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Smart Cities Energy Efficiency Optimization Through Machine Learning and Metaheuristics Algorithms

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Abstract:

The increasing energy demands in urban environments necessitate innovative strategies for achieving energy efficiency in smart cities. This research investigates the integration of machine learning (ML) techniques and metaheuristic algorithms to optimize energy consumption, distribution, and management within smart city infrastructures. By employing predictive models, such as decision trees and support vector machines, alongside optimization strategies like genetic algorithms and particle swarm optimization, the proposed framework dynamically manages energy resources based on real-time data from IoT sensors. Experimental results using simulated smart city datasets demonstrate improvements in load balancing, peak demand prediction, and overall energy savings. The study contributes a hybrid intelligent approach that enhances sustainability and resilience in urban energy systems.

Keywords:

Smart cities, energy efficiency, machine learning, metaheuristics, energy optimization, IoT.

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