

Copy-Waste: Rare Contaminant Detection in Residential Recycling

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Introduction

Our objective is to reduce the risk and cost within residential recycling streams through three deliverables:

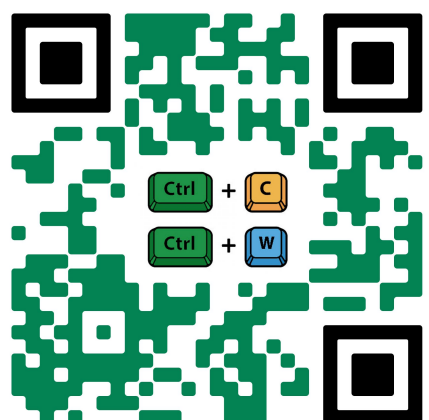
1. A universal bin detector which can be deployed to any automated collection vehicle to identify when a collection event occurs.
2. An interactive dashboard which displays residential recycling collection data analytics and insights
3. An automated system which can generate artificial image datasets to aid in detecting previously undetectable contaminants

Why is this needed?

Mismanagement of recyclable waste is an environmental disaster and a burden on society. Recycling is an inefficient, costly and risky process as rare and severe contaminants can pose an immediate risk.

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Scan to view our project in more detail on GitHub

Data Augmentation Pipeline Conclusion

Our data pipeline focuses on detecting rare and severe contaminants. It is difficult to train machine learning models without large datasets. This data augmentation pipeline attempts to solve this issue by generating large artificial image datasets of rare contaminants from a small sample of real images.

The sample objects are inserted into real images of recycling collection. Random effects and transformations are applied to the artificial images to provide variety to the dataset and mimic real world conditions.



Augmentation Results

- The pipeline accepts a variety of objects and is capable of generating multiple datasets of 10,000+ images.
- Detected x number of objects
- Mask R CNN Model
- 17 object classes



Literature Cited

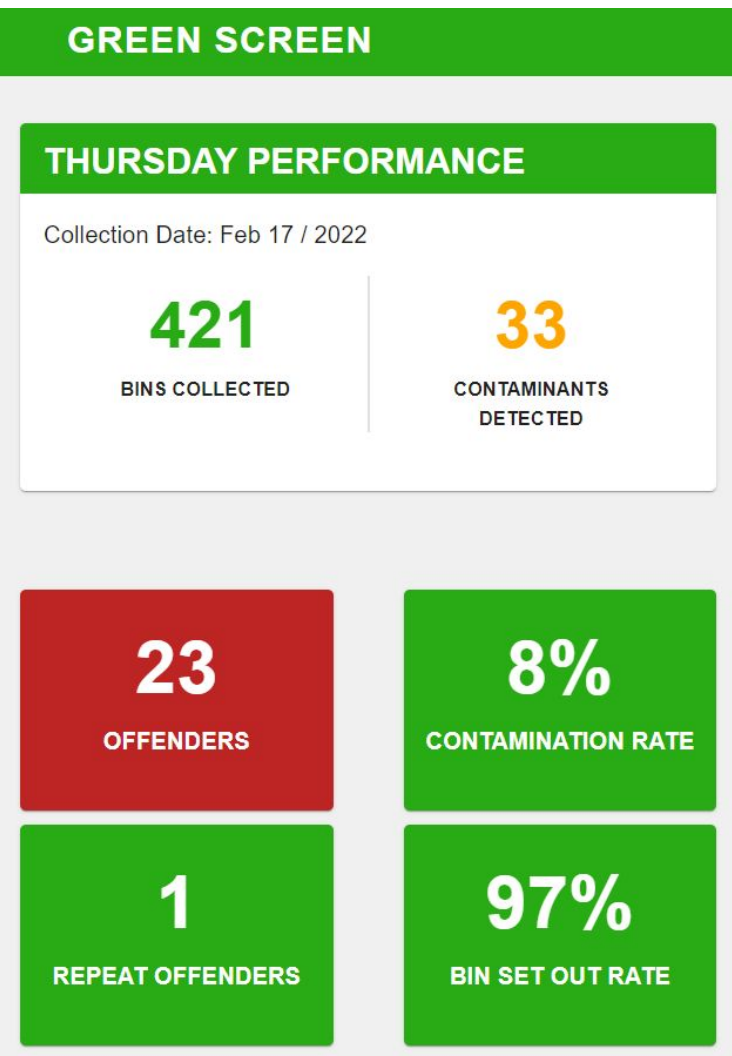
Ghiasi, G., Cui, Y., Srinivas, A., Qian, R., Lin, T., Cubuk, E., Le, Q., Zoph, B. (2021). Simple Copy-Paste is a Strong Data Augmentation Method for Instance Segmentation. arXiv, <https://arxiv.org/abs/2012.07177v2>.

Deloitte Canada. (2019) Economic Study of the Canadian Plastics Industry, Market and Waste. <https://publications.gc.ca/site/eng/9.871296/publication.html>.

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Bin Detector Results

The bin detector allows for rapid scalability of smart recycling collection by deploying the detection model onto collection vehicles in any new municipalities. This model is already deployed to multiple municipalities across Canada and ensures blue bin detection is maximized to record all recycling collection events.



Dashboard Results

The dashboard strives to build an interactive platform which provides recycling insights to municipalities. Increasing the availability of this information allows the municipality to strategize and evaluate recycling information to reduce costs and inefficiencies.

Future Work

- Continue to add additional rare and severe objects within the image dataset for detection
- Experiment with object transformations to improve the detection performance
- Implement ability for municipality workers to communicate and share points of concern on the dashboard

