Ph.D. in Information Technology
Thesis Defense

July 11th, 2023
at 17:00
Aula 1A and online by Teams

Lorenzo MORO – XXXV Cycle

Quantum machine learning methods for anomaly detection in telecommunication and quantum compiling

Supervisor: Prof. **Enrico Prati**

Abstract:

This thesis explores the application of emerging technologies, such as artificial intelligence and quantum computing, in industrial telecommunications applications. The primary aim is to identify real-world industrial telecommunications problems more efficiently addressed using currently available quantum computers (QCs) than classical computers. By collaborating with Vista Technology SRL, the main sponsor of the research, we explored two classes of real-world telecommunications problems to determine the most promising areas for detecting a quantum advantage. Since the quantum hardware currently limits the problems that can be tackled, we additionally investigated the use of artificial intelligence, specifically reinforcement learning (RL) techniques, to enhance quantum computation by developing and patenting a method for real-time compilation of quantum circuits and controlling the hardware more effectively. Such an approach aims to allow industrially relevant problems to be addressed sooner, and to gain a deeper understanding of the capabilities and limitations of current quantum hardware. Our research identified anomaly detection and adiabatic computers as the most promising class of problems and quantum hardware for detecting a quantum advantage in real-world telecommunications problems. As a prominent example, we used Quantum Restricted Boltzmann Machines (QRBMs) as Network Intrusion Detection Systems, detecting a quantum speed-up up to 41 times faster than a 128-core CPU, demonstrating that quantum speed-up already emerges in current hardware on real-world problems.

PhD Committee

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