

# AI-based detection of items of waste in an image

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## Problem Statement

### Usage of AI to detect Waste in an image.

- A huge amount of solid waste is generated every day in our country. This waste is manually segregated, and then burned/recycled. Due to the intense labour involved, this process is very slow.
- Hence, develop an algorithm to analyse images of solid waste and train a Machine Learning model for waste classification.



## Prototype

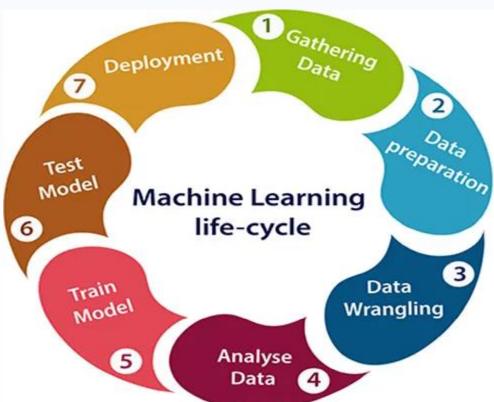
- The AI model is built on **Python** programming language, using **TensorFlow** and **Keras** libraries to define and set up a **Convolutional Neural Network (CNN)** model for image classification.
- The **ResNet-50 V2** architecture was trained with the preprocessed data. The model was optimized by experimenting with different learning rates, batch sizes and other parameters.
- Finally, deployment involves creating an API for **real-time image analysis**, to develop efficient detection through our model.



## Methodology

The AI model developed has the following flow of processes-

- Input**
  - Image Data collection
- Workflow**
  - Data Preprocessing
  - Model Building
  - Model Training
  - Model Evaluation
- Output**
  - Classification of items in image (Labelling)



## Results & Discussion

The Resnet model used in the project has showed an **accuracy** of **97%** with the test dataset. The training dataset consisted of **25000 images**, from a few categories of plastic waste.

The project has yielded **promising results**, and the accuracy obtained makes the model viable. However, before actual implementation, the **model needs to be trained on more data**, and also on more categories of waste.

A screenshot of a terminal window showing the evaluation of a machine learning model. The output includes accuracy and loss values for multiple epochs, indicating high performance.

```
RS parameter takes a list)
names="tensorflow_hub", # save experiment logs here
        riment_name="resnet50V2")) # name of log files

accuracy: 0.9304 - val_loss: 0.1117 - val_accuracy: 0.9636
accuracy: 0.9746 - val_loss: 0.0828 - val_accuracy: 0.9736
accuracy: 0.9828 - val_loss: 0.0757 - val_accuracy: 0.9748
accuracy: 0.9884 - val_loss: 0.0696 - val_accuracy: 0.9766
accuracy: 0.9897 - val_loss: 0.0688 - val_accuracy: 0.9744

Run with a helper.py script...
```

## Conclusion & Applications

- Environmental Impact:**  
AI waste detection contributes to reducing environmental harm by increasing recycling rates, minimizing landfill waste, and supporting sustainable waste management practices.
- Improved Efficiency of waste segregation:**  
AI-based waste detection systems can significantly enhance the efficiency of waste sorting and management processes. They can accurately classify and sort waste materials faster than manual methods.