**Object Detection: A Cheat Sheet**

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| Object Detection: It is a computer vision technique that uses neural networks to find and recognize objects in pictures. | Steps of Object Detection   * Gathering a Dataset of images * Annotating the Dataset * Image Processing * Training the Deep Learning Model * Evaluating the model * Model Use | A banana and a cup on a table  Description automatically generated |
| Object Detection Algorithms   * YOLO (You Only Look Once) * Region-based Convolutional Neural Networks (R-CNN) * Fast R- CNN * Faster R-CNN * Spatial Pyramid Pooling | YOLO: Real time object detection algorithm. Multiple Frame per Second. Speed and Accuracy.  R-CNN: 1. Region Proposal – Selective Search Algorithm  2. Feature Extraction  3. Object Classification – Support Vector Machine (SVM)  4. Bounding Box Regression  5- Non maximum Suppression (NMS)  Fast R- CNN: Developed by Ross Girshick  Region of Interest (ROI) Pooling  Single Shot Multibox Detector | Faster R-CNN: Single end-to-end Unified Network  Microsoft Researchers  Region Proposal Network (RPN)  Single Shot Multibox Detector  A dog and cat looking at a search  Description automatically generated  R-CNN model  Image credit: https://d2l.ai/chapter\_computer-vision/rcnn.html |
| Libraries and Algorithms  Histogram of Oriented Gradients:  Feature Extractor  Gradient Orientation  Human Detection | Scale-Invariant feature transform (SIFT)  D.Lowe  Invariance to image scale and rotation  Patented Algorithm | Single Shot Detector (SSD)  A diagram of a diagram of a diagram  Description automatically generated with medium confidence |
| Other Tools  TensorFlow  Free and Open-Source Library  Keras: Open-Source Library  Provides Python Interface for  Artificial Neural Network | CenterNet  Predicts object center points  Does not use bounding boxes  Other Concepts in Object detection:  Bounding Boxes: Bounds/borders the object | Annotations: Object Naming System  Confidence Scores: Probability  Indicates accuracy number between 0 and 1  Intersection over Union (IoU):  Extent of overlap of two boxes |
| Some Challenges in Object  Detection:  Time Challenge: Slow model  Training time: HOG, R-CNN  Resource Intensive  Lower Quality images:  SSD  Lower Recall Rate: YOLO |  | Additional Links:  <https://neptune.ai/blog/object-detection-algorithms-and-libraries>  [Machine Learning Mastery](https://machinelearningmastery.com/object-recognition-with-deep-learning/)  [Digital Ocean](https://www.digitalocean.com/community/tutorials/faster-r-cnn-explained-object-detection) |

*Reflection*

Object detection is incorporated into everyday life without having a term for the concept.

Prior to delving into the concept of object detection while working on this interesting project, the concept would have been referred to as motion detection in the home security system, or facial recognition when the iPhone produces a collage of a friend’s or family members pictures stored in the phone over the years. This is always a pleasant surprise when presented to the individual or made into a Happy Birthday video. The car back up camera system also uses object detection daily while reversing the car. Working on this project put technical terms to what had become the norm in everyday living. It felt very enlightening to understand this phenomenon from the back end. There is a quest for more technical knowledge of artificial intelligence concepts incorporated into our daily domestic and professional lives.

This project creates an understanding that artificial intelligence is evolving very quickly and there is a role for everyone to contribute. An individual can contribute or modify in a best fit way to already existing technology. This project has created an appreciation for “Open Source”.

References

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