Object Detection Cheat Sheet

A Quick Reference Guide for Object Detection Tasks

A08 Lionel Silva Hac-King-Do ITAI 1378 CV

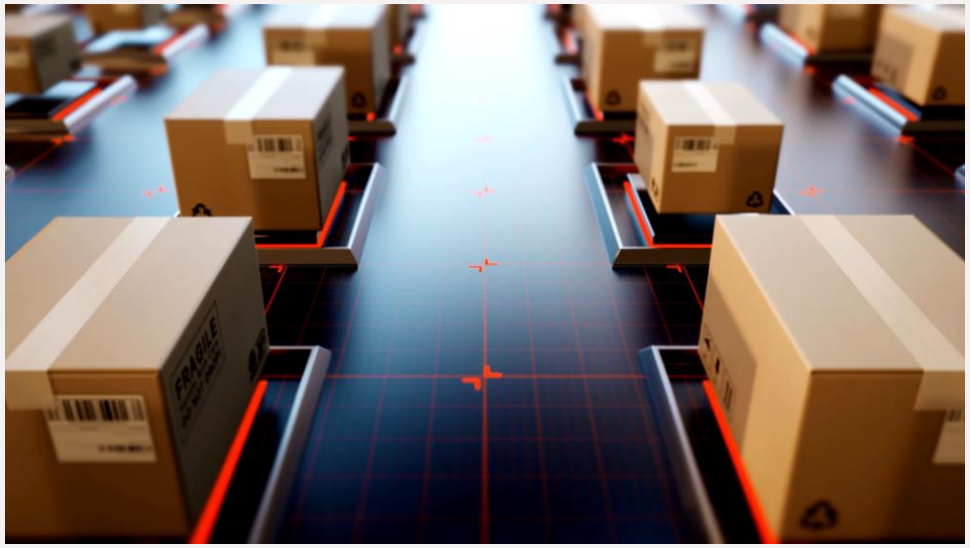
Lionel Silva

Munachimso Benson

Brenden Morrow

Monique Rathnam

Emmanuel Igwilo



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Key Concepts

Bounding box is a virtual box utilized to encompass an object of interest in an image or video. It serves as a reference point for the object recognition and is used to determine the position and dimension of the object within the image.

Annotations: labels images in a provided dataset to train machine learning models. list of annotation formats (including bounding boxes) XML file, JSON, COCO, and Pickle.

Intersection over Union (IoU) evaluates the similarity between any two bounding boxes by computing the ratio of their intersection to their union.

Key Concepts

Confidence score : A score that indicates the possibility of an object being present in the bounding box.

Anchor boxes are prearranged boxes of multiple dimensions and aspect ratios used to produce the object proposals.

Object Detection Algorithms

- R-CNN uses a discriminating search technique to identify Rols in the input images and utilizes a region-wise classifier based on DCN (Deep Convolutional Neural Network) to independently classify the Rols.
- Faster region-based convolutional neural network is an object detection model that up grades on (Fast-R-CNN) by using region proposal network (RPN). The system can evaluate a region-based object classification (ROI pooling) by using the features maps generated through the convolutional layer.
- Fast R-CNN is an upgraded version of the R-CNN that collects CNN features independently of their region of interest (ROI) into one forward pass across the image.
- SSD- Single Shot Detector is a CV and ML algorithm that is used for object detection. The algorithm executes real time detection of numerous objects in an image with high precision.

Object Detection Algorithms

- YOLO is an object detection architecture which stands for YOU ONLY LOOK ONCE. It requires the use of one neural network trained end to end to take a photo as input and anticipates bounding boxes and class labels for every bounding box directly.

Tools and libraries

```
# Import necessary libraries
import tensorflow as tf
import tensorflow_hub as hub
import tensorflow_datasets as tfds
import numpy as np
import matplotlib.pyplot as plt
import matplotlib.patches as patches
import cv2
from PIL import Image
import requests
from io import BytesIO

print("TensorFlow version:", tf.__version__)
print("TensorFlow Hub version:", hub.__version__)
```

Tools and libraries

```
import tensorflow_datasets as tfds
import matplotlib.pyplot as plt

# Load a smaller dataset
def load_data(split='train'):
dataset, info = tfds.load('voc/2007', split=split, shuffle_files=True, with_info=True)
return dataset, info

# Load the train dataset and extract info
train_dataset, train_info = load_data('train[:10%]')

# Load the validation dataset
validation_dataset, validation_info = load_data('validation[:10%]')

# Get class names
class_names = train_info.features["objects"]["label"].names # Changed from ds_info to train_info
print("Class names:", class_names)
```

Steps for object Detection

- Collect Data: gather dataset images
- Preprocess the data: sampling, transformation, denoising, imputation, normalization, and feature extraction.
- Training the model: assign labels to regions of images.
- Evaluate: Find all the objects in an image and check to see if the found objects belong to the correct class.
- Inference: verify the process of the running data points to calculate the outputs.

Common Challenges and Troubleshooting for object Detection

- Object classification and localization: this can be solved by using region-based CNNs.
- Speed for real-time detection: this can be achieved by Fast R-CNN and Faster R-CNN.
- Multiple spatial scales and aspect ratios: use single shot detectors(SSD) to detect objects with one pass through the CNN frame.
- Limited data: use COCO dataset .
- Class imbalance: COCO dataset.

References

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