Madison Fichtner
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Quantum Computing Descriptions
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"Quantum computing is the area of study focused on developing computer technology based on the principles of quantum theory, which explains the nature and behavior and matter on the atomic and subatomic level." Quantum computers are different from binary digital computers in that they are unimaginably faster in their data processing powers and this is why quantum computing is the future of technological advancement and consumer electronics. The way that these computers can accomplish this is through quantum mechanics; this allows its qubits, or quantum bits, to be in a superposition state of either being a 1, 0, or both at the same time while a modern binary digital computers non-quantum bits can only be in one state at a time, a 1 or a 0. A traditional computer is only able to process one command or problem and their possible solutions at a time due to this bit constraint; while an ideal quantum computer would be able to explore every possible solution to a presented problem at the same time and decide which are the most viable within seconds. Therefore, making quantum computers far superior to modern computers and the currently readily available consumer technology. If current research and development continues to progress, we may see the development of consumer quantum computers within the next two decades.

Being able to process multiple things at a time with the use of a single computer would be something that would revolutionize the computer and technology industry. Creating something that can do this would involve the use of superposition, or as defined by dictionary.com, "..the act of superposing or state of being superposed.", or in other words, multiple states of something occurring at the same time and place in space. Quantum computing presents the opportunity for many things; such as advanced machine learning, simulation of advanced quantum physics, and simply much quicker computers. The hope for machine learning and advanced artificial intelligence may become a reality with the creation of quantum computing. Machine learning is dependent on manipulating and classifying insanely large numbers of problems efficiently and we currently cannot effectively achieve this. A computer that could work thousands of times faster than a modern computer and have the storage space necessary could possibly pave the way for computers to learn without the instruction of a human programmer. The desire of physicists to simulate advanced quantum physics problems is what led to the original conception of quantum computing.

There are still many things that must be accomplished before quantum computers become viable. The most difficult problem being faced right now is the development of the architecture of the components that will be comprised of hundreds of quantum bits that will allow quantum computing to occur, and their size and the space required to house the components. The delay is due mostly to the lack of capable hardware being a more ideal size at the current time. Following Moore's Law, the theory that the speed of integrated circuits would double every 18 months and the size of it would be cut in half; the necessary hardware to minimize the size of the computers to a commercially viable product will simply take time to develop, some estimate it to be about 20 years. The fore-runners in the field of developing quantum computing are who

would be expected; Google, Microsoft, IBM, many institutions such as MIT, and even some startup companies, and most notably a company named D-Wave.

D-Wave have built a quantum computer called the D-Wave 2X™. The 2X™ was tested against state of the art workstations and it was 3,600 times quicker than them, processing 100 solutions in half of a second while the workstations took a half an hour to do the same job. The 2X™ is roughly 10 feet in length, 7 feet wide, and 10 feet tall. It has a refrigeration system that keeps the processor which contains 1000 qubits, at a temperature of -273 degrees celsius, .015 degrees above absolute zero, which takes up most space in the computer's dimensions. The processor actually produces no heat, and is held in a high vacuum magnetic field that is 50,000x less strong than Earth's magnetic field, and is able to consider all possible answers to a problem and return them back to the user of the computer in the order of most optimal. An incredible accomplishment of the 2X™ is its ability to operate with far less power supplied than a traditional supercomputer, the 2X™ only requires 25kW while a supercomputer requires 3500kW. To put all of this into perspective, the 2X™ is one of first viable quantum computers and the hardware is doing nothing but advancing from here, and as stated before, if Moore's law holds steady we may see commercially available 2X™'s at a fraction of the size within 2 decades.

Quantum computing would and probably will cause an incredible leap in our ability to produce artificial intelligence as well as give computers the ability to learn new things without the instruction from a programmer. Machine learning is capable through a machine's ability to recognize patterns in computational learning and understand what is going on. A current example of machine learning is in the discussion of autonomous vehicles and their ability to recognize situations going on in their environment and being capable of avoiding accidents and disaster. Quantum computers would ideally be able to understand more of what is going on around them due to their ability to learn and adapt. If a car could predict and decide what is going on around it so that it can avoid causing injury to a human or causing a wreck, the futuristic idea of self driving cars may become more and more viable and possibly normal. The biggest problem with autonomy is that computers are not able to learn from past decisions it has made, and are unable predict and make decisions as naturally as a human can; but with quantum computing a vehicle's computer would be able to process what is happening in its environment and make decisions exponentially faster. Quantum Computing will hopefully lead to the advancement of human life and overall technology within our lifetimes. The dream of having self driving cars, interactive artificial intelligence, more precise medical and surgery, and technology that can eliminate human error in sensitive fields of work may be achieved through the usage of the incredible, quantum computer.

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