

MKSSS'S Cummins  
College Of Engineering  
for Women,Pune

# WASTE CLASSIFICATION

Akshita Totala - UCE2023504  
Srushti Chikhale- UCE2023512  
Girija Desai - UCE2023516

Waste Classification System Using Deep Learning



# PROBLEM STATEMENT

- Manual waste segregation is slow and inaccurate
- Leads to improper recycling
- Increases pollution and harms environment
- Need for fast, automatic, AI-based classification system



# PROJECT OVERVIEW

Deep Learning model classifies 6 waste types

Uses MobileNetV2 for efficiency and speed

Includes preprocessing, augmentation, fine-tuning

Integrated with Tkinter GUI for real-time predictions

# **DATASET & TOOLS USED**

## **Dataset**

- Kaggle Waste Classification Dataset
  - 6 categories: cardboard, glass, metal, paper, plastic, trash
  - ~5000 images, train/test split

## **Tools and Technologies**

- Python, TensorFlow, Keras
  - OpenCV, PIL, Matplotlib
  - Tkinter (GUI), VS Code

# METHODOLOGY

- Resize images to 224×224 and normalize pixel values
  - Apply data augmentation (rotation, shift, flip)
  - Load MobileNetV2 without top layers
  - Add custom dense classification layers
  - Train with frozen layers, then fine-tune entire model
  - Evaluate using accuracy curves & confusion matrix
  - Integrate final model into GUI

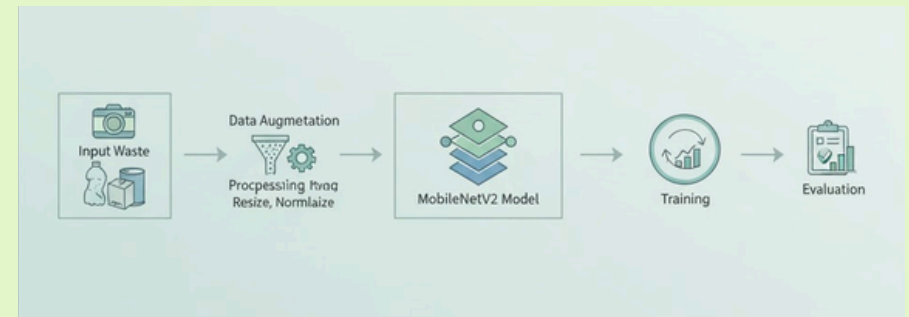
# MOBILENET V2 ARCHITECTURE

- Lightweight CNN designed for mobile/edge devices
  - Uses depthwise separable convolutions → faster & smaller
  - Pretrained on ImageNet for strong feature extraction
  - Custom head added for 6-class classification
  - Highly efficient for real-time predictions

# TRAINING PIPELINE

Input images → preprocessing → augmentation

- Initial training with base layers frozen
- Fine-tuning at low learning rate
- Softmax output for multi-class prediction
- Optimizer: Adam
- Loss: Categorical Crossentropy



# RESULTS & OBSERVATIONS

## Results:

- Training accuracy: 85%
- Validation accuracy: ~72%
- Testing accuracy :~78%
- Strong performance on paper, plastic, cardboard

## Observations:

- Trash class accuracy lower due to fewer samples
- Augmentation improved generalization
- MobileNetV2 faster than custom CNNs
- Fine-tuning boosted validation accuracy



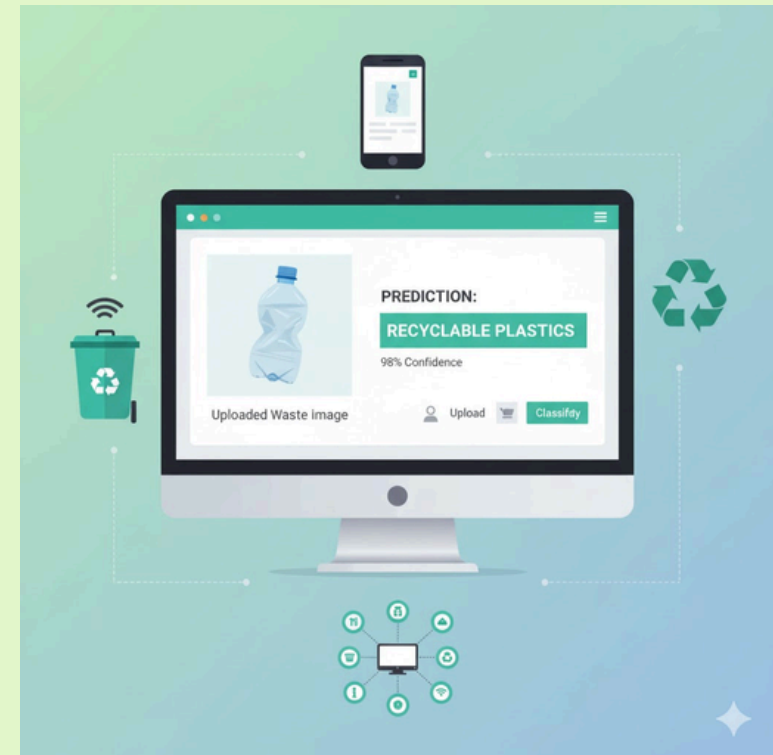
# GUI & APPLICATIONS

## Tkinter GUI:

- Allows user to upload image
- Displays predicted waste category in real-time
- Simple and user-friendly interface

## Applications:

- Smart waste bins
- Automated sorting at recycling plants
- Municipal waste monitoring
- Mobile/Web waste identification apps



# CONCLUSION

- Deep Learning successfully automates waste classification
  - MobileNetV2 offers high accuracy with low computation
  - GUI proves practicality and usability

# FUTURE SCOPE

- IoT-enabled smart bins
  - Deploy as mobile/web app
  - Add more data for improved accuracy
    - Real-time camera-based classification
    - Cloud analytics for waste tracking

# THANK YOU

