

# ARTIFICIAL INTELLIGENCE-ENABLED SMART BINS FOR SORTING WASTE DISPOSAL

## NAME OF AUTHORS

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## I. INTRODUCTION

Waste disposal is one of the major challenges facing Ghana and this is only going to get worse as population growth increases. According to Ghana's Environmental Protection Agency (EPA), 2800 metric tons of municipal solid waste is generated per day in Accra. Which is to say that we only collect about 2,200 tons of waste leaving behind 600 tons of waste in open drains and water bodies. In 2013, it was reported that there were about 40 plastic manufacturing companies producing about 26,000 metric tons of assorted plastic products in Ghana and over 10,000 metric tons of finished plastic products imported annually. Plastic is one of the most notable materials used daily since its rise to mass commercial use after World War 1, and this has not changed much especially in developing countries. Poor waste disposal has huge environmental impacts and causes serious health problems affecting not just humans but all living things. Burning of plastic waste causes the release toxic substances such as dioxins.

Waste disposal landfill sites are one of the biggest contributing factors to diseases such as cholera and diarrhoea. Poor waste disposal in Accra also contributes to floods due to choked gutters. In Accra, waste management problem can easily be observed as soon as one steps onto the street. The plastic bags and wrappers that seem to be a permanent sight in urban areas are the result of the rigorous cocktail of money and time restraints, apathy towards the environment, poverty, and disregard for environmental laws. This creates a serious threat to the advancing of Ghana's economy and the health of its citizens.

## II. METHODOLOGY

### A. Solid Waste Disposal In Ghana: A Study of WA Municipality

We got this dataset from a 2018 solid waste disposal study by Patrick Aaniamenga Bowan. This study was carried out in the Wa Municipality. In the study, it was cited that human activity is increasing the concentration in the atmosphere of greenhouse gases and this is expected to result in a significant warming of the earth's surface and other associated changes in climate within the next few decades. The greenhouse gases that are making the largest contribution to global warming are carbon dioxide, methane and nitrous oxide. These substances three are produced during the management and disposal of wastes. According to this study, simple percentages were used to analyse the quantitative data obtained from the household questionnaire administration and qualitative data from interviews conducted with all other categories of respondents were analysed manually by making summaries of the views of the respondents and supporting these with relevant quotations that captured these views, supported with data from documentary sources.

### B. Label Selection

We selected four (4) labels for our prediction model consisting of the type of waste disposal such as plastic bottles, sachet water rubbers, polythene bags and paper. These labels were used to categorise them into groups for easy sorting of waste. We used Google Colab to develop deep learning routines and data processing via computer vision.

### C. Deep learning and Computer Vision

In this study we employed the use of Keras which is an API of Tensorflow. Tensorflow was chosen for image recognition, classification and accurate prediction of waste disposal. Our trained Keras model employed the use of four (4) classes for prediction and classification. After training the data, we employed the use of computer vision to detect the type of object or waste.

### D. Sorting Of Waste

The smart bins are classified into four groups based on their type of waste disposal. That is, there are smart bins specifically reserved for plastic bottles, others reserved for sachet water rubbers, another reserved for plastic bags and the last reserved for papers. The smart bin size ranges from 13 gallons (50 litres) to 20 gallons with cameras to detect objects. The smart bin's design enables it to detect the right waste material before activating a switch to open the bin.

### III. RESULTS

The aim of this paper is to devise a machine learning scheme that can identify waste disposals and sort them based the type of waste (paper, polythene, sachet rubber and plastic bottles). The data used here are samples collected from online and personal pictures taken by us to train the model.

#### A. Training & Testing

We trained a Keras prediction model with an increasing number of labels. The trained model was obtained by selecting the model which produced high accuracy using forty iterations. A total of ninety-six (96) images were used for training our models and forty-eight (48) images for testing.

### IV. CONCLUSION

Waste classification models can identify the type of disposable material in real-time. We used deep learning algorithms to design a prediction model based on four (4) waste classifications. The outcome shows that this model has great potential in the waste management industry to sort waste. However, the model will need to be trained with more images to boost accuracy.

### REFERENCES

- [1] Patrick A. Bowan and Lee Felix Anzagira, "Solid Waste Disposal in Ghana: A Study of The Wa Municipality", August 2018.
- [2] Narayan Sharma, Nirman Singha and Tanmoy Dutta, "Smart Bin Implementation for Smart Cities", September 2015