Charles **MOUSSA**

MATHEMATICAL ENGINEER · DATA SCIENTIST · QUANTUM COMPUTING SCIENTIST

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Experience

Leiden Institute of Advanced Computer Science
Leiden, Netherlands

PH.D. IN QUANTUM MACHINE LEARNING (THESIS SUBMITTED)
2019 - 2023
- Combining Quantum Computing, Optimization and Machine Learning for industrial problems.
- Ph.D. sponsored by TotalEnergies, under the supervision of Vedran Dunjko and Thomas Bäck.
- 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 about quantum computing and applications in Machine Learning, Chemistry, Optimization, Differential equations.
- Implementation of classical and quantum algorithms:
  Genetic Algorithms, Restricted Boltzmann Machines, Grover Search, TotalQBoost...
- Coding algorithms with different quantum simulation softwares:
  Qiskit, D-Wave Sapi, 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 everyday 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 which manages rental properties.
- Implemented a SERP (Search Engine Results Page) in Laravel by scrapping Google.
- Data Extraction from websites using CasperJs.

Publications and 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.
- Participation in ICT with Industry 2022, Leiden (Netherlands): Automatic Trailer Generation use case with RTL.

CONFERENCE
2021
- Charles Moussa, Jan N. van Rijn, Thomas Bäck, Vedran Dunjko: "Hyperparameter Importance of Quantum Neural Networks Across Small Datasets, Discovery Science, 2022. An extended version has also been submitted to the journal: Machine Learning.
- Charles Moussa, Hao Wang, Henri Calandra, Thomas Bäck, Vedran Dunjko: "Tabu-driven Quantum Neighborhood Samplers", EVOCOP, 2021.

Journal   *2020-2021*
- Charles Moussa, Max Hunter Gordon, Michal Baczyk, M. Cerezo, Lukasz Cincio, Patrick J. Coles: "Resource frugal optimizer for quantum machine learning , Arxiv, 2022.
- Charles Moussa, Hao Wang, Thomas Bäck, Vedran Dunjko: "Unsupervised strategies for identifying optimal parameters in Quantum Approximate Optimization Algorithm, EPJ Quantum Technology, 2022.
- Charles Moussa, Henri Calandra, Vedran Dunjko: "To quantum or not to quantum: towards algorithm selection in near-term quantum optimization", Quantum Science and Technology, 2020.
- Xavier Bonet-Monroig, Hao Wang, Diederick Vermetten, Bruno Senjean, Charles Moussa, Thomas Bäck, Vedran Dunjko, Thomas E O'Brien: "Performance comparison of optimization methods on variational quantum algorithms", Arxiv, 2021.

Workshop   *2019*
- Charles Moussa, Henri Calandra, Travis Humble: "Function Maximization with Dynamic Quantum Search ", Quantum Technology and Optimization Problems, 2019.

Programming & Language Skills

Programming

Quantum Computing : Qiskit, PennyLane, D-Wave Sapi/Ocean, myQLM, Cirq, TensorFlow-Quantum.

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

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

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

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

Languages

French : Native

English : Advanced

Spanish : Good

Japanese, Dutch : Notions

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).

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.
- Participation in an Artificial Intelligence, Machine Learning Meetup by sharing knowledge and notebooks.

Web programming

Website development for family businesses
- Designing an online course membership-based website : rcmedreview.com
- Designing a family restaurant website : lepampam.com