Cat Following Mobile Robot

ELEC 845 Project

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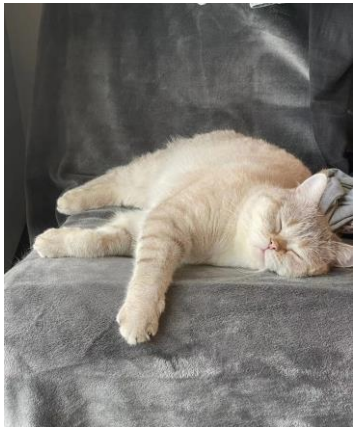
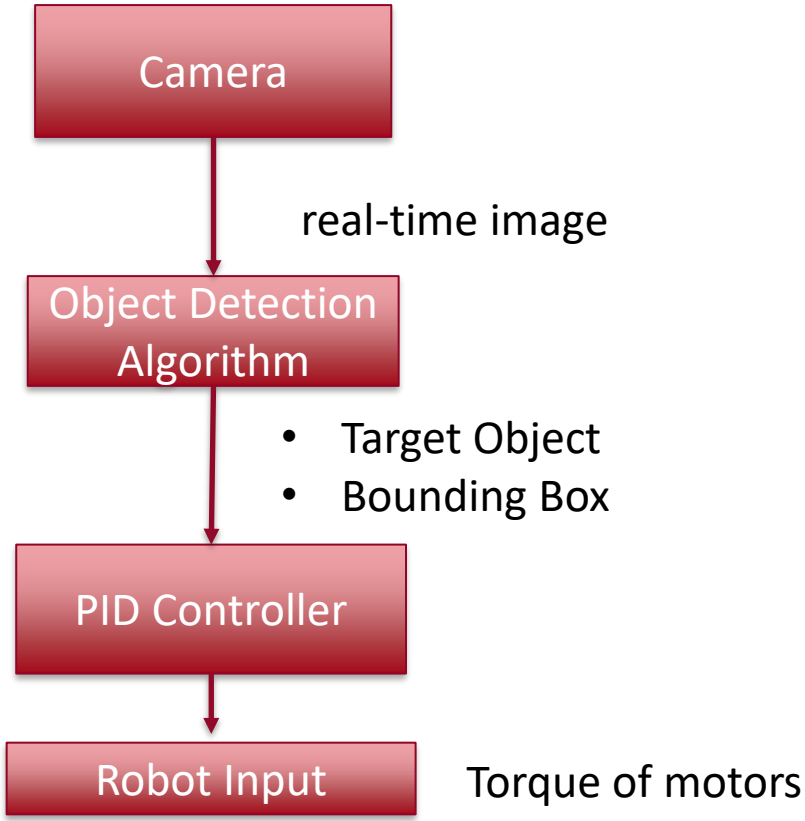
Motivation



- Objective:
  - Capable of following and interacting with Jojo
  - Avoid Collision* (If time allowed)

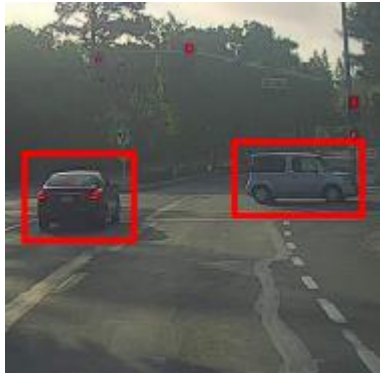
Robot Setup

Framework


Camera
real-time image
Object Detection Algorithm
• Target Object
• Bounding Box
PID Controller
Robot Input
Torque of motors

Object Detection

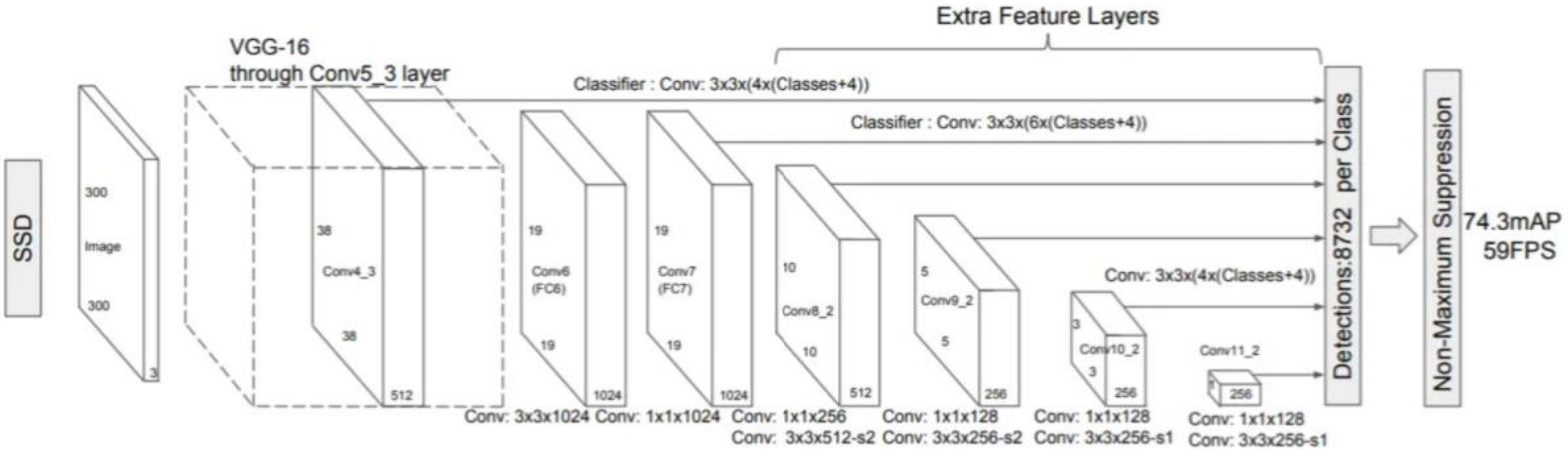
Image Classification
Output: y



Object Detection

Output y = $\begin{bmatrix} p_c \\ bbox \\ class \end{bmatrix}$

Single Shot detector



Features:

- Multiple feature maps with different sizes and number of channel
- Various anchor box sizes for different feature maps

Non-max suppression

Each output prediction is : $\begin{bmatrix} p_c \\ bbox \\ class \end{bmatrix}$

Remove all boxes with $p_c < 0.6$

While there are any remaining boxes:

- Pick the box with the largest p_c as a prediction
- Remove any remaining box with IoU >or= 0.5 with the box prediction in previous step

Figure Source : https://towardsdatascience.com/non-maximum-suppression-nms-93ce178e177c

PID Controller

- Input: information (area and center position) of bounding box from SSD
- Controller:
  - Desired Output:
    1. 0.5m distance between cat and robot
    2. Cat always in the front of the robot (center of bounding box close to the center of image)
  - Calculate the area and center of the bounding box when the cat sits at the desired position