

Deep Learning for Intelligent Waste Sorting in Sri Lanka: A Conceptual Review

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Abstract

Urban waste management in Sri Lanka is increasingly challenged by rising waste volumes, reliance on manual sorting, and inefficient collection systems. This review paper aims to examine how deep learning, particularly Convolutional Neural Networks (CNNs), has been applied in global studies for intelligent waste classification and to assess its potential applicability in the Sri Lankan context. A systematic survey of recent research highlights models such as lightweight CNNs, VGG16, DenseNet, and hybrid CNN-SVM approaches, which report accuracies exceeding 90% across datasets like TrashNet. Techniques including transfer learning, data augmentation, and optimization methods have been widely adopted to improve model generalization and real-time usability. The review identifies key opportunities for Sri Lanka, including the use of localized datasets, cost-effective deployment without reliance on IoT infrastructure, and mobile or web-based platforms for citizen and municipal use. However, most reported studies are based on controlled datasets not reflective of Sri Lanka's waste profile, and no significant local implementation has yet been reported. This limitation emphasizes the need for future work on dataset creation, model adaptation, and real-world evaluation under local conditions. The paper concludes that while deep learning offers strong potential to enhance waste classification, further research and pilot projects are essential to translate these global advancements into practical, sustainable solutions for urban Sri Lanka.

Keywords: Waste classification, Deep learning, Convolutional Neural Networks, Urban waste management, Sri Lanka