

Smart City CO₂ Reduction Using Deep Learning and Metaheuristic Algorithms for Urban Planning Optimization

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Abstract:

With the rapid urbanization and increasing carbon emissions in metropolitan areas, there is a growing demand for intelligent solutions that support sustainable urban planning. This study presents a hybrid optimization framework that integrates deep learning models with metaheuristic algorithms to reduce CO₂ emissions in smart cities. The framework analyzes urban mobility patterns, energy consumption, and infrastructure usage through data collected from IoT-enabled sensors. Deep learning techniques, such as Long Short-Term Memory (LSTM) networks and Convolutional Neural Networks (CNNs), are employed to forecast emission trends. Simultaneously, metaheuristic algorithms—including Particle Swarm Optimization (PSO) and Genetic Algorithms (GA)—optimize traffic flow, energy allocation, and green infrastructure planning. The proposed system demonstrates significant emission reduction potential and offers strategic insights for policymakers aiming to implement sustainable urban development initiatives.

Keywords:

Smart city, CO₂ reduction, deep learning, metaheuristic algorithms, urban planning, sustainability.

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