Idea proposal Submission

Real-Time Recycling Sorting Using Deep Learning

Group no: Group 8

Group Members:

1. Tekia Tekle
2. Firehiwet Zerihun
3. Biniyam Demissew
4. Daniel Alemu
5. Eyob Sisay
6. Haymanot Tamrat

Real-Time Recycling Sorting Using Deep Learning

1. Project Idea

The goal of this project is to develop an automated system that uses deep learning-based computer vision to classify and sort recyclable materials (e.g., plastic, paper, metal, glass) in real time. Manual sorting methods are slow, labor-intensive, and prone to errors, leading to inefficient recycling. This AI-powered system will improve sorting accuracy, reduce contamination, and enhance recycling efficiency.

2. Relevance to Sustainable Development Goals (SDGs)

This project aligns with:

Primary Alignment:

- SDG 12 (Responsible Consumption and Production): Promotes sustainable waste management by increasing recycling rates.

Secondary Alignment:

- SDG 13 (Climate Action): Reduces landfill waste and associated greenhouse gas emissions.
- SDG 11 (Sustainable Cities and Communities): Reduce the environmental impact of cities; Promotes cleaner cities by reducing improper waste disposal.

3. Literature Examples

1. "Real-Time Household Waste Detection and Classification Using Deep Learning" (2023) – Uses the YOLOv8 model to sort household waste into 17 categories. Designed for smart bins and robotic waste sorting

2. "Real-Time Recycling Material Detection with CNNs" (2022) – A CNN-based system that sorts paper, plastic, metal, and carton on a conveyor belt

4. Data Description

- Dataset: Publicly available datasets (e.g., TrashNet, Kaggle Waste Images) containing labeled images of recyclable materials.
- Data Format: JPEG/PNG images (224x224 pixels for model input).
- Data Size: ~10,000 images across multiple waste categories.
- Preprocessing: Image resizing, normalization, and augmentation (rotation, flipping) to enhance model robustness.

5. Approach (Deep Learning)

- Model: A Convolutional Neural Network (CNN) will be trained for image classification, with potential fine-tuning using transfer learning (e.g., ResNet, EfficientNet).
- Justification: CNNs are highly effective for image recognition tasks, and deep learning allows for high accuracy in complex sorting scenarios.
- Deployment: The system will be optimized for real-time performance, enabling integration with conveyor belts or smart bins in recycling facilities.

Expected Outcomes:

- Improved Sorting Accuracy: Target ≥90% classification precision.
- Cost Efficiency: Reduces reliance on manual labor, lowering operational costs.
- Scalability: Can be adapted for use in municipal recycling programs worldwide.