

## Task 1 Report

# Task 1: Edge AI Prototype — Recyclable Item Classifier

**Author:** Davis Onger

**Tools Used:** TensorFlow, TensorFlow Lite, Python, PIL

**Simulation:** Local machine (can be deployed to Raspberry Pi or Colab)

## Goal

The goal of this project was to:

1. **Train** a lightweight image classification model to recognize **recyclable vs. non-recyclable** items.
2. **Convert** the trained model to **TensorFlow Lite** format for edge deployment.
3. **Test** the converted model on a sample image.
4. **Explain** the relevance of Edge AI in real-time applications.

## Step-by-Step Deliverables

### 1. Dataset Preparation

- Directory: `dataset/`
  - └─ `recyclable/` and `non_recyclable/` folders containing images.
- Images resized to **128×128** and split:
  - **80% for training**
  - **20% for validation**

### 2. Model Training

- A lightweight **CNN model** with:
  - 2 Conv2D + MaxPooling layers
  - Flatten + Dense(64) + Sigmoid output
- Compiled using **binary\_crossentropy** and **Adam optimizer**
- Trained for **5 epochs**
- Final accuracy:
  - **Training Accuracy:** ~75–100% (overfitting likely due to small dataset)
  - **Validation Accuracy:** 50%

*Note: Performance was limited due to the small dataset. More data and augmentation would improve results.*

### 3. TensorFlow Lite Conversion

- Converted **.h5** model to **.tflite** using **TFLiteConverter**
- Verified conversion logs and saved as:
  - **recyclable\_classifier.tflite**

### 4. Inference on Sample Image

- Image resized to 128×128, normalized and passed through TFLite interpreter





Output:

item1.jpeg → Prediction: Recyclable



## Edge AI Benefits for Real-Time Applications

Feature	Benefit
<b>Low Latency</b>	Makes decisions instantly without sending data to the cloud

-  **Offline Usage** Works in remote areas without internet
-  **Data Privacy** Keeps sensitive data local (e.g., face, health)
-  **Power Efficiency** Models are optimized for low-resource environments like Raspberry Pi
-  **Reduced Costs** Avoids recurring cloud computation and storage fees

## Summary

Component	Description
Model	CNN with 2 conv layers
Dataset	10 images, 2 classes
Training Accuracy	~75–100%
Validation Accuracy	<b>50%</b> (limited by dataset size)
Edge Format	<code>.tflite</code> model generated
Test Prediction	Output generated for test image

## Conclusion

Despite using a small dataset, this project demonstrates a complete **Edge AI pipeline**: training, optimizing, and deploying an image classifier on resource-constrained environments. The working prototype can be scaled up with a larger dataset and deployed to devices like Raspberry Pi for real-world recycling awareness and waste management systems.