MSCA Postdoctoral Fellowship Offer

Research Theme Title: Advancing Quantum Optimization Techniques for Near-Term Devices Using Hybrid Variational Algorithms

Research Theme Code: RLA-EURECAT-01

Area of Application: Digital Business and Industry

Location: EURECAT, Barcelona, Spain

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Brief Theme Description:

Quantum optimization is an emerging field that aims to solve complex optimization problems more efficiently by leveraging the principles of quantum mechanics. Unlike classical optimization methods, quantum optimization uses quantum bits (qubits) to explore multiple potential solutions simultaneously, exploiting phenomena like superposition and entanglement. This approach offers the potential for significant speed-ups in solving problems that are otherwise computationally intractable for classical systems.

The project aims to explore quantum optimization algorithms using variational methods for near-term quantum devices. These devices are anticipated to feature a limited number of physical qubits and low-error correction capabilities, making it essential to leverage hybrid approaches combining quantum and classical resources.

The primary focus will be on applying variational algorithms like the Variational Quantum Eigensolver (VQE) and the Quantum Approximate Optimization Algorithm (QAOA) to both classical optimization problems and problems in quantum chemistry. VQE and QAOA are particularly promising as they use quantum states to represent complex solution spaces, allowing optimization processes that are exponentially hard on classical computers to be tackled more efficiently.

The successful postdoctoral candidate will contribute to advancing these techniques, focusing on developing practical algorithms and validating them on existing GPU clusters and possibly on available quantum hardware.

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Marie Skłodowska-Curie COFUND (Grant Agreement No 101126667).

Available Infrastructures: 34 qubits Quantum Simulator.

Possible Secondments: ICFO, Freie Universität Berlin.

Keywords: Quantum Computing, Quantum Optimization, Variational Algorithms, Quantum Chemistry, Hybrid Algorithms, Error Mitigation.

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