

An aerial photograph of a vast landfill filled with a dense layer of discarded plastic waste, including bottles, bags, and other debris in various colors. A small figure of a person wearing a blue shirt and a green cap is visible in the middle ground, standing on the waste and holding a large, full, light-colored bag, providing a sense of scale to the massive pile of trash.

Waste Image Classification

A potential strategy for
increasing the purity of
recyclable waste

The Data: Images

Created by Mindy Yang & Gary Thung

403 Cardboard



501 Glass



410 Metal



594 Paper



482 Plastic



137 Trash



The tool: Deep Neural Networks



Compute Intensive

The best model in this project has 22,910,480 parameters



Time Intensive

Testing models is slow because each one takes so long to run



Faster on a GPU

Graphical Processing Units are optimized for performing operations on matrices



Climate/NGO Commitments



**Google Compute
Cloud**



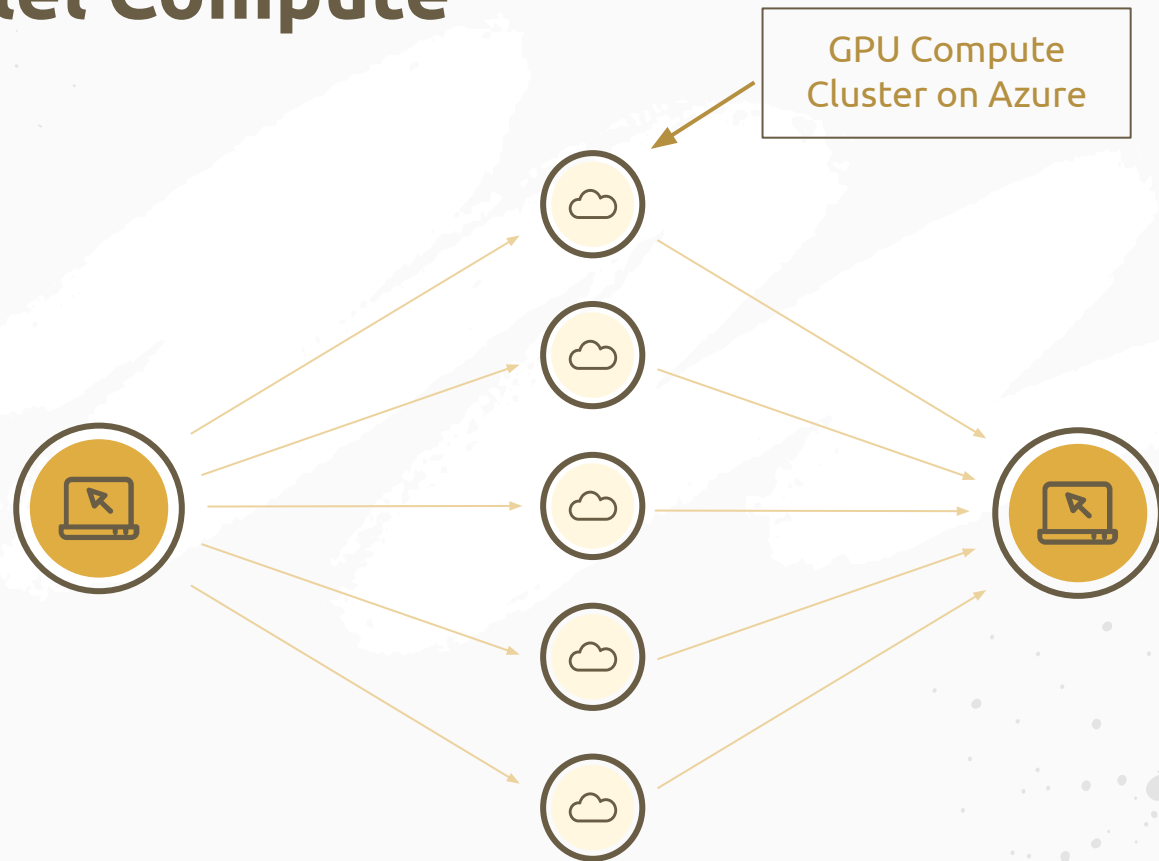
**Microsoft
Azure**



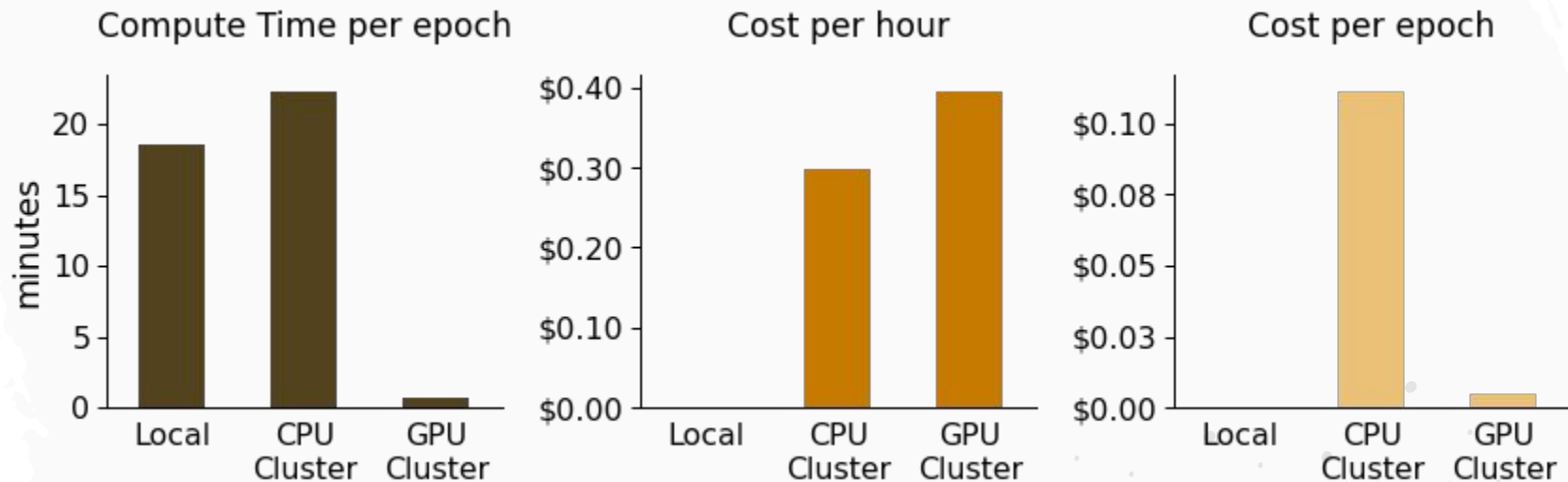
**Amazon Web
Services**

| | Google Compute Cloud | Microsoft Azure | Amazon Web Services |
|--------------------------------|-------------------------|--------------------|---------------------------------|
| % renewable energy | 100% | 60% | 42% |
| Energy Emissions Offset | 100% | 100+% | 50% |
| Renewable by | 2017 | 2025 | 2025 |
| Goal | Net 0 | Net Negative | Net 0 |
| Nonprofit support | \$0 | \$3500/yr | \$2000/yr (-\$175 admin fee) |

Parallel Compute



Cloud Cost



The final model: Xception



134 Layers

22,910,480 possible
adjustments



Pretrained

On imagenet dataset
with 1000 categories

How the model “sees”

- Filters move across the images looking for different details
- Those details form abstractions of the images



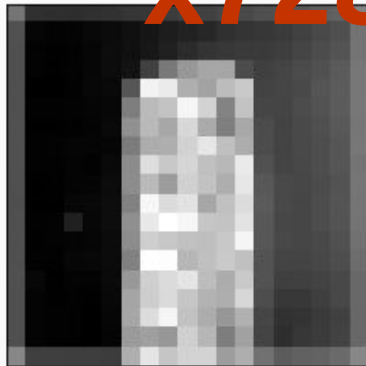
x128



x256



x728



x1024



Predictive Accuracy: 91.1%

plastic



plastic



plastic



paper



glass



paper



glass



plastic



Recommendations

- Increase number of images in dataset
- Review categories

Future Work

- Evaluate Trash vs Recyclable first, then recycling type
- Can the difference between types of plastics?
- If this proves effective release versions for as cell phone apps and for recycling facilities.





Thank you!



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