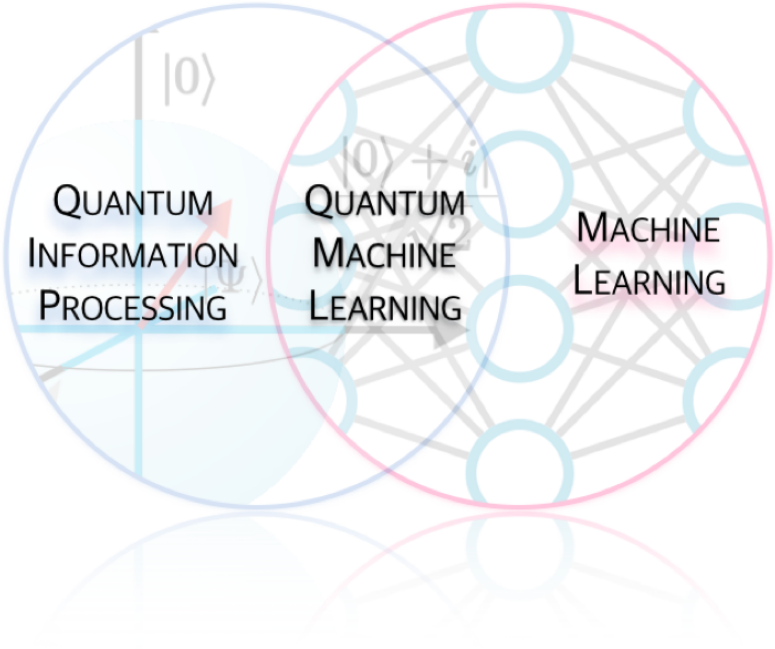
Proposta di Tesi di Laurea Triennale o Magistrale

Quantum Machine Learning



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Machine learning has fundamentally changed the way humans interact with and relate to data. Applications range from self-driving cars to intelligent agents capable of exceeding the best humans at Jeopardy and Go [1]. These applications exhibit large data sets and push current algorithms and computational resources to their limit, where information is fundamentally governed by the laws of physics. The laws are quantum mechanical at the scales of present day information processing technology [2], in contrast to the more familiar 'classical' physics at the human scale. The interface of quantum physics and machine learning naturally goes both ways: machine learning algorithms find application in understanding and controlling quantum systems and, on the other hand, quantum computational devices promise enhancement of the performance of machine learning algorithms for problems beyond the reach of classical computing.
Then it should not surprise that lots of efforts are being made to effectively bring these two worlds in contact, in order to outperform the current computational capabilities. Anyway, despite this growing level of interest in the field, a comprehensive theory of quantum learning, or how quantum information can in principle be applied to intelligent forms of computing, is only in the very first stages of development [3].

In this framework, the student will build an expertise both in the fields of quantum information processing and machine learning with the goal to implement/simulate a simple learning algorithm on a quantum device.

[1] Vishal Maini, *"Machine Learning for Humans"*, https://medium.com/machine-learning-for-humans/supervised-learning-740383a2feab (2017).
[2] John Preskill, *"Quantum Computing in the NISQ era and beyond"*, arXiv:1801.00862 (2018).
[3] J. Biamonte et al., *"Quantum Machine Learning"*, Nature **549** (2017).