Introduction

We want to educate users to be more mindful of recycling throwaway items, so that we can reduce users to the contamination at the source. We use pictures of different throwaway items from [6] and train a classifier to output a label which is a type of the object.

Related work

Object detection and classification approaches for throwaway items is a well studied topic. Yang and Thung and Chu et al. use a AlexNet [4] like architectures, and have very poor accuracy. [6], their classifier was confused between plastic and glass categories.

To have more robust classification we experiment with different classifiers namely ResNet by He et al. Because of the skip connection mechanism in [3] we find that

Classification and Localization Methods

• Hybrid approach to Transfer Learning [2]
  – Start with pretrained weights, and add BatchNorm and Dense Layers on the top.
  – Freeze the base layers, and train with a higher learning rate for few epochs.
  – Unfreeze the base layers, and train with lower learning rate.

• Fine-tune with Faster R-CNN Network
  – We used Faster R-CNN network with Inception V2 trained on MS COCO dataset as the baseline.
  – Conducted experiments by fine tuning it with TrashNet dataset with hand annotated bounding boxes, randomly generated collages, collages with images at 4 quadrants and their bounding boxes.

Experiments and Results

• Hybrid Transfer Learning for Classification

  \[
  \text{precision} = \frac{TP}{TP + FP}, \quad \text{recall} = \frac{TP}{TP + FN}, \quad \text{F1-Score} = \frac{2 \times \text{precision} \times \text{recall}}{\text{precision} + \text{recall}}
  \]

  \[
  \text{confusion matrix for Hybrid Transfer Learning is below}
  \]

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<th>metal</th>
<th>paper</th>
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  \[
  \text{F1-Score for Hybrid Transfer Learning}
  \]

  Loss 0.00002 (TrashNet)  0.00002 (Collage)  0.00002 (Collage)  0.00002 (Collage)

  Precision 0.98  0.90  0.90  0.90  0.90  0.90  0.90
  Recall 0.99  0.86  0.86  0.90  0.87  0.87  0.87
  F1-Score 0.97  0.76  0.81  0.90  0.84  0.77

  Loss 1.214  1.442  1.452
  Precision 0.816  0.842  0.697  0.7
  Recall 0.565  0.878  0.791  0.793
  F1-Score 0.839  0.749  0.708  0.743

References


