

Waste Management

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Introduction

Humans create waste, we create waste. From residential, commercial, institutional, and city areas, different types of waste are developed. 16,688 tonnes of food, which is enough to find 12 million people three times a day, is wasted daily according to Solid Waste Management and Public Cleansing Corporation (SWCorp).



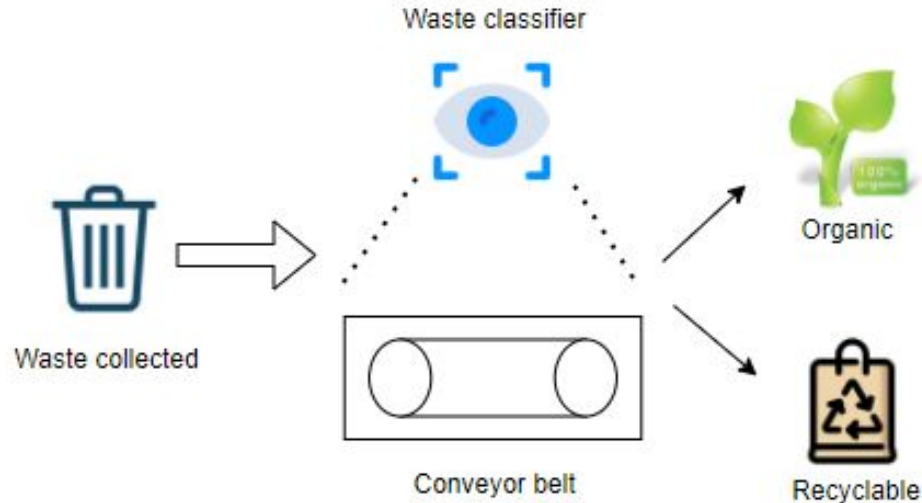
Problem Statement

Waste segregation is a time-consuming, hard labour work, especially when there are still Malaysians who do not comply to the waste separation rule. When the speed of waste management cannot meet to the amount of waste generated by the end of the day, people tend to not segregate the waste at all. This causes hazardous waste to flow into the environment and cause health and safety issues.



The idea

Our idea of waste management was using computer vision to detect organic and recyclable waste to be separated out from all the waste generated. This will reduce the amount of time required to segregate this two types of waste so that more resources can be directed to handle hazardous waste.



The journey

- Data Collection
- Annotation
- Data Processing
- Architecture and Modelling
- Evaluation

Data Collection

- Data Collected from Kaggle
- Link: <https://www.kaggle.com/techsash/waste-classification-data>
- Around 25 thousands colour images

Data Processing

- Image Transform: RandomCrop, Rotate, Horizontal Flip
- Annotation: None
- Data Split: Train, Test, Validation
- Input shape: 80 x 80 with 3 channels
- Batch Size: 32
- Number of Class: 2

Model Architecture

LayerName (LayerType)	nIn,nOut	TotalParams	ParamsShape
cnn1 (ConvolutionLayer)	3,96	34,944	b:{1,96}, W:{96,3,11,11}
layer1 (LocalResponseNormalization)	-, -	0	-
maxpool1 (SubsamplingLayer)	-, -	0	-
cnn2 (ConvolutionLayer)	96,256	614,656	b:{1,256}, W:{256,96,5,5}
maxpool2 (SubsamplingLayer)	-, -	0	-
layer5 (LocalResponseNormalization)	-, -	0	-
cnn3 (ConvolutionLayer)	256,384	885,120	b:{1,384}, W:{384,256,3,3}
cnn4 (ConvolutionLayer)	384,384	1,327,488	b:{1,384}, W:{384,384,3,3}
cnn5 (ConvolutionLayer)	384,256	884,992	b:{1,256}, W:{256,384,3,3}
maxpool3 (SubsamplingLayer)	-, -	0	-
ffn1 (DenseLayer)	256,4096	1,052,672	W:{256,4096}, b:{1,4096}
ffn2 (DenseLayer)	4096,4096	16,781,312	W:{4096,4096}, b:{1,4096}
output (OutputLayer)	4096,2	8,194	W:{4096,2}, b:{1,2}

Total Parameters:	21,589,378		
Trainable Parameters:	21,589,378		
Frozen Parameters:	0		

Evaluation Metrics

- Balanced Dataset
- Confusion Matrix
- Accuracy Score is an Acceptable Evaluation Metrics

Model Demo

- Github link for the project:
<https://github.com/mshaek/WasteManagementClassifier>

Possible Improvements

- Detection of other different types of waste, hazardous, chemical etc.
- More specific detection of objects like carrot from organic waste and paper from recyclable waste.
- Object Detection of organic waste instead of image detection

Resources

- <https://www.thestar.com.my/news/nation/2019/07/30/generating-more-waste-than-ever>
- <https://www.nst.com.my/news/nation/2018/12/441882/amount-food-wasted-malaysians-enough-feed-12-million-people-day>
- <https://www.intechopen.com/books/waste-management-an-integrated-vision/solid-waste-management-in-malaysia-a-move-towards-sustainability>
- <https://www.freemalaysiatoday.com/category/nation/2019/01/06/garbage-separation-drive-turning-out-to-be-a-wasted-effort/>
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