Journal of Computer Science and Information Systems,

ISSN 2535-1451

# Advanced Neural Networks for $CO_2$ Emission Reduction in Smart Cities Energy Optimization Systems

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**Abstract:**

As urbanization accelerates and environmental concerns intensify, the reduction of carbon dioxide ($CO_2$) emissions has become a critical objective in the development of smart cities. This research investigates the application of advanced neural network architectures to optimize energy systems for minimizing $CO_2$ emissions. The proposed model integrates real-time urban energy consumption data with predictive neural networks to enhance energy distribution efficiency, promote renewable energy integration, and reduce reliance on fossil fuels. By employing deep learning techniques, including convolutional and recurrent neural networks, the system forecasts emission patterns, identifies energy inefficiencies, and suggests adaptive control strategies for intelligent energy management. Simulation results across various smart city scenarios indicate significant improvements in emission reduction and energy utilization efficiency, positioning the model as a key enabler in sustainable urban development.

**Keywords:**

$CO_2$ emission reduction, smart cities, neural networks, energy optimization, deep learning, sustainable development

ISSN 2535-1451

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