

Charles MOUSSA

RESEARCH SCIENTIST

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Experience

Stealth Startup

Leiden, Netherlands (Remote)

RESEARCH SCIENTIST

Sep. 2023 - Now

- Designing software and research code for unconventional physics-based hardware for AI workloads.
- Application of generative models, benchmarking algorithms, and software engineering for future open-source Jax libraries.

Leiden Institute of Advanced Computer Science

Leiden, Netherlands

PH.D. IN QUANTUM MACHINE LEARNING

2019 - 2023

- Ph.D. sponsored by TotalEnergies, combining Quantum Computing, Optimization, and Machine Learning for industrial problems.
- Thesis on Algorithm selection and configuration for Noisy Intermediate Scale Quantum methods for industrial applications.
- Development of hybrid quantum-classical algorithms for research and education: QAOA, Quantum Neural Networks, quantum GAN, and optimizers for variational algorithms.
- Participation in teaching activities as guest presenter and developing tutorials. Supervision of students.

Los Alamos National Laboratory

New Mexico

QUANTUM COMPUTING FELLOW

Jun. 2022 - Aug. 2022

- Selected fellow for the Quantum Computing Summer school.
- Implementation of QML algorithms on simulators and hardware for quantum data.

Modis - TotalEnergies

Pau, France

QUANTUM COMPUTING SCIENTIST

Mar. 2019 - Jun. 2019

- Helping TotalEnergies in their quantum computing project.
- Implementation of quantum algorithms on Atos Quantum Learning Machine.
- Supervising two interns in their research projects.

Oak Ridge National Laboratory - TotalEnergies

Oak Ridge, Tennessee

QUANTUM COMPUTING RESEARCHER

Aug. 2017 - Jan. 2019

- Investigating quantum computing and applications in Machine Learning, Chemistry, Optimization, and Differential equations.
- Implementation of classical and quantum algorithms: Genetic Algorithms, Restricted Boltzmann Machines, Grover Search, TotalQBoost...
- Coding algorithms with different quantum simulation software: Qiskit, D-Wave API, PennyLane, Strawberry Fields, Atos Quantum Learning Machine.
- Writing reports for documentation on quantum algorithms potential for industry use cases.

Sarenza (Leader in selling shoes online in France)

Paris, France

DATA SCIENTIST

Apr. 2016 - Oct. 2016

- Created fact tables with Hive (SQL for Hadoop) that are updated daily to save time in Data preparation for Data Science use cases.
- Recommendation system using collaborative filtering.
- Using Transfer Learning to extract features for clustering.
- Sales forecasting with Machine Learning algorithms (Random forests, XGBoost, Extreme Gradient Boosting...) using Python and Spark.

Bikay (Global IT start-up part of the French Tech Cambodia community)

Phnom Penh, Cambodia

WEB DEVELOPER

Jun. 2015 - Sep. 2015

- Developed in a team a web management platform in Laravel (PHP framework with JavaScript, jQuery, Ajax, and HTML/CSS) for a company that manages rental properties.
- Implemented a SERP (Search Engine Results Page) in Laravel by scrapping Google.
- Data Extraction from websites using CasperJs.

Programming & Language Skills

PROGRAMMING

Quantum Computing : Qiskit, PennyLane, D-Wave API, myQLM, Cirq, TensorFlow-Quantum.

Statistics and Machine Learning : Scikit-Learn, R, TensorFlow, Keras, Pytorch, Equinox.

General Languages : Python, SQL, Java, Bash, C/C++, Fortran, VBA, Julia, Jax.

Big Data : Spark, Hive (SQL for Hadoop), MongoDB.

Web Programming : HTML/CSS, PHP, Javascript, jQuery, Ajax, CasperJS, Laravel, Wordpress.

LANGUAGES

Proficient : French (Native), English (Advanced).

Notions : Dutch, Spanish, Japanese.

Education

National Institute of Applied Sciences (School of Engineering)

Rouen, France

MASTER'S DEGREE IN MATHEMATICAL ENGINEERING

2011 - 2016

- Applied Mathematics (Statistics, Optimization, Machine Learning, Partial Differential Equations).
- Computer Science (Programming, Virtual reality, Web Technologies).

University of Rouen

Rouen, France

MASTER'S DEGREE IN ACTUARIES AND MATHEMATICAL ENGINEERING IN INSURANCE AND FINANCE

2015 - 2016

- Insurance, Finance, Economy, Management, Banking and Finance Law.
- Mathematics (Pricing, NonParametric Tests, Statistics of extreme values, Survival Analysis, Risk Management).

Hackathons

HACKATHONS

2019-2022

- Second place at the BIG Quantum Hackathon by QuantX, Paris 2021.
Implemented a Wasserstein quantum GAN with Gradient Penalty and applied to images provided by BMW for car design.
- Participation in QHack 2019, 2022, and 2023. Second place in 2022 coding challenges. First place in two open challenges and second prize in three others.

Learning & Education/Side Projects

Secretary/Webmaster of LEO (PhD Association)

SOCIAL PROJECTS

2020-2022

- Organization of events for PhDs at Leiden University during pandemic.
- In contact with external associations and university entities for raising and tackling PhD-related problems.

Experimentation of Data Science algorithms

DATA SCIENCE PROJECTS

- Experimentation of Machine Learning algorithms on various datasets.
- Application on horse races: scrapping data from websites saved into a NoSQL database, and application of Machine Learning for predicting winners.

Web programming

WEBSITE DEVELOPMENT FOR FAMILY BUSINESSES

- Designing an online course membership-based website : rcmedreview.com.

Publications

CONFERENCE

- C. Moussa, H. Wang, M. Araya-Polo, T. Bäck, V. Dunjko: "Application of quantum-inspired generative models to small molecular datasets, QCE IEEE, 2023.
- C. Moussa, J. N. van Rijn, T. Bäck, V. Dunjko: "Hyperparameter Importance of Quantum Neural Networks Across Small Datasets, Discovery Science, 2022.
- C. Moussa, H. Wang, H. Calandra, T. Bäck, V. Dunjko: "Tabu-driven Quantum Neighborhood Samplers", EVOCOP, 2021.

JOURNAL

- C. Moussa, M. Hunter Gordon, M. Baczyk, M. Cerezo, L. Cincio, P. J. Coles: "Resource frugal optimizer for quantum machine learning, Quantum Science and Technology, 2023.
- C. Moussa, Y. Patel, J. N. van Rijn, T. Bäck, V. Dunjko: "Hyperparameter importance and optimization of quantum neural networks across small datasets, Machine Learning, 2023.
- C. Moussa, H. Wang, T. Bäck, V. Dunjko: "Unsupervised strategies for identifying optimal parameters in Quantum Approximate Optimization Algorithm, EPJ Quantum Technology, 2022.
- C. Moussa, H. Calandra, V. Dunjko: "To quantum or not to quantum: towards algorithm selection in near-term quantum optimization", Quantum Science and Technology, 2020.
- X. Bonet-Monroig, H. Wang, D. Vermetten, B. Senjean, C. Moussa, T. Bäck, V. Dunjko, T. E O'Brien: "Performance comparison of optimization methods on variational quantum algorithms", Arxiv, 2021.

WORKSHOP

- C. Moussa, H. Calandra, T. Humble: "Function Maximization with Dynamic Quantum Search ", Quantum Technology and Optimization Problems, 2019.