

Deep Learning Applications in Renewable Energy Grid Optimization and Sustainability Practices

Nizar M. Soufian, Sofia Arkhstan, Weiguo Gee

1. Palestine Polytechnic University, Technology department, Palestine
2. Department of Computer System, South Ural State University, 454080 Chelyabinsk, Russia
3. School of Computer System, Hebei University of Engineering, Handan, Hebei, 056038, China

Abstract:

The global transition towards renewable energy sources necessitates the development of intelligent systems capable of managing complex and dynamic energy grids. This study investigates the application of deep learning techniques to optimize the operation and integration of renewable energy within modern power grids. By analyzing large-scale datasets from solar, wind, and other renewable sources, deep learning models—such as convolutional neural networks (CNNs) and recurrent neural networks (RNNs)—are employed for accurate energy demand forecasting, fault detection, and real-time grid balancing. These models enhance decision-making processes in energy distribution and contribute to the stability and reliability of the grid. Furthermore, the integration of deep learning into sustainability practices promotes energy efficiency, reduces dependence on fossil fuels, and supports carbon-neutral goals. The findings indicate that deep learning offers transformative potential for optimizing renewable energy systems and advancing sustainable development initiatives.

Keywords:

Deep learning, renewable energy, smart grid, sustainability, energy optimization, forecasting.

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