Google Moves Closer to a Universal Quantum Computer

Summary:

The article starts off with a brief history of successes in the quantum computing field, describing the 2 common ways to implement quantum computing with their respective drawbacks and What Google is doing to overcome these issues.

The article starts off by describing that quantum computers have been in the works for 30 years now and that companies like IBM and D-Wave have already created functioning quantum computers using their respective methods. Now Google is trying to create a working method using both of the methods used for IBM and D-Waves computers.

The first approach that was used by IBM is to construct digital circuits using qubits (a quantum computing bit that is made up of the superposition of both 1 and 0) in a particular arrangement to solve a specific problem. This method, despite the arrangement of qubits to be tailor made for specific problem, is what much of quantum computing theory is based off of.

The second approach to quantum computing, devised by D-Wave, is to grab a group of qubits and shape their interactions until a solution is reached, which would allow any problem to be computed; called adiabatic quantum computing (AQC). The issues are that this method cannot be scaled up to larger systems. This is because random noise introduces errors that cannot easily be corrected. In effect, if the system were scaled up, the computer would produce a completely inaccurate result if it ever reached one at all because the noise and errors are compounded as the system gets larger. In addition, there is no guarantee that the way the problem is solved is the most efficient way. Despite these issues, D-Wave, using this method, has created the first viable, commercial quantum computer… for the low price of $15 million.

What Google wants to do is to combine the different methods with the benefits of both: the viability of AQC and the error correction of IBM’s method. Google arranges 9 qubits using logic gates that steer the qubits into a state that encodes the solution to a problem. This new approach could allow for quantum error correction which would allow the process to be scaled up from a 9 qubit computer to computers with thousands or even millions of qubits, which would increase computing power to an unimaginable scale.

The benefits of quantum computers are that it will allow scientists to solve problems that are unsolvable with conventional “classical” computers. Problems such as quantum dynamics simulations and interactions between many elections, which are needed for chemistry simulations, would be easily solved.

Thoughts:

The thought that we are moving closer and closer to an actual, feasible implementation of a quantum computer is absolutely exciting to me. With conventional computers, we are nearing a performance cap in which it is no longer physically possible to shrink a CPU die any smaller. With the advent of quantum computers we have now created another universe of possibility for advancement and performance improvement. Problems that are far too time consuming for classical computers will be done easily with quantum computers. Also, with the advent of quantum computers, it is conceivable that and industry shift decrease the demand for classical computers and drive the price of conventional computers down, making conventional computers more accessible for everyone. In short, Google is making strides to take two successful methods for quantum computing and combining them to make a more useful and practical quantum computer. With these advancements, it makes it conceivable that we will have a working commercial quantum computer within the next 30 years. The applications and the problems that could be solved with this new and emerging technology will likely shape humanity for the next 100 years and it is this growth is absolutely exhilarating.

References:

Ball, Philip, and Nature Magazine. "Google Moves Closer to a Universal Quantum Computer." *Scientific American*. N.p., 08 June 2016. Web. 23 Nov. 2016. <https://www.scientificamerican.com/article/google-moves-closer-to-a-universal-quantum-computer/>.