CS 445 Computational Photography
Final Project
Object Detection

Byeong-Bin Seong, seong7

Introduction

I was planning to do a drone related personal project next semester. Then, I had the thought that what if my drone could detect certain objects? However, a drone would have a dynamic change of the camera position. So, I decided to start my final project as a static camera.

So what could I detect in my project?

- -Moving objects
- -Objects with certain colors.

Implementation

In my project, I used a method called background subtraction. It is a method that works quite well when the camera is not moving. It is often used with surveillance camera in the real world.

I have 2 versions of the detector.

- -Detector by Video file input (video.m)
- -Detector by Webcam (webcam.m)

Moving Objects

I first collect the background image for few frames, then I take the median of it to use it as a background reference, similary done in project 5.

Then for each frame I subtract the current frame from the background image, then turn it into a binary image (black and white).

However by just doing so, many of the moving object components are disconnected and have many irregularities. So I proccess it with with:

bwareaopen(…,n) :	To remove small negligible components.
imfill(…, 'holes') :	To fill wholes in my detection
bwmorph(…,'bridge') :	Connects detected components that might have been seperated due to lighting and etc.

Example

input image

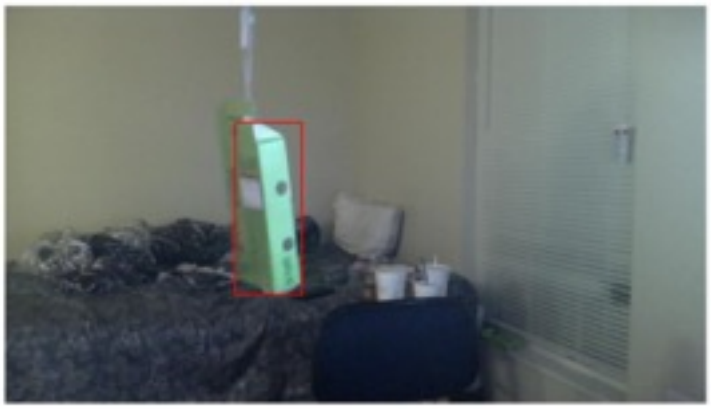
subtracted with background

processed image

As we can see on the exmaples, the subtracted image has some noise on the left side of the image, and some on the top of the box. And by processing it, you can see that most of the noises are cleaned up.

Result

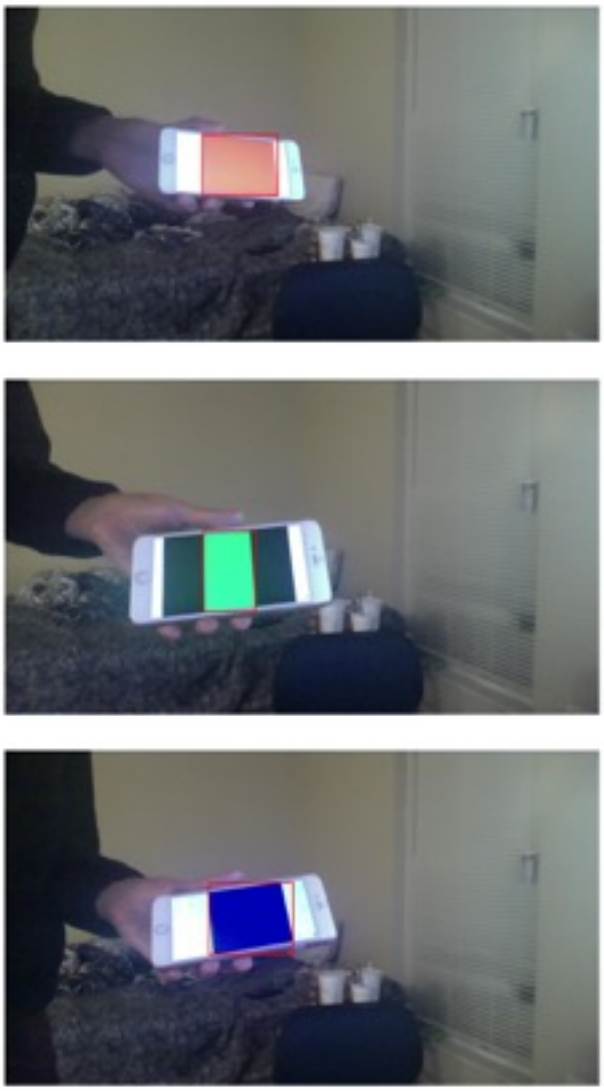
Object detector



The box I hung on a string, has been succesfully detected by my detector.

Detected multiple objects, but has a small shouldn't be detected objects.

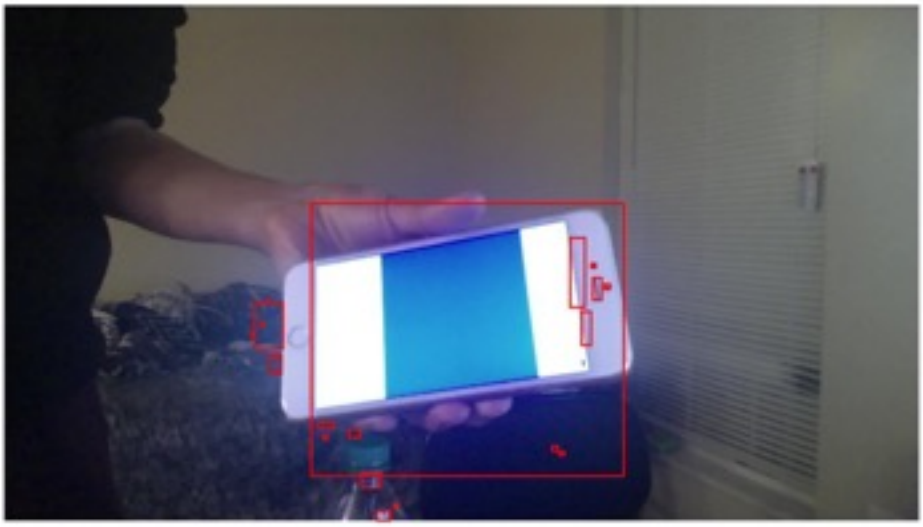
Color detector



Successfully detected Red, Green and Blue

Limitations

My process are sometime not enough to detect perfectly, it could detect one object as a multiples object as you saw in my second result.
Also for the color detector, when changing the subtracted image to binary, the needed threshold for im2bw are different for each color, in different environment, which could lead to this kind of situation:



There are many unnecessary detection.
To resolve this, I needed to increase the Threshold.

Future improvements

Ultimately I want to detect certain image pattern to lead my drone. So, I will need to improve my detection from static to dynamic camera, and I think the background subtraction method will not work, since the background will keep changing as the drone move.
Also for the color detection, I could also implement a way to calculate the threshold, in different environments.