

IoT and Smart Agriculture Systems Optimization Using Machine Learning and Metaheuristics Algorithms

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Abstract:

Smart agriculture systems, powered by IoT, offer significant potential for optimizing resource usage and increasing crop yield efficiency. This study presents an optimization framework that combines IoT technologies with machine learning and metaheuristics algorithms to enhance agricultural operations. IoT sensors are deployed across agricultural fields to collect real-time data on soil moisture, temperature, humidity, crop health, and environmental factors. Machine learning models, such as Random Forests and Support Vector Machines (SVM), are applied to analyze this data and predict crop growth, irrigation needs, and pest infestations. Additionally, metaheuristic algorithms, including Genetic Algorithms (GA) and Particle Swarm Optimization (PSO), are used to optimize irrigation schedules, fertilization strategies, and resource allocation. The system dynamically adapts to environmental changes, improving yield predictions, reducing waste, and supporting sustainable farming practices. Experimental results demonstrate the effectiveness of this hybrid framework in increasing crop productivity while minimizing resource consumption.

Keywords:

IoT, smart agriculture, machine learning, metaheuristics, optimization, resource management.

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