JOGGING A HAMILTONIAN:

Fast Hamiltonian Simulation using Quantum Walks, Qubitization and QSVT

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ABSTRACT

The problem of efficiently simulating a Hamiltonian is one of the long standing problems in computational physics. Today, the problem of Hamiltonian simulation stands as one of the most impacting and significant contribution of quantum computers. Furthermore since it is a BQP-complete problem, devising any efficient classical algorithm for the same is believed to be intractable.

In this project, we plan to study and analyse Hamiltoninan simulation using quantum walks, qubitization and quantum singular value transformation. We will also compare the efficiency of these algorithms with other methods such as trotterization and quantum signal processing. Furthermore, we will explore applications of Hamiltonian simulation such as solving quantum linear systems.

Our final aim for this project is to culminate our work in the form of a open-source library for fast Hamiltonian simulation.

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