

Smart Cities Energy Consumption Forecasting Using Deep Learning and Optimization Algorithms

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Abstract:

The integration of deep learning and optimization algorithms is revolutionizing energy consumption forecasting in smart cities, enabling more accurate predictions and efficient energy management. Advanced models such as Long Short-Term Memory (LSTM) networks, Transformer-based architectures, and hybrid approaches combining Seasonal Autoregressive Integrated Moving Average (SARIMA) with Grey Wolf Optimization (GWO) have demonstrated superior performance in capturing complex temporal patterns and seasonal fluctuations in energy usage. For instance, a study employing a GWO-SARIMA-LSTM model achieved a 15% reduction in prediction error, highlighting the effectiveness of hybrid models in enhancing forecasting accuracy [cite]turn0academia19[. These methodologies not only improve the reliability of energy demand predictions but also support the development of sustainable and resilient urban infrastructures by facilitating proactive energy management strategies.

Keywords: Smart Cities, Energy Consumption Forecasting, Deep Learning, LSTM, Optimization Algorithms, Sustainable Urban Infrastructure

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