Quantum machine learning algorithms

1 Description

The idea of using the theory of quantum mechanics to obtain computers potentially exponentially faster for certain applications, such as the factorization of prime numbers, arouses considerable interest and research efforts from the scientific community nowadays. In quantum computation [1, 2, 3, 4, 5], information is represented and manipulated using quantum properties. Quantum machine learning [6, 7, 8, 9] studies how to exploit the power of quantum computation to develop new types of machine learning methods.

2 Objectives

The goal of this project is to implement any possible variant of quantum machine learning methods. In particular, two possibilities are considered: 1) Modification of classical machine learning methods to exploits characteristics of quantum computation. 2) To implement a classical ML algorithm using a simulator of a quantum computer (see suggestions below).

The student should: 1) Conceive the proposal. 2) Implement the proposal.

As in other projects, a report should describe the characteristics of the design, implementation, and results. A Jupyter notebook should include calls to the implemented function that illustrate the way it works.

3 Suggestions

- Read `https://www.nature.com/nature/journal/v549/n7671/pdf/nature23474.pdf` and see references within.
- See different quantum computer simulators in Python `https://github.com/corbett/QuantumComputing` `https://github.com/thmp/quantum`
- Other resources on Quantum ML `https://github.com/krishnakumarsekar/awesome-quantum-machine-learning`
- Implementations can use any Python library.

References

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[5] Ashley Montanaro. Quantum algorithms: an overview. *arXiv preprint arXiv:1511.04206*, 2015.

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