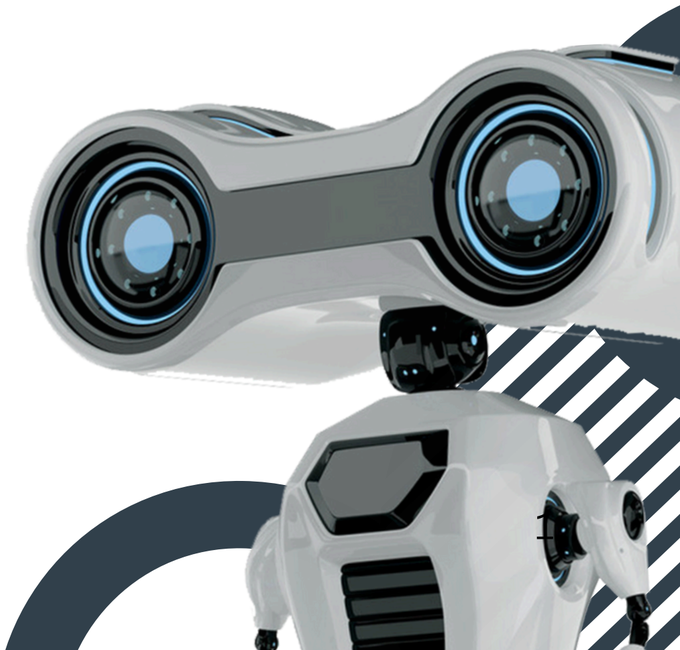
Garbage Classification

SUBJECT: ARTIFICIAL INTELLIGENCE

Lecturer: Mr. Ngin Kimlong

Members: YORY Sreykhuoch and SROY Liza



Overview

Introduction

Garbage classification is an important challenge in modern waste management systems, as improper sorting of waste can cause environmental pollution and reduce recycling efficiency. Traditional manual garbage sorting methods are time-consuming, labor-intensive, and often inaccurate due to human error. With the increasing amount of waste generated in urban areas, there is a growing need for an automated solution that can classify garbage efficiently and accurately. Advances in deep learning, particularly Convolutional Neural Networks (CNNs), have shown strong performance in image classification tasks.

Problem Statement

- Proper garbage sorting is essential for effective recycling and environmental protection.
- Manual waste classification is time-consuming, inefficient, and prone to human error.
- Different types of waste often look visually similar, making classification difficult.
- There is a need for an automated system that can accurately classify garbage using images.

Objective

Main Objective

- To design and implement a Convolutional Neural Network (CNN) for automatic garbage image classification.

Specific Objectives

- To preprocess garbage image data for CNN input
- To design a CNN architecture from scratch using PyTorch
- To train the CNN model using labeled image data
- To evaluate the model performance using accuracy

Methodology

- Collect and organize garbage images by class folders
- Resize images to a fixed input size
- Apply image transformations and tensor conversion
- Split data into training and testing sets
- Train CNN model using supervised learning
- Evaluate model performance on test data

About Dataset

Dataset Description

- TrashNet dataset (2527 images)
- 6 classes includes Cardboard , Trash , Plastic, Paper ,Metal , Glass
- Dataset challenges

Image Preparation

- All images resized to 64 × 64 pixels
- Converted to RGB format
- Pixel values normalized to improve training stability

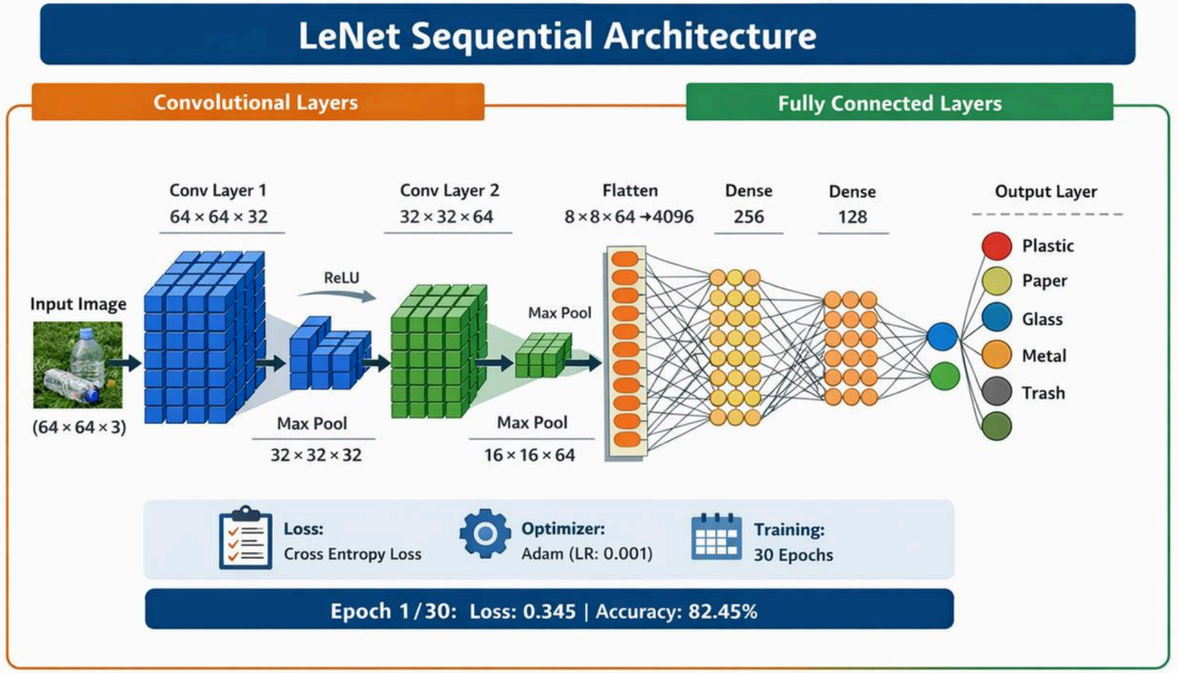
Data Augmentation (Training Only)

- Random horizontal flipping
- Random rotation (±15°)
- Color jitter (brightness & contrast variation)

Model Design (CNN Architecture) & Training

key points:

- Input: 3 × 64 × 64 RGB image
- Feature extraction: 2 Conv layers + ReLU + MaxPooling
- Flattening before classification
- Fully connected layers: 256 → 128 → 6 (output classes)
- Loss: CrossEntropyLoss
- Optimizer: Adam, LR = 0.001
- Training: 30 epochs, mini-batch DataLoader, backpropagation
- Metrics: Training accuracy per epoch



Experimental Results

Dataset	Metric	Value
Training Set	Accuracy	87.00%
Testing Set	Accuracy	70.00%
Total Epochs	Epochs	30
Optimizer	Adam	lr = 0.001

Conclusion

- CNN model successfully classifies garbage images
- Network design is simple and effective
- Model demonstrates strong understanding of CNN architecture
- Suitable as a foundation for real-world waste classification systems

Thank You