# Project 3 – Buoy Detection

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1) Part0

    a. It's required to use RGB. I cropped the buoys from frame 1 to 43 with rectangle shapes, using imwrite function to save them. I found that imwrite actually scale the RGB values, so I also save the original RGB values in .mat files.

    b. Extract the values from different buoy samples, I can get the mean R, G, B and the deviation of different buoy samples. Then using a Gaussian model to fit them. Using them as the standard to judge if a point is the buoy.

    c. Read the frames, compare all the pixels in the frame with the standard. Calculate the possibilities that a specific pixel is a buoy.

    d. Using the possibilities to compare with some thresholds and finally get the buoy areas.


Histogram for green buoy

Histogram for red buoy

Histogram for yellow buoy
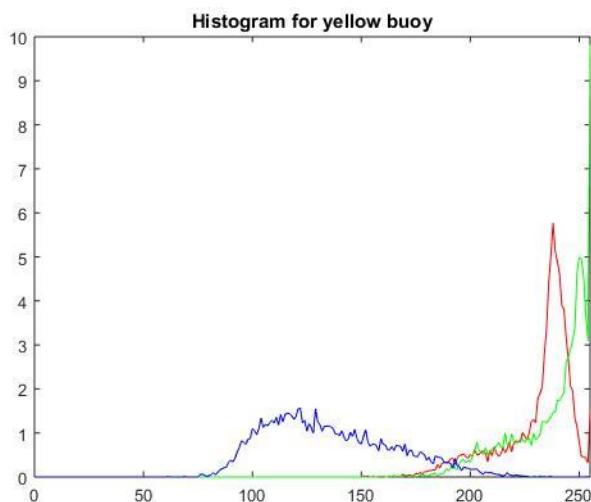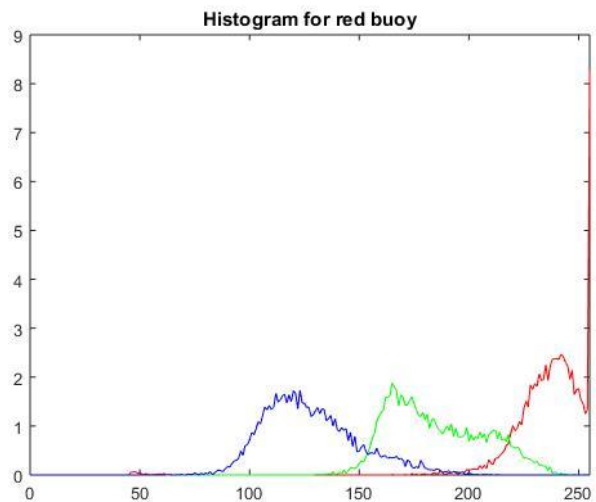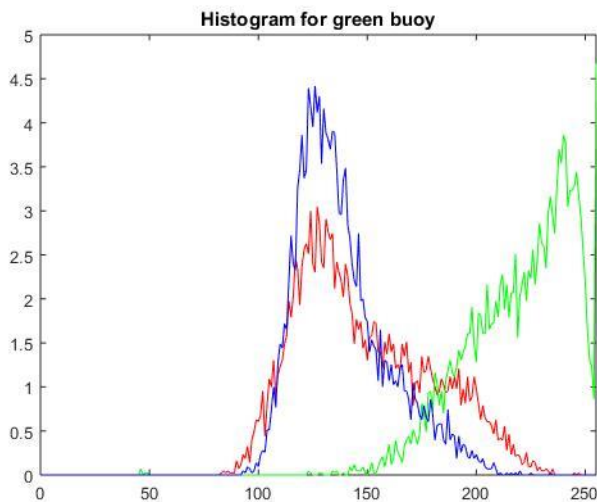
2) Part1

a. As you can see the EM1D3N result plot. My implementation of the GMM is very similar to the Matlab fitgmdist function.
b. The EM1D4N result shows that if we forcedly to separate 3 samples into 4 Gaussian distributions, the previous distribution which has the smallest standard deviation will be regarded as 2 different distributions.
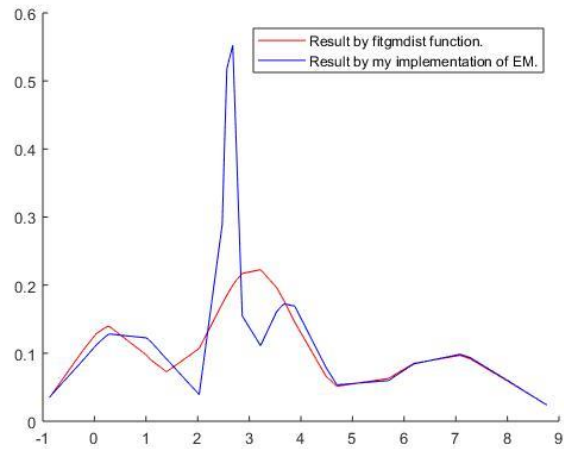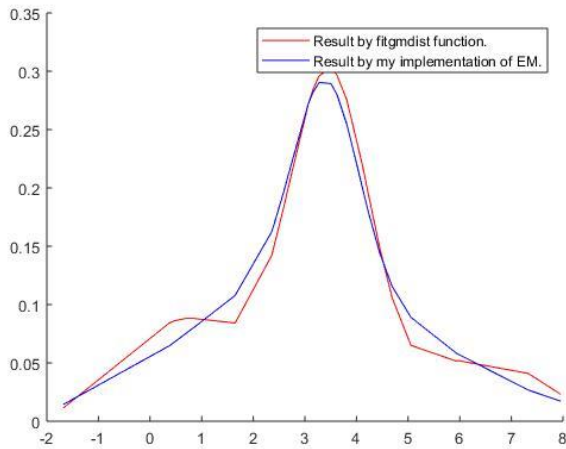
3) Part2
   a. I used my own implementation of GMM to separate the mixed buoy sample data. The results are quite accurate, you can compare with the results in the Part0.
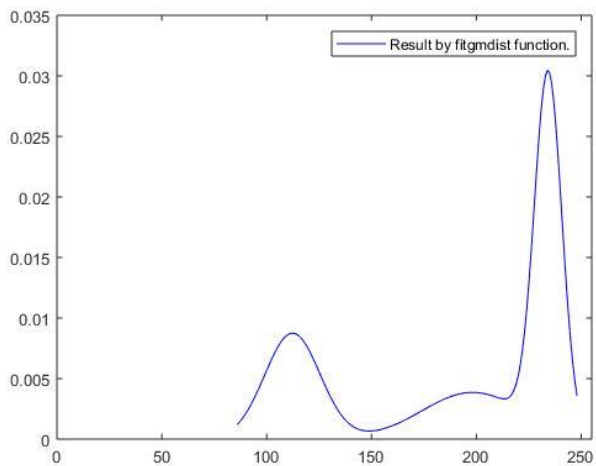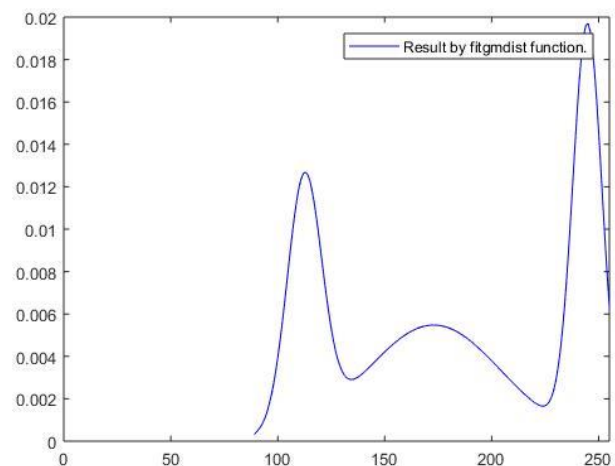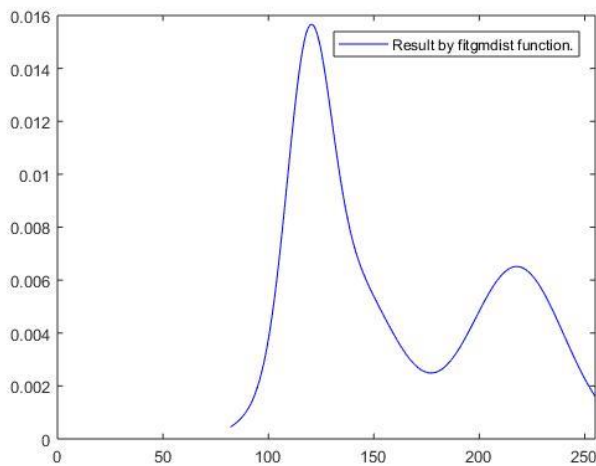
4) Part3

    a. Please watch the video I made in the Output folders.

5) Extra.

    a. Yes. There is a representation of image called HSV. H stands for hue, S stands for saturation, V stands for value (brightness). The advantage of this representation is that it consider about light condition and saturation while maintain the number of parameters to be 3.

    b. I'm sure this HSV representation is better than RGB. However, I don't have enough time to find the perfect threshold after finishing implementation. My video output is not correct since sometimes it detects more than 1 same color buoys. But it can run continuously from frame 1 to 200. While the previous part 3, we can't get results sometimes because the random initial positions yields wrong GM results.