Project Overview: Garbage Classification Using Deep Learnings

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1. Introduction

This project focuses on using deep learning for image classification to distinguish between different categories of garbage. The system utilizes TensorFlow and Keras to build and train a Convolutional Neural Network (CNN) that can identify and classify garbage images with high accuracy.

2. Problem Statement

The main goal is to develop a model that can automatically classify garbage into its respective categories using labeled image data. This automation helps in promoting efficient waste sorting and recycling, reducing manual effort, and supporting environmental sustainability.

3. Methodology

1. Data Loading: Load images categorized in class-specific folders.
2. Preprocessing: Resize images, normalize pixel values, and split into training and validation datasets.
3. Model Design: Build a CNN using Keras, including layers like Conv2D, MaxPooling, Flatten, and Dense.
4. Model Compilation: Use loss functions, optimizers (e.g., Adam), and evaluation metrics for configuration.
5. Training: Train the model on the prepared dataset while monitoring performance on validation data.
6. Evaluation & Prediction: Evaluate the trained model using test data and predict categories for new images.

4. Tools and Libraries

- Data Handling: os, pandas, numpy
- Visualization: seaborn, matplotlib
- Image Processing: cv2 (OpenCV)
- Deep Learning Frameworks: tensorflow, keras
- Data Augmentation & Evaluation: ImageDataGenerator, sklearn

5. Core Functional Blocks

While the document shows several 'Function Blocks' without detailed description, they likely represent:
- Data ingestion and preprocessing functions
- Model construction code
- Training loop
- Evaluation scripts
- Prediction logic
- Visualization routines

6. Conclusion

This project demonstrates the application of CNNs for environmental and smart city use cases, particularly garbage classification. It emphasizes deep learning's capability to automate and improve accuracy in tasks that traditionally require manual work.