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TechTalk

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Emerging Trends in Advanced Machine Learning: from Neuromorphic to Quantum Systems

Bio

Alberto Marchisio received his B.Sc. and M.Sc. degrees in Electronic Engineering from Politecnico di Torino, Turin, Italy, in October 2015 and April 2018, respectively. He received his Ph.D. degree in Computer Science from the Vienna University of Technology (TU Wien) Informatics, Doctoral College Resilient Embedded Systems, Vienna, Austria, in September 2023. Currently, he is a Research Group Leader with the eBrain Lab, Division of Engineering, New York University Abu Dhabi (NYUAD), United Arab Emirates. His main research interests include hardware and software optimizations for machine learning, braininspired computing, VLSI architecture design, emerging computing technologies, robust design, and approximate computing for energy efficiency. He (co-)authored 30+ papers in prestigious international conferences and journals. He received the honorable mention at the Italian National Finals of Maths Olympic Games in 2012, and the Richard Newton Young Fellow Award in 2019.

Abstract

Current Machine Learning (ML) systems applied on classical computing platforms are extremely resource hungry. Hence, we explore emerging computational paradigms such as Neuromorphic Computing (NC) and Quantum Computing (QC). An NC system uses Spiking Neural Networks (SNNs), while QC paradigms applied to Machine Learning (ML) applications form a Quantum Machine Learning (QML) system. After reviewing the basic concepts of SNNs and QML, this talk discusses practical applications of SNNs and their optimizations for efficiency and robustness. We also explore the design space of hybrid QML models by investigating different architectural permutations and quantum hyperparameters.

This talk will provide an overview of the contributions on this topic during the last decade, as well as a discussion on the challenges and open issues.

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