Daniele Cucurachi

Computational Physicist · VC Advisor

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Summary

I am a computational physicist combining expertise in scientific software development and research with a passion for startups and entrepreneurship. Currently, I develop advanced quantum algorithms at **Pasqal**, pushing the boundaries of **quantum machine learning**. Alongside, as an AdVenture Partner with **Scientifica Venture Capital**, I scout and support high-potential startups, fostering the next wave of deep tech breakthroughs.

Professional Experience

Quantum Algorithm Developer - Quantum Machine Learning
Amsterdam, The Netherlands

Pasqal
Apr 2024 - Present

- Led cross-team collaboration to develop a GPU cluster-based simulator for benchmarking optimization algorithms, loss-balancing techniques and sampling techniques used in the training of quantum Physics-Informed Neural Networks (PINNs), **accelerating the application of quantum machine learning models to real-world problems**.
- Contributed to the development of internal libraries for simulating quantum PINNs by conducting code reviews, increasing test coverage by **5%**, and implementing new features to improve the evaluation of PINNs' performance and generalization capacities.
- Discovered and fixed a hidden bug in Pasqal's codebase that produced false results in the training of quantum PINNs using loss-balancing techniques, **preventing potentially damaging misinterpretations that could have affected every user relying on these models**.

AdVenture Partner
remote

Scientifica Venture Capital
Nov 2023 - Present

- Responsible for identifying promising startups and innovative technological projects within universities and research departments, fostering potential investments by Scientifica Venture Capital.
- Independently scouted and evaluated over **50 early-stage startups** across various deep tech sectors, leading to the selection of 2 high-potential investment opportunities projected to have substantial long-term growth.

Research Assistant
Cambridge, UK & remote

University of Cambridge (Quantum Information Group, Cavendish Laboratory)
Jun 2023 – Jan 2024

- Developed an algorithm for optimizing parametrized proposal strategies in quantum-enhanced Monte Carlo Markov chains (MCMC), **increasing the MCMC convergence speed up to 40%**. A Python simulator of the first version of the algorithm is available on my GitHub (**click here**).
- The final version of the algorithm will be soon released, currently in the process of preparing this project for submission to a peer-reviewed journal.

Quantum Engineer (Internship)
Helsinki, Finland

IQM Quantum Computers
Feb 2022 – Aug 2022

- Developed Python libraries for the design and simulation of superconducting quantum processors:
  - Opened more than **40 merge/pull requests** within my first six months for software projects involving up to 20 contributors. A small part of my contributions (open-source projects only) can be found **here**.
  - Developed a novel library feature to **speed up the routing of quantum processors exponentially**, currently utilized by the *IQM Design Team*.
  - Participated in cross-team collaboration to design 3 photomasks' layouts and 4 novel superconducting circuit elements.
  - Hands-on experience with large codebases, collaborative programming tools such as GitHub and GitLab with Git, and software engineering best practices such as unit testing and conducting code reviews.
- Modeled electromagnetic coupling in quantum processing units (QPUs) through finite element methods (ANSYS HFSS).

Education

University of Cambridge
Cambridge, UK

Visiting Student in the Physics Department (Master's Thesis)
Sep 2022 - Mar 2023

- Awarded the **Scientifica VC "Thesis" Award** for outstanding master's thesis

EPFL - École Polytechnique Fédérale de Lausanne
Lausanne, Switzerland

Master of Science (MSc) in Applied Physics
Sep 2020 - May 2023

- Final GPA: **top 10%** in the class of 2023
- EPFL is ranked **10th worldwide** in the 2024 QS World University Rankings for "Engineering & Technology" and **11th worldwide** for "Natural Sciences"

Politecnico di Torino
Torino, Italy

Bachelor of Science (BSc) in Physics Engineering
Sep 2017 - Jul 2020

- Final Grade: **110/110 with honours** (**top 2%** in the class of 2020)

Associations

Researcher *London, UK & remote*

United Italian Societies (UIS) Research Centre *Mar 2024 - Present*

Supervisor: Dr. Enrico Fontana (Quantum Computing Researcher at JP Morgan)

- Currently working on a commentary-type article about key investment trends and recent socio-economic shifts in the evolving quantum industry, as well as the role of quantum technology in global geopolitics.
- The preliminary results of my research have been presented at the **"Osservatorio sulle Metamorfosi Socio-Tecnologiche"** event, hosted by United Italian Societies (UIS) at the **Italian Cultural Institute (ICI)** in London.

Vice President *Lausanne, Switzerland*

EPFL Quantum Computing Association *Feb 2021 - Sep 2022*

- Led the EPFL QC Association, an organization dedicated to advocating and informing about the fast-expanding world of quantum computing, and creating a bridge between ambitious students and the industry.
- Organized three successful association events leading a team of five, managed advertising campaigns to promote them, and secured events funding and sponsorships from quantum companies (such as *Quantum Machines*).
    - The last organized event **"EPFL Quantum Hackathon"**, focused on quantum computation and its ties to chemistry simulations and drug discovery, attracted more than **100 international participants**.
- Mentored three junior members, helping them secure their first internships in the quantum industry.

Publications

Journal Articles & PrePrints

Technology and Performance Benchmarks of IQM's 20-Qubit Quantum Computer

Leonid Abdurakhimov, Janos Adam, Hasnain Ahmad, Olli Ahonen, Manuel Algaba, Guillermo Alonso, Rohit Beriwal, Matthias Beuerle, Daniele Cucurachi et al. *arXiv*, URL: `https://arxiv.org/abs/2408.12433`, 2024

Awards & Honours

2023	**Scientifica VC "Thesis" Award:** Scientifica VC annually awards grants to the best thesis in STEM subjects. The selected candidates receive a grant of €3,000 and gain access to a mentorship programme on entrepreneurship and the world of startups. I was selected as a winner for my master's thesis.	*UK / Italy*
2023	**Lead The Future (LTF) Member:** among the few Italian students selected to be mentees for LeadTheFuture, a leading mentorship non-profit organization for students in STEM, with an acceptance rate below 20% (over 2000 applications a year).	*Italy*
2023	**Winner of the IMC "Trading simulation":** ranked first among around 40 participants at the "Trading Simulation" organized by IMC Trading at the "EPFL Forum" event (2023 edition).	*Switzerland*
2020	**Graduated "with honours" (Politecnico di Torino):** at Politecnico di Torino honours may be awarded at the discretion of the Graduation Committee upon reaching a final grade of at least 110.51/110.00.	*Italy*
2018-20	**"Riduzione per Merito":** awarded merit-based tuition fee reduction for two consecutive academic years (2018/19 & 2019/20), granted to the top students at Politecnico di Torino maintaining a GPA above 27/30.	*Italy*

Technical Skills & Languages

Programming	Python, Bash, C/C++ (basic), MATLAB (basic)
Python Packages	PyTorch, Qiskit, Numpy, Pandas, Scipy, Qadence, KQCircuits, Ray Tune, Scikit-Learn, Gdspy, Matplotlib, QuTip
Software & Tools	GitLab and GitHub with Git (version control) for collaborative software development, MLflow, ANSYS High Frequency Simulation Software (HFSS), KLayout, Sonnet Software, LTspice (analog circuit simulations), LaTeX (technical writing)
Experience with	Numerical Simulations, Machine Learning Algorithms, Data Analysis and Visualization | **OS:** Windows, Linux (Ubuntu)
Languages	**English:** Full Professional Proficiency (level C2), **Italian:** Native

Hobbies

Chess	Currently holding a rating of **2000 in blitz chess** on Lichess.org (ranking in the **98th percentile** of users), I am always up for a game.
Trail running	Achieved a personal best with an average pace of 4 minutes and 07 seconds per kilometer in a 10 km run. Participated in **"Il Castello di Pietra"** (Porte di Pietra 20° Edizione), an international trail running competition.

Volunteering

Pool Lifeguard *Novara, Italy*

Federazione Italiana Nuoto *2015*

- Obtained lifeguard license "Piscina (P) Rif. PIE-432/2014-5".

Volunteer at a Children's Summer Camp *Novara, Italy*

Parrocchia Madonna Pellegrina *Jun 2014 - Jun 2017*

- Organized activities, trips and excursions for a group of around 60 children.
- Assisted the summer camp organizers with handling the finances.