Instituto Tecnológico y de Estudios Superiores de Monterrey

Quantum Computing

Reading 13

Quantum Algorithms Revisited

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Abstract

In this text, that is based on the paper: "Quantum Algorithms Revisited" by R. Cleve et al, two ideas are extracted arbitrarily and discussed, according to the interest of the author.

1 Idea 1

The interferometer case

We deduced interferometry from observations that did not match our linear view of the world. From some observations we deduced that some things behave like waves, and we created the maths that describe it and we studied the phenomena that affects waves, thus creating interferometry, and how this relates to the information in a certain system. Using interferomerty we can measure objects with a high degree of accuracy using a classical phenomenon.

When interferomerty is used in the quantum realm, we can create a set of algorithms that are very useful because they solve problems that classical computers can not solve in the same fashion, specially when we are talking about the quantum Fourier transform, and the other algorithms mentioned in the paper, where interferometry is a modular artefact. All of this is one more instance that serves as an example of how our understanding of the physical world gives us tools to solve problems in a very efficient way, and how some phenomena that appears to be fundamentally indifferent to another one, can be linked maybe artificially but building a sinergy between systems.

2 Idea 2

Other phenomena leading us to new algorithms

In this paper, the authors talk about algorithms that use interferometry and how this phenomenon is relevant for a set of important quantum algorithms that have a relevant impact in computer science, but this is just a property of quantum systems. Also we must have into consideration that there are groundbreaking applications using quantum systems in other areas.

- Quantum entanglement is a crucial part of the quantum teleportation protocol. Entanglement also is used in applications involving radars and sonars, as the work that has been described to us in class by Ph. D. Lanzagorta.
- Quantum tunnelling might be a good candidate to solve non-convex optimisation problems, if we manage to translate an optimisation problem into a valid Hamiltonian represented by a computing unit in a quantum processor, whenever the optimisation algorithm finds a local minima, we will have a chance of getting our of that local minima thanks to quantum tunnelling.