# Qeios

Peer Review

# Review of: "Quantum Meets SAR: A Novel Range-Doppler Algorithm for Next-Gen Earth Observation"

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Authors try to apply the quantum Fourier transform algorithm to speed up the process of synthetic aperture radar data processing over the classical FFT counterpart. The paper requires detailed explanations for many sections to improve clarity, credibility, and reproducibility of the proposed work. Below are a few specific comments to the authors.

In section II.B, authors mention that when a qubit is measured, it will be found in one of the basis states, and this quality of superposition is central to quantum computing, which is ambiguous. In section II.D, operators A and U are used without maintaining consistency in notation. Rewriting section II would be good to improve the quality of the paper.

In section III, authors list a set of equations where most of the symbols and notations are not explained clearly. Each term needs to be explicitly explained and elaborated for the reader to avoid incorrect inference.

Adding a specific example to elucidate how amplitude encoding is achieved in section IV is required. The section only provides a generic definition of amplitude encoding and does not clearly depict how it is employed and/or exploited in the proposed work.

Figures 1 and 3, and the explanation provided in section VI, need to be consistent and explained in detail. More theoretical background with a specific example needs to be provided, for example, in equation 5, what does the "big plus" symbol mean? Is it modulo addition? Is it summation? Similarly, how is phase correction captured in the RCMC block?

Furthermore, authors need to provide the specific quantum circuit being used for the implementation rather than a generic QFT diagram.

The paper needs more technical depth and a study of existing methods used, if any, in the relevant area,

including more relevant citations. For example, how different is this work from the work reported in the paper https://www.nature.com/articles/s41598-023-38611-x (Quantum range-migration-algorithm for synthetic aperture radar applications).

Authors' claim that QFT acts as a speedup tool is not substantiated with quantitative results. For the data set verified, how much speed-up was observed in comparison to the FFT algorithm? The claim of hardware executability in the conclusion needs more explanation in the results, as the work is simulation-based, and all circuits that are implemented in a simulator cannot be realized in the existing hardware. A miniature version hardware test of the algorithm would be a good addition to improve the quality and credibility of the paper.

Hope this review encourages the authors to revise and improve subsequent versions.

## Declarations

**Potential competing interests:** No potential competing interests to declare.