ESE 650 SPRING 2013: PROJECT 1 REPORT

INTRODUCTION:

This report describes the algorithm I used for project 1: Colour Segmentation. For detection of depth and centroid of a red barrel.

ALGORITHM:

STAGE 1:

- Collected images from the dataset provided, some of these were taken under low light conditions, hence converted the images from RGB space to Ycbcr, in order to extract all the pixels.
- I chose three classes for segmentation, Red(barrel), White(mainly walls) and Floor(shades of gray or closer).
- Using ROIPOLY, I hand labelled around 29 images and stored the masks for each classes as a mat files.
- Using these masks and original image, extracted the pixels of all classes from the training images.

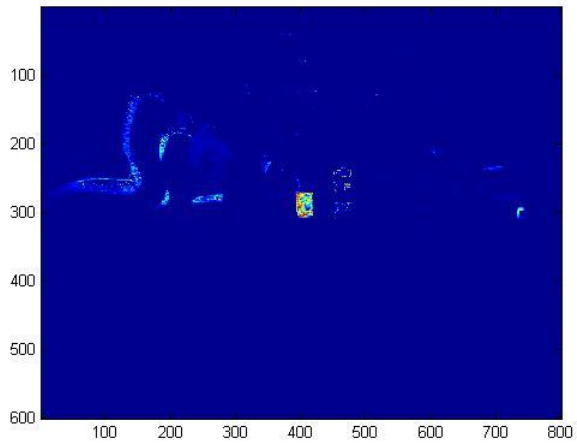
STAGE 2:

- Built a Gaussian model for each class, found parameters μ and $\sum$, these were used to describe the probability density of every pixel.
- Found the prior over each class and used Bayes rule to find probability of class being selected given a pixel.
- Stored all the above probability values in a matrix, plotted the heat map of the same to set a threshold for selecting only those values that will help detect the Red barrel.
- Using these pixels created a binary images where the pixels depicting class red were ones and rest zeros. Due to the Presence of pixels of this class at places other than the red barrel there were spurious distributions that we needed to get rid off for selecting the barrel alone.

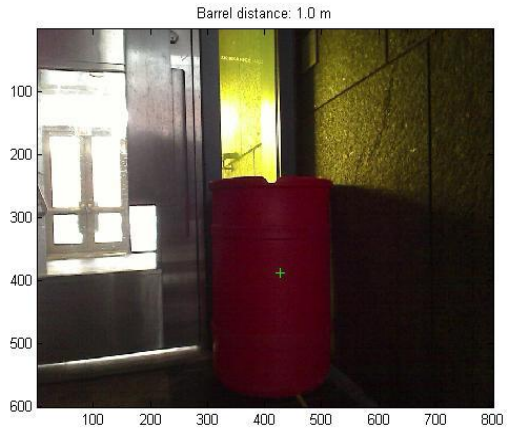
STAGE 3:

- Resized the image for faster processing.

- Used functions bwlabeln, bwconvhull to cluster the connected components , removed smalled patches of unnecessary pixels using bwareaopen.

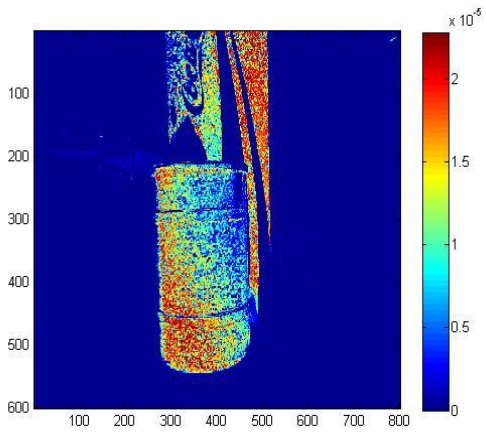


HeatMap



Detection under low light conditions

- Used regionprops for plotting the bounding box also. In some training examples there were more than one box being detected, to avoid this I used Shape heuristics such as aspect ratio (width/ height of the barrel) and also the area of the bounding box to be greater than a minimum threshold of 400 hundred pixels (as in demand by training set). Also extracted centroids using regionprops



Difficult image: As the image has spread out class , and many connected components

STAGE 4:

- For finding the depth of the barrel, I used the Knn algorithm and used the square root of the area of the barrel and the aspect ratio as the features of the training examples, set aside a few of them to test.

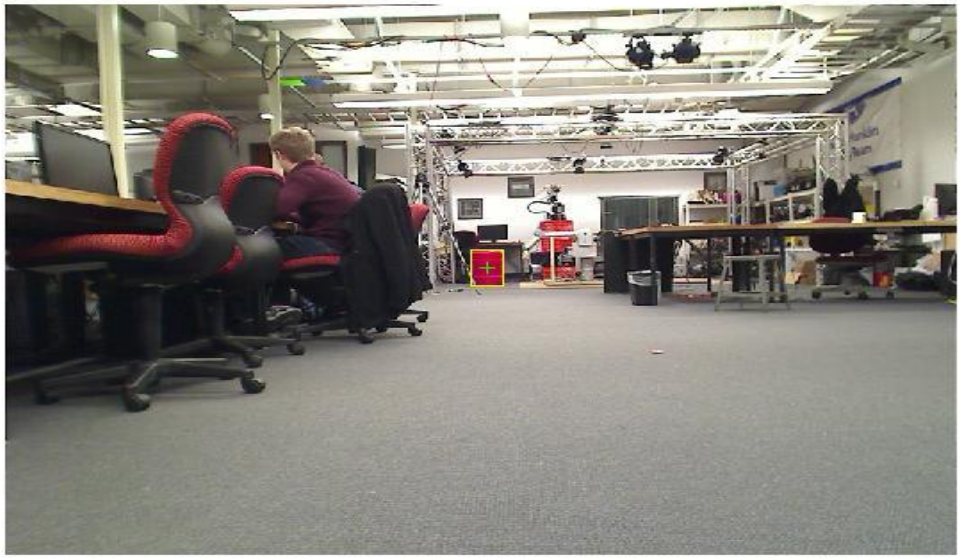
CONCLUSION AND PERFORMANCE

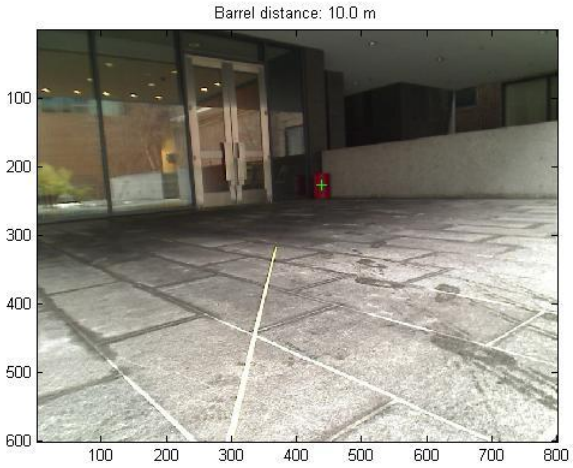
The above algorithm could detect majority of the barrel depths, also the one sin low lighting, however certain images that had hidden barrels or camouflaged with other items was difficult.

IMPROVEMENTS

In order to detect the barrels that are against similar colour objects or a hidden, Gaussian mixture models can be used.

Results




Barrel distance: 10.0 m
100
200
300
400
500
600
100
200
300
400
500
600
700
800