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Quantum Neural Networks: current status and next steps

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Classical machine learning has proven valuable since its implementation on classical computers became feasible. On the other hand, quantum computation claims to present an exponential advantage over any classical algorithm for specialized tasks. Thus, adapting the machine learning paradigm to the quantum realm is a promising way forward.

We start the talk with a general introduction to the mathematical framework required for this adaptation. These basic notions are crucial to understanding how we can manipulate quantum systems and what the limitations are. Afterward, we discuss different approaches to “quantizing” the neural network architecture, i.e., adapting classical neural networks to quantum systems, before focusing on Dissipative Quantum Neural Networks. We show that this ansatz has the potential to be a “quantum universal approximator” as it can be used to learn any quantum operation. Lastly, preliminary numerical results and possible next steps are discussed.

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