | **Bachelor degree in Physics** UNIVERSITÀ DEGLI STUDI DI PAVIA *Pavia - Italy*
Graduation date: 24-09-2019
Thesis: "Machine learning techniques applied to the quantum many-body problem"

Contributions: conferences, schools

- Nov 2023 | **Quantum Techniques in Machine Learning (QTML) 2023** CERN *Geneve - Switzerland*
Talk: A General Approach to Dropout in Quantum Neural Networks
- Oct 2023 | **Quantum Computing and Simulation Workshop** ISTITUTO VENETO *Venezia - Italy*
Poster: A General Approach to Dropout in Quantum Neural Networks
- Aug 2023 | **Superconducting Qubits and Algorithms (SQA) Conference** IQM QUANTUM COMPUTERS *Munich - Germany*
Poster: Symmetrizing Quantum Machine Learning for Quantum Field Theory

Jun 2023		International Conference on Optics of Excitons in Confined Systems	UNIVERSITÀ DEL SALENTO	Lecce - Italy
Talk: Quantum computing platform with polariton integrated circuits				
Nov 2022		Quantum Techniques in Machine Learning (QTML) 2022	UNIVERSITY FEDERICO II	Napoli - Italy
Poster: Quantum variational learning for entanglement witnessing				
Ago - Sept 2022		VCQ & AppQlinfo SummerSchool 2022	UNIVERSITÄT WIEN	Wien - Austria
Student Talk: Quantum variational learning for entanglement witnessing				
Jul 2022		World Congress On Computational Intelligence 2022	IEEE	Padova - Italy
Talk: Quantum variational learning for entanglement witnessing				
Jun 2022		Quantum Computing Hard- and Software Summer School 2022	EPFL, ETH ZÜRICH	Lausanne - Switzerland
Poster: Quantum variational learning for entanglement witnessing				

Extracurricular Activities

Apr 2023 - present		Technical-scientific Committee Member	BEQUANTUM	Online - Italy
<ul style="list-style-type: none"> Production of technical posts. General posts review. 				
May 2023		1st Place	ETH QUANTUM HACKATHON 2023 - IQM CHALLENGE	Zurich - Switzerland
<ul style="list-style-type: none"> Topic: Exploiting symmetries in Quantum Machine Learning Tasks: TicTacToe (given), Schwinger model (our proposal) [link] 				
Apr 2022 - Jul 2022		Mentee	QUANTUM OPEN SOURCE FOUNDATION (QOSF)	Online
<ul style="list-style-type: none"> Implementation of Krylov module within tequila Python package [link] Mentor: Prof. Jakob Kottmann 				
2022 - 2023		Phd Student representative	UNIVERSITÀ DEGLI STUDI DI PAVIA	Pavia - Italy
Jan 2022		2nd Place	MIT IQHACK 2022 - MICROSOFT/IONQ DIVISION	Online
<ul style="list-style-type: none"> Topic: Quantum game with educational purposes Blackjack-inspired quantum game named QuHackJack [link] 				

Skills

- Programming: Python, C++(basic)
- Quantum programming: **PennyLane** (in combination with **JAX**), **Qiskit**, **tequila**, **AWS Braket**
- Soft skills: predisposition to interpersonal relationships, teamwork, quick learner, proactive, time management

Languages

Italian: Native **English:** Level C1 **French:** Level A1

Publications

F. Scala et al.		Adv. Quantum Tech. 2300220	A GENERAL APPROACH TO DROPOUT IN QUANTUM NEURAL NETWORKS	2023
F. Scala et al.		arXiv:2306.05072	DETERMINISTIC ENTANGLING GATES WITH NONLINEAR QUANTUM PHOTONIC INTERFEROMETERS	2023 (In review)
J. Kottmann, F. Scala		arXiv:2302.10660	COMPACT EFFECTIVE BASIS GENERATION: INSIGHTS FROM INTERPRETABLE CIRCUIT DESIGN	2023 (Acc. by JCTC)
F. Scala et al.		IEEE - IJCNN 2022 Proceedings	QUANTUM VARIATIONAL LEARNING FOR ENTANGLEMENT WITNESSING	2022