

The Possibility of Utilizing Quantum Computing for DNA Sequencing

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This paper critiques the research paper ‘**Algorithm for DNA sequence assembly by quantum annealing**,’ which primarily focuses on the algorithm proposed by Jugas et al. With the integration of quantum computing, it enables us to solve current problems in computer science in a fraction of the time it would take on a traditional computer. The paper discusses the utilization of quantum computers with an algorithm proposed by Jugas et al. Although its ability is only simulated to be correct, it can solve the classic 'Traveling Salesman Problem' and sequences for both artificial and actual DNA.

Due to the theoretical nature of this, since it has still only been hypothesized that this algorithm would work with quantum computing, we will have to take a closer look at his work and see if it would conceptually work for now. The authors hypothesized that by using Genomic Signal Processing, which takes a DNA sequence and converts it to a numerical value. Using this data, they use Pearson correlation coefficient to detect if there is any overlap between DNA by seeing the strength of association between two variables; finally, we formulate the assembly problem as an optimization task.

A classic example of using the Pearson correlation coefficient and formulating the assembly problem as an optimization task, is a way in which we can look at and try to solve the classic “Traveling Salesman Problem”. The assembly tool that was used to run the algorithm was based on de novo tools that include de Bruijn graph (DBG), overlap layout consensus (OLC), string graph, greedy, and hybrid algorithms that are currently the most advanced technology in DNA sequencing. This provides more accuracy and speed while sequencing. This is a well-known problem in Computer Science with no easy answer with our current technology. Next, they used their algorithm both on a classic computer and then compared the results with the

output of a “hybrid” method that combines both traditional computers with quantum computing to perform the calculations. To do this, a quantum annealer, by D-Wave, was used. Quantum annealer is a way we can use quantum computing to solve optimization problems.

The conclusion of the paper showed that the use of quantum annealer using the de novo assembly tools and the use of this algorithm proposed by Katarzyna Nałęcz-Charkiewicz* and Robert M. Nowak could be a viable solution based on the proposed method proposed by Jugas et al. With the use of Genomic Signal Processing, Pearson correlation coefficient, and the de novo assembly task, we have found a possible way to viably use quantum computing or, using the hybrid approach, to sequence DNA faster than traditional methods.

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