Save the environment: Detecting waste in the wild

Project 1.2

Deep Learning in Computer Vision

June 2022

Litter has been accumulating around us as most local governments and international organizations fail to tackle this crisis, which is having a catastrophic impact on biodiversity and marine animals. In this project, you are asked to build a deep learning object detection system that can automatically detect trash and litter and in images in the wild. This object detection can then be deployed in robotic machines that can scan areas and collect and clean beaches, forests and roads.

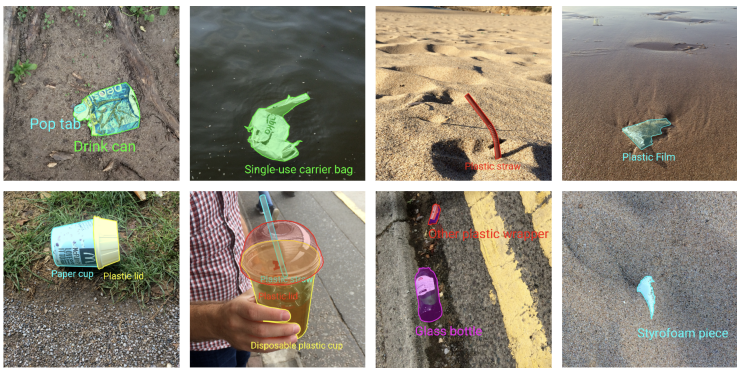

Figure 1: Examples from the TACO dataset.

Detecting trash in the wild can be a very challenging problem. Not only do we have to take into account that trash can be deformable, transparent, aged, fragmented, occluded and camouflaged, we also need models to be aware of the vast diverse features that make our natural world.

To train your object detection model, you will use the TACO dataset (Fig. 1). More details about the dataset as well as useful tools to visualize the data can be found in the *demo.ipynb* file on the HPC under /dtu/datasets1/02514/. The images and the annotation file in a json COCO-style format can be found under the datasets folder of the course on the HPC. Before you start working

on the object detection model, there are a few things that you need to take care of in order to be able to perform proper experiments and analysis of the model. For example, the given images need to be split properly to training, validation and test set and you need to select the number of the output categories for your model (e.g. use only the supercategories).

The task

Your tasks for training and deploying a simple object detector to detect litter and trash are:

1. Extract object proposals for all the images of the dataset (e.g. Selecting Search, Edge Boxes, etc)
2. Finetune a convolutional neural network to classify object proposals.
3. Apply the model on the test images and implement non-maximum suppresion and Intersection over Union (IoU).
4. Evaluate the object detection performance using standard metrics.

Optional tasks:

1. Improve the simple model above by adding a bounding-box regression output that improves the detection performance.
2. Improve the efficiency of the simple model (i.e., ROI pooling layer inspired by Fast RCNN).
3. Implement a Convolutional Neural Network that is trained to generate generic object proposals to replace the object proposal algorithm (i.e., Region Proposal Network inspired by Faster RCNN).

The goal of the project is not to simply apply an object detection model that you find online, but rather to build step-by-step a simple model by yourself. After that, feel free to improve this model by following the suggestions in the optional tasks above or to even apply a single-stage object detector.

Hand-in

Your process, performance evaluation and results should be documented and discussed in a PDF poster to be uploaded on DTU Learn. Project 1.1 and Project 1.2 should be described on the same poster.