Project Vlog 1
ENSE 400
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----------WILL----------

Team Introductions

We are Team Copy Waste.

Here is our team, I am Will, and I have Nolan and Rishabh with me.

Roles:

- Will: Backend, Database/API lead
- Rishabh: Frontend
- Nolan: ML lead
- All: ML

The Mission of our project is to detect severe and rare occurrence waste in recycling

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Project Background & Business Need / Opportunity

To give some context on why we believe there is an opportunity for improvement

- Studies have found that people find recycling confusing and as a result Household Recycling is contaminated with common objects as well as rare and hazardous objects.
- Processing and sorting recycling is a largely manual process.

- These rare and severe contaminants cost cities millions of dollars each year to extract and pose a large safety concern for facility workers.
- Specifically, Municipalities are particularly interested in detecting Propane Tanks, Needles, Batteries and Diapers which pose a direct risk and can contaminate an entire truck load of recycling.
- Our project will focus on using Machine Learning and Computer Vision to detect these rare objects which are not reliably detected.

---------- **NOLAN** ----------

Reason

Recycling at its current state is extremely contaminated, expensive, and inefficient. It is estimated that only 9% of all plastics in Canada are recycled and significant portions of the collected plastic are diverted to landfills because of contamination. This is not sustainable for cities and a large burden on the environment. As aspiring engineers, but more importantly citizens who utilize our planet's benefits, we believe it is also our responsibility to create and improve tools which lead to a more sustainable environment, safeguard the public and protect human life.

Our project's purpose is to increase recycling collection rates and reduce operator costs by identifying severe and rare contaminants at the source. It is difficult to train detection models for rare contaminants as large datasets of images do not exist. Our platform will synthetically create a large image dataset of rare contaminants, allowing it to be possible to train detection models. Detecting these contaminants will

lead to safer work environments for waste management workers, educational campaigns for households, reduce costs for municipalities and improve the quality of recycling.

---------- **NOLAN** ----------

Impact

Our long term vision for this project is to remove the burden of managing waste and recycling from individuals. Our goal is to allow the automation of this process by enabling the detection of rare items and expanding the number of objects that can be detected with computer vision. We will accomplish this by reducing the number of sample images required to train a machine learning model.

In conjunction with political movements demanding more drastic action on environmental impacts and waste, this project can be used to help society achieve that objective through automation of waste collection facilities.

----------**RISHABH**----------

Who

Our goal is to develop a product which is able to detect rare and severe contamination in recycling for waste management companies and municipalities. Although they are uncommon, they present safety hazards to workers as well as contaminate recycling. We will primarily be working with an industry partner and several

municipalities across Western Canada to identify rare and severe contamination which is currently a priority.

Our industry partner will provide us with guidance, their experience, and connections throughout this project. They will serve as a link between our team and waste management entities. We will meet with their team on a weekly sprint basis and hope to create a solution which adds value to their overall product. As our Industry Partner expands into new markets, this product can reach a global audience.

As an extension to our solution, the data will also be utilized by our industry partner to identify households which have placed rare occurrence waste in recycling and allow waste management companies to create educational campaigns.

----------RISHABH----------

What

The technologies we will use in this project are:

- the Copy Paste Algorithm, which is where we get our name
- the Mask R-CNN Model
- YOLO for segmentation and classification
- AWS to build our architecture
- Python as our general programming language
- and the React Framework for our front-end interface

Currently our project has three primary objectives.

- First, as a preliminary task, we will build a universal waste bin detector to understand the fundamentals of Machine Learning

- Create an Automated Pipeline which takes an image and applies the Copy-Paste Augmentation algorithm to create a large dataset of images which will classify new rare and severe contaminants
- Build a User Interface that the customer will interact with

Our envisioned constraints at this stage of our project is that

- We have Limited knowledge of Machine Learning, Artificial Intelligence and the Copy-Paste Algorithm
- Access to test our solution on active waste trucks can be difficult
- We expect this project to be expensive so managing cost for project architecture is important to us
- We are submitting a Mitacs proposal to receive a grant for this project. Therefore, we are obligated to fulfill their requirements in order to validate our research