Quantum Computing

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ABSTRACT

Quantum Computing is a multidisciplinary field of study consisting of concepts from Computer science, Physics, Mathematics. It focuses on the area of quantum mechanics, that studies the behavior of particles at a microscopic level. At subatomic levels, the equations that describe how particles behave is different from those that describe the macroscopic world around us. Quantum computers take advantage of these behaviors to perform computations in a completely new way.

Analogous to traditional computers whose unit of operation is bits, quantum computer has quantum bits (qubit). Bits generally stays in two positions, 0 (low) and 1 (high). Qubit also stays in these two states, but in a combination of both the states. These leads to the fundamental concepts of quantum mechanics.

Superposition, states that much like waves in classical physics, two or more qubits can be added as a unit and operated on. While our classical computers can be in one state at a time, superposition enables quantum computers to be in a huge number of states in a single time, which helps in decreasing computation time.

Entanglement, states that two or more qubits are linked so closely that one gives immediate knowledge about the others, no matter how far they are apart. It helps in solving complex problems faster.

Interference, is a concept which helps to lead our results to a desired output. Due to superposition, when quantum computer's result is measured, it's wavefunction collapses and goes to a classical output. So, a constructive wave to enhance correct result and destructive wave to compress wrong result is used and this concept is known as interference.

Though quantum computer is not fully error-free in present time, the current studies show a significant advancement and expected to change the world of computation in upcoming future.