ECO SORT – ADVANCED WASTE CLASSIFICATION SYSTEM

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Abstract

Effective waste management and recycling plays a pivotal role in mitigating environmental pollution and fostering sustainability. Existing waste classification methods employing machine learning can identify waste categories such as glass, cardboard, and metal; however, they often fall short in differentiating recyclable from non-recyclable items within these categories. This study aims to investigate the development of an advanced waste classification model capable of not only identifying waste categories but also determining their recyclability status using deep Convolutional Neural Networks (CNNs).

Previous research in the waste classification domain has primarily focused on recognizing waste materials but has not extensively addressed the recyclability aspect. In this study, we will build upon prior work and expand the scope to include recyclability detection. The dataset used for this research will consist of images from the TACO dataset, supplemented with additional images from other sources, resulting in a moderately-sized dataset encompassing various waste categories and their recyclability status. The dataset will be preprocessed, annotated, and partitioned into training, validation, and testing sets.

Convolutional Neural Networks (CNNs) are ideal for waste classification and recyclability detection tasks due to their ability to learn and capture hierarchical patterns and features in images. CNNs consist of convolutional layers, pooling layers, and fully connected layers that can extract and process complex patterns from raw image data. This hierarchical feature extraction is particularly useful for tasks like waste classification, where the model needs to identify and distinguish between different waste materials and their recyclability status.

In earlier relative models, CNNs have demonstrated promising results in waste classification tasks. Researchers have used various CNN architectures like VGG, ResNet, DenseNet, and MobileNet for waste classification problems, achieving high classification accuracy and other performance metrics. For instance, models have achieved accuracy levels above 90% for waste material classification tasks, which indicates their potential for accurately classifying waste materials.

However, most of these earlier models have focused on identifying waste materials without considering their recyclability status. By incorporating the recyclability aspect into our proposed model, we aim to further improve the performance of waste classification systems and provide more valuable information for waste management purposes.