Paper: *Quantum Algorithm Implementations for Beginners*

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Quote

This review aims to explain the principles of quantum programming, which are quite different from classical programming, with straightforward algebra that makes understanding of the underlying fascinating quantum mechanical principles optional [J. et al. (2022)].

Overview

The paper "Quantum Algorithm Implementations for Beginners" is published through the collaboration of 34 authors. The paper discusses that in recent years there has been significant commercial and security interest and investment in quantum computing technology due to the continual advancements and the slowing down of standard hardware scaling rules [J. et al. (2022)]. Despite growing interest, many researchers and developers lack the understanding and access to quantum algorithms and their implementations [J. et al. (2022)]. The paper focuses on explaining and adapting classical programming to the principles of quantum programming. One of such algorithms discussed is Grover's Algorithm for searching. Moreover, the paper also expands on the overview of quantum computing methods and how they are applied to actual quantum hardware [J. et al. (2022)]. Finally, the paper concludes with a survey of 20 various quantum algorithms explaining the implementation's outcomes variations between the simulator and the actual hardware runs. The authors also provide clarification on potential difficulties and limitations encountered when implementing quantum algorithms.

Intellectual Merit

The paper focuses on the potential application of classical algorithms with quantum computers. On successful implementation, most of these classical algorithms exhibit extremely fast processing speeds. This growth in computation power has been one of the primary objectives for advancement in computing. Such progress expands the possibility of the generation of quantum algorithms and gives a new outlook to researchers for the generation of efficient algorithms. Moreover, the attempt of the author to generate clear explanations and methodologies has made the other researchers aware of the possibilities and working principles of quantum computing. This might result in researchers adapting their algorithms and thought processes to quantum principles. Furthermore, this paper also has the possibility to expand the field of quantum computing and generate enthusiasm among new researchers in computer science.

Broader Impact

Through the paper, the authors have validated that the current developments in quantum computing have the ability to pave the way for the acceptance and use of quantum computers. When attempting to solve real-world problems, these Quantum algorithms offer significant performance improvement. With the use of computers almost essential in every field, the improvement in computation power will have a drastic impact on people's lives. These improvements could have a significant impact on domains such as computational biology, chemistry, medicine, physics simulation, software engineering, and many others.

Keywords Quantum Computer, Quantum Circuit, Classical Algorithms, Quantum Algorithms, Grover's Algorithm

Open Questions

- The authors of the paper have discussed the implementation of various classical algorithms with quantum computers. Is there a possibility to adapt all known classical algorithms to quantum algorithms?
- Many of the algorithms presented in the paper mention that the probabilistic output has low accuracy. How will such low output accuracy be adopted in the real-world implementation?

References

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