

# A Deep Learning Approach to Intelligent Waste Classification

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**Abstract:** *As the difficulties associated with waste management escalate due to urban growth and industrialization, there is a growing need for an automated system to classify waste for effective waste management. This research presents an innovative deep learning model that categorizes six distinct types of waste through the Recycling Waste Classification Network (RWCKT), utilizing a dataset of 2,527 trash items. Incorporating advanced conventional neural networks (CNNs) and an adaptive learning methodology, RWCNet achieves an overall accuracy of 95.01%, surpassing current techniques. The model also shows impressive F1-scores across all waste categories, highlighting its strength and dependability. Score-CAM (class activation mapping) is employed to provide visual interpretability, giving clarity into its decision-making process. Furthermore, we advocate for the RWC's incorporation into a real-time waste management framework by merging image, text, and voice recognition for enhanced user engagement. This research emphasizes the diverse possibilities of artificial intelligence in waste management, promoting more effective recycling practices and environmental sustainability*

**Keywords:** Waste Management, Recycling, Waste Sorting, Multi-Label Sorting, Convolutional Neural Network (CNN), Advanced Learning Techniques

