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Smart Cities CO₂ Emission Reduction Optimization Through IoT-Based Machine Learning Algorithms

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Abstract:

The growing challenge of climate change has made CO_2 emission reduction in urban areas a critical goal for achieving sustainable development. Smart cities, utilizing the Internet of Things (IoT) and advanced machine learning algorithms, offer innovative solutions for monitoring, predicting, and minimizing CO_2 emissions. This study focuses on integrating IoT-based sensors for real-time monitoring of environmental variables, combined with machine learning models to optimize energy consumption and reduce emissions across key urban sectors. By employing data-driven approaches, including regression analysis, neural networks, and reinforcement learning, the research proposes optimization strategies for energy usage in transportation, buildings, and industrial activities. The system showcases its potential to significantly reduce emissions while improving the efficiency of urban infrastructure. Performance metrics are provided to assess the effectiveness of the algorithm in predicting CO_2 levels and optimizing emission control processes.

Keywords:

Smart cities, CO₂ emission reduction, machine learning, IoT, optimization, energy efficiency

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.