Trash Classification Using Convolutional Neural Networks

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Overview

In today's fast paced scenario with all the technological advances and latest gadgets, the major urban cities and even Tier -2 cities in the world are still struggling with trash management. Very few countries have implemented a proper waste collection as per the categories in which they lie such as organic, garbage, biodegradable, hazardous, etc. by recycling but most of them dump all the trash to the landfills where all sorts of garbage gets mixed up which is quite dangerous for our environment resulting in toxins and various

air borne diseases. The quantity of generated trash in day to day life is affecting land, water, and air which causes a serious threat to the aquatic species and their surroundings and ultimately to humans if not managed properly. The objective of this study is to develop a system that can classify these trash images into their correct categories

Data

The dataset TrashNet is created by Thung and Young which spans six categories and consists of 2527 images in total. The pictures were taken by placing the object on a white poster board and using sunlight and/or room lighting. The pictures have been resized down to 512 x 384.

- 501 Glass
- 594 Paper
- 403 Cardboard
- 482 Plastic
- 410 Metal
- 137 Trash

Approach

I propose a multilayer hybrid deep-learning system (MHS) which uses a CNN-based algorithm to extract image features and a multilayer perceptrons (MLP) method to consolidate image features and other feature information to classify wastes. I will try to modify the well known CNN architectures to achieve the best accuracy in predicting the probability of the label

Steps

1. Data pre-processing of trash images and creating augmented data to see if it assists in obtaining high classification accuracy.
2. To verify results by training various CNN architectures such as VGG-19, AlexNet, VGG-16, GoogleNet, ResNet, Densenet121, InceptionResnetV2, MobileNet, Keras Sequential, and XGBoost models at different k-folds using cross validations.
3. To experiment with two classifiers, Softmax and Support Vector Machine (SVM), as the last layer of our model structure.

4. To measure how the number of epochs affects model performances.
5. Evaluation of models majorly on accuracy metrics and class prediction probability. Comparison of Results to see the prediction accuracy per class category.

Use of Transfer Learning

Transfer Learning Techniques are used to develop a better neural network , to avoid training the model layers from the scratch, some pre-trained model are used and their knowledge on our custom dataset by making a small change in our architecture which is called transfer learning and the expense of training a new model gets saved. Pre-trained model ResNet 50 which is 50 layer CNN used as a feature extractor and for the classification of waste images into different categories.