Enhancing Waste Management: Smart Classification with Hybrid CNN-LSTM and Transfer Learning

125018039 Karunya R V
125018041 Kanchanapalli Leelankitha
125018047 Nirupama N

ABSTRACT

Waste management has become more important than ever in mitigating pollution and helping the sustainable environment occur through industrialization and the development of smart cities. Accurate identification of waste characteristics as they occur in their natural state, guarantees effective recycling. In recent times, deep learning methods have been employed in enhancing varied processes in waste management in aspects of capture, classification, composting, and dumping. However, the selection of the most appropriate DL approach for waste classification is not easy. In this paper, an advanced approach is proposed for waste classification with a Hybrid CNN-LSTM model using transfer learning, which classifies wastes into two major categories: recyclable and organic. This hybrid model combines the strengths of Convolutional Neural Networks (CNN) and Long Short-Term Memory (LSTM) networks and uses transfer learning on ImageNet to improve the accuracy in classification and provides forecasting. The improved data augmentation process would resolve various issues related to overfitting and data sampling. As far as the experimental analysis of the TrashNet dataset is concerned, there are images divided into shots of organic and recyclable waste. The proposed hybrid model is implemented in MATLAB and evaluated according to several performance metrics such as precision, recall, testing and training loss, and accuracy. Results indicate that this model outperforms the existing DL methods in terms of precision and major improvement with regard to waste classification and management. Improving classification processes by this approach supports environmental sustainability and boosts recycling and waste disposal efficiency. The combination of CNN with an LSTM network makes for an extremely robust framework for the management of heterogeneous data about wastes aimed at ensuring reliable and scalable classification and forecasting in real-world applications.

REFERENCES

1. Lilhore, U. K., Simaiya, S., Dalal, S., & Damaševičius, R. (2023). A smart waste classification model using hybrid CNN-LSTM with transfer learning for sustainable environment. Springer, 83, 29505–29529. https://doi.org/10.1007/s11042-023-16677-z
2. Mohammed, M. A., Abdulhasan, M. J., Kumar, N. M., Abdulkareem, K. H., Mostafa, S. A., Maashi, M. S., Khalid, L. S., Abdulaali, H. S., & Chopra, S. S. (2023). Automated waste-sorting and recycling classification using artificial neural network and features fusion: A digital-enabled circular economy vision for smart cities. *Springer*, 82, 39617–39632. https://doi.org/10.1007/s11042-021-11537-0

GUIDE NAME : DR. NITHYA R

GUIDE SIGNATURE :