EDUNET FOUNDATION – AICTE PROJECT

Task 1: Problem Identification and Planning

Theme: AI/ML in Sustainability
Project Title: Waste Classification using CNN for Smart Recycling
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1. Introduction

Sustainable waste management has become one of the major global challenges due to the rapid increase in solid waste generation. Improper waste segregation contributes to land pollution, health hazards, and environmental degradation. To address this issue, Artificial Intelligence and Machine Learning can play a crucial role in developing automated waste classification systems. This project focuses on using Convolutional Neural Networks (CNNs) to automatically identify different types of waste and assist in efficient recycling.

2. Problem Statement

Waste segregation is often performed manually, which is time-consuming, unhygienic, and prone to human error. Lack of automation in this process leads to inefficient recycling and excessive landfill use. There is a strong need for a smart and automated system that can accurately classify waste into different categories such as organic, recyclable, and non-recyclable materials. This project proposes an image-based classification approach using CNN to enable smart recycling and promote environmental sustainability.

3. Objectives

To design and implement a CNN model capable of classifying waste images automatically.To promote sustainable waste management through AI-driven automation.To support recycling initiatives and reduce human intervention in waste segregation.To improve classification accuracy through proper data preprocessing and model tuning.

4. Methodology

The methodology involves five key stages: dataset selection, data preprocessing, model building, training, and evaluation. An open-source waste classification dataset from Kaggle will be used, containing labeled images of organic and recyclable waste. Images will be resized, normalized, and augmented to improve model robustness. The CNN architecture will include multiple convolutional and pooling layers followed by dense layers for classification. The model will be trained using TensorFlow/Keras, and evaluated based on accuracy, loss, and confusion matrix. Optimization techniques such as dropout and learning rate scheduling will be applied to enhance model performance.

5. Dataset Information

Since the dataset tab in the Edunet portal currently does not display any data, an alternative dataset is selected from Kaggle: the Waste Classification Dataset (https://www.kaggle.com/datasets/techsash/waste-classification-data). This dataset contains around 25,000 images divided into two main categories—Organic and Recyclable. Each image is in JPG format and represents real-world waste materials. This dataset is suitable for CNN training and helps simulate an automated waste segregation system.

6. Expected Outcome

The expected result is a trained CNN model capable of classifying waste images into appropriate categories with a predicted accuracy of approximately 90–95%. The model will assist in automating waste segregation processes and can be integrated with smart bins or IoT-based systems in the future. This will help in improving recycling efficiency, reducing manual labor, and promoting cleaner cities.

7. Sustainable Development Goals (SDGs) Addressed

SDG 12 – Responsible Consumption and Production: Encourages proper waste management and recycling.**SDG 13 – Climate Action:** Reduces environmental impact through sustainable waste processing.

8. Conclusion

This project highlights the potential of Artificial Intelligence in promoting environmental sustainability. By leveraging CNNs for waste classification, it aims to create a foundation for smarter waste management systems that minimize pollution and optimize recycling processes. This initiative not only supports sustainable development goals but also contributes to building a cleaner and greener future.