

Quantum Algorithms for Smart Agriculture Optimization in Potato Farming and Water Resource Management

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Abstract:

Smart agriculture is rapidly evolving with the integration of advanced computational technologies aimed at enhancing crop yield, resource efficiency, and sustainability. This paper investigates the application of quantum algorithms for optimizing potato farming and water resource management in IoT-enabled agricultural systems. By leveraging quantum-inspired techniques such as the Quantum Approximate Optimization Algorithm (QAOA) and Quantum Machine Learning (QML), the study enhances the efficiency of data processing and decision-making in complex agricultural environments. The proposed framework incorporates real-time data from soil sensors, weather stations, and irrigation systems to predict crop needs, manage irrigation schedules, and minimize water usage without compromising crop productivity. Experimental simulations demonstrate that quantum algorithms outperform classical heuristics in terms of computational speed and optimization quality, offering a transformative approach for sustainable agriculture. This research underscores the potential of quantum computing in addressing pressing challenges in agricultural optimization, particularly in water-scarce regions.

Keywords:

quantum algorithms, smart agriculture, potato farming, water resource management, IoT, optimization

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