Homework 3 – Traffic Light Detection

Submitted in partial fulfillment of the requirements for the course of

ENPM809T – Autonomous Robotics

By

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INTRODUCTION

The aim of this project is to use OpenCV on the Raspberry Pi to facilitate object identification and tracking to simulate a camera used for navigation onboard an autonomous vehicles, including writing data to file and subsequent analysis in Matplotlib. We first detect the green light on the traffic sign and track it as it is moved around the screen. Then, the analysis of hardware performance limitations are tested.

APPROACH

We first mask the image by converting it to the HSV scale to detect green colour. Then a contour of the detected region is found along with its centre and a bounding circle is drawn. Finally, the traffic light sign is moved around the screen and the green light is tracked. Finally, the time taken per frame is tracked by writing to a .txt file, and the data is plotted as an x/y graph of processing time vs frame and as a histogram of processing time vs number of frames.

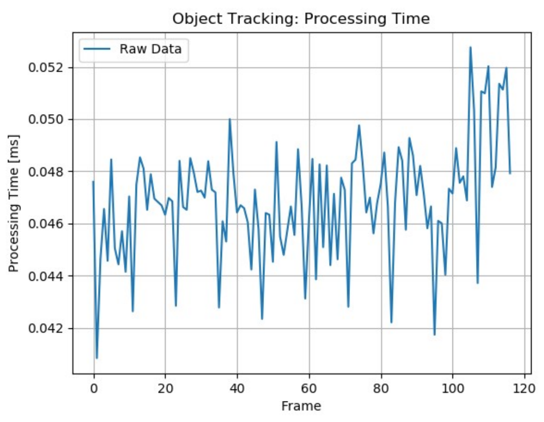
CODE AND OUTPUT VIDEO

The entire repository containing the problem statement and the data can be viewed on https://github.com/adheeshc/raspi-Traffic-Light-Detection

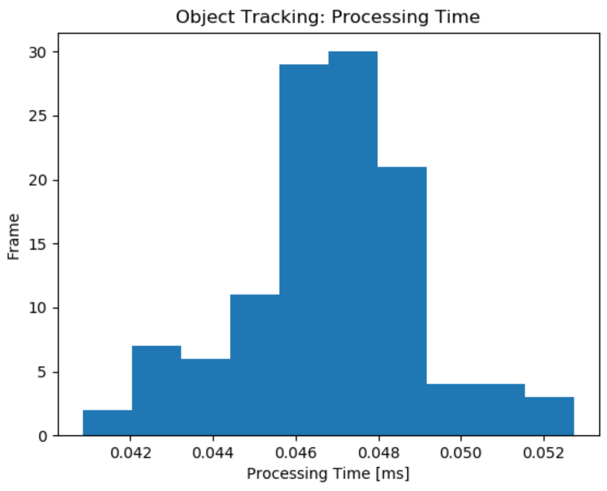
The YouTube output video can also be viewed on https://youtu.be/CadWwJlj5XU

RESULTS

The processing times tend to be between 40 – 60 milliseconds. The image processing is pretty simple with very less computation required and so we get a good frame rate with good processing speeds. However, on increasing our computation as per our requirements this delay can cause problems when trying to control the robot. So multi threading might be a good idea to especially when more complex object recognition is performed.



In our histogram plot, we see most of our frame rates are concentrated around the 0.047s mark which is a pretty good result which can we can try to improve as we add more computation


Object Tracking: Processing Time
Frame
Processing Time [ms]