#### ISSN 2535-1451

### Neural Networks for Sustainable Energy Optimization in Smart Cities Through IoT Applications

Nader Behdad, Weiguo Gee, Wang Zhang

- 1. Electrical and Computer Engineering, The Polytechnic University of the Philippines, Manila, 1016, Philippines
- 2. School of Computer System, Hebei University of Engineering, Handan, Hebei, 056038, China
- 3. School of Earth and Space Sciences, Peking University, Beijing, 100871, China

#### Abstract:

As urbanization increases, the need for sustainable energy solutions in smart cities becomes critical. This study investigates the application of neural networks for optimizing energy systems in smart cities using IoT-based technologies. The research integrates IoT sensors to collect real-time data on energy consumption, renewable energy generation, and environmental factors. Neural network models are then employed to analyze this data and make real-time predictions, enabling dynamic energy management. The proposed approach aims to optimize energy distribution by predicting demand patterns, identifying inefficiencies, and suggesting energy-saving strategies. By leveraging deep learning algorithms, the system can dynamically adjust the energy grid, enhance the integration of renewable energy sources, and reduce carbon footprints. The study highlights the potential of IoT and neural networks to create intelligent energy management systems that contribute to sustainability goals and improve the overall efficiency of smart cities.

### **Keywords:**

Neural networks, sustainable energy, smart cities, IoT, energy optimization, renewable energy.

# **REQUEST FOR FULL TEXT**

## REFERENCES

- El-Kenawy, E. S. M., Eid, M. M., Saber, M., & Ibrahim, A. (2020). MbGWO-SFS: Modified binary grey wolf optimizer based on stochastic fractal search for feature selection. IEEE Access, 8, 107635-107649.
- [2] El-Kenawy, E. S., & Eid, M. (2020). Hybrid gray wolf and particle swarm optimization for feature selection. Int. J. Innov. Comput. Inf. Control, 16(3), 831-844.
- [3] El-Kenawy, E. S. M., Khodadadi, N., Mirjalili, S., Abdelhamid, A. A., Eid, M. M., & Ibrahim, A. (2024). Greylag goose optimization: nature-inspired optimization algorithm. Expert Systems with Applications, 238, 122147.
- [4] Abdollahzadeh, B., Khodadadi, N., Barshandeh, S., Trojovský, P., Gharehchopogh, F. S., El-kenawy, E. S. M., ... & Mirjalili, S. (2024). Puma optimizer (PO): a novel metaheuristic optimization algorithm and its application in machine learning. Cluster Computing, 27(4), 5235-5283.
- [5] Khodadadi, N., Khodadadi, E., Al-Tashi, Q., El-Kenawy, E. S. M., Abualigah, L., Abdulkadir, S. J., ... & Mirjalili, S. (2023). BAOA: binary arithmetic optimization algorithm with K-nearest neighbor classifier for feature selection. IEEE Access, 11, 94094-94115.
- [6] Khodadadi, N., Abualigah, L., El-Kenawy, E. S. M., Snasel, V., & Mirjalili, S. (2022). An archive-based multi-objective arithmetic optimization algorithm for solving industrial engineering problems. IEEE Access, 10, 106673-106698.
- [7] El-Kenawy, E. S. M. T., & SM, E. (2019). A machine learning model for hemoglobin estimation and anemia classification. International Journal of Computer Science and Information Security (IJCSIS), 17(2), 100-108.
- [8] El-kenawy, E. S. M. T. (2018). Solar radiation machine learning production depend on training neural networks with ant colony optimization algorithms. International Journal of Advanced Research in Computer and Communication Engineering (IJARCCE), 7(5), 1-4.
- [9] Hassib, E. M., El-Desouky, A. I., Labib, L. M., & El-Kenawy, E. S. M. (2020). WOA+ BRNN: An imbalanced big data classification framework using Whale optimization and deep neural network. soft computing, 24(8), 5573-5592.
- [10] Kaveh, A., Talatahari, S., & Khodadadi, N. (2019). The hybrid invasive weed optimization-shuffled frog-leaping algorithm applied to optimal design of frame structures. Periodica Polytechnica Civil Engineering, 63(3), 882-897.
- [11] Khodadadi, N., Abualigah, L., & Mirjalili, S. (2022). Multi-objective stochastic paint optimizer (MOSPO). Neural Computing and Applications, 34(20), 18035-18058.
- [12] Kaveh, A., Talatahari, S., & Khodadadi, N. (2022). Stochastic paint optimizer: theory and application in civil engineering. Engineering with Computers, 1-32.
- [13] Khodadadi, N., & Mirjalili, S. (2022). Truss optimization with natural frequency constraints using generalized normal distribution optimization. Applied Intelligence, 52(9), 10384-10397.
- [14] Khodadadi, N., Soleimanian Gharehchopogh, F., & Mirjalili, S. (2022). MOAVOA: a new multi-objective artificial vultures optimization algorithm. Neural Computing and Applications, 34(23), 20791-20829.
- [15] Khodadadi, N., Abualigah, L., Al-Tashi, Q., & Mirjalili, S. (2023). Multi-objective chaos game optimization. Neural Computing and Applications, 35(20), 14973-15004.