AUV-IITK PRESENTATION (IP SUBSYSTEM)

PROBLEMS IN THE PRESENT PRE-PROCESSING PART OF IMAGE PROCESSING CODE

1. Present code does nothing but converts the original Mat image into HSV color space and then directly thresholding and no image enhancements, which makes it vulnerable to change in lighting conditions and thresholding problems

2. Thresholding is difficult since the image is not very clear and colors are faded.

3. There is only one noise reduction technique applied which is not very useful because its input is not that well thresholded.

PROBLEMS WITH THE UNDERWATER IMAGES

1. Underwater imaging is challenging due to the physical properties existing in such environments. Different from common images, underwater images suffer from poor visibility due to the attenuation of the propagated light.

2. It is necessary to get a enhanced image because further processing depend heavily on the original image , since object detection is color based so it is important to have a color enhanced image.

3. Underwater images have faded colors.

4. There is also a blue color-cast over the image, which is also necessary to remove to have the color balanced image.

SOLUTIONS TO THE PROBLEMS UNDERWATER IMAGES

1. Traditional enhancing techniques like white balance, color correction, histogram equalization

2. Image is white balanced in order to remove the color cast.

3. White balancing is an important processing step that aims to enhance the image appearance by discarding unwanted color casts, due to various illuminants.

4. Color enhancement is applied.

5. Algorithm used for color correction is CLAHE (contrast limited adaptive histogram equalization) algorithm.

Ordinary histogram equalization uses the same transformation derived from the image histogram to transform all pixels. This works well when the distribution of pixel values is similar throughout the image. However, when the image contains regions that are significantly lighter or darker than most of the image, the contrast in those regions will not be sufficiently enhanced.

Adaptive histogram equalization (AHE) is a computer image processing technique used to improve contrast in images. It differs from ordinary histogram equalization in the respect that the adaptive method computes several histograms, each corresponding to a distinct section of the image, and uses them to redistribute the lightness values of the image. It is therefore suitable for improving the local contrast and enhancing the definitions of edges in each region of an image.

However, AHE has a tendency to over-amplify noise in relatively homogeneous regions of an image. A variant of adaptive histogram equalization called contrast limited adaptive histogram equalization (CLAHE) prevents this by limiting the amplification.

ALTERNATIVES TO THE SOLUTIONS

1. Enhancing underwater images by fusion framework : framework blends specific inputs and weights carefully chosen from the processed input images.

2. Color cast detection and adjustments using neural networks : to find the type of color cast using neural networks and then accordingly applied methods to apply it.

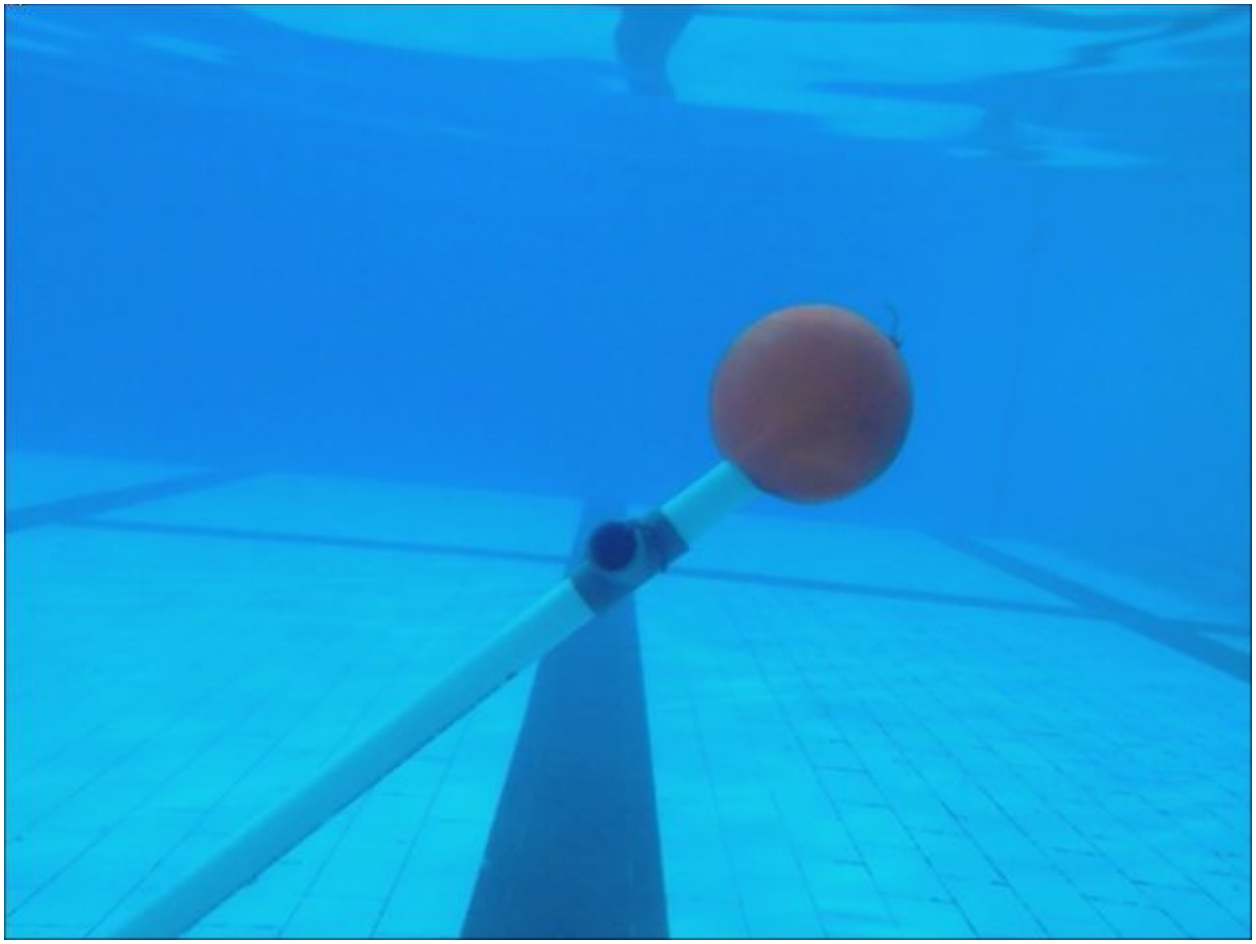
TO-DO

1. To apply neural networks in color-cast detection and its adjustment.

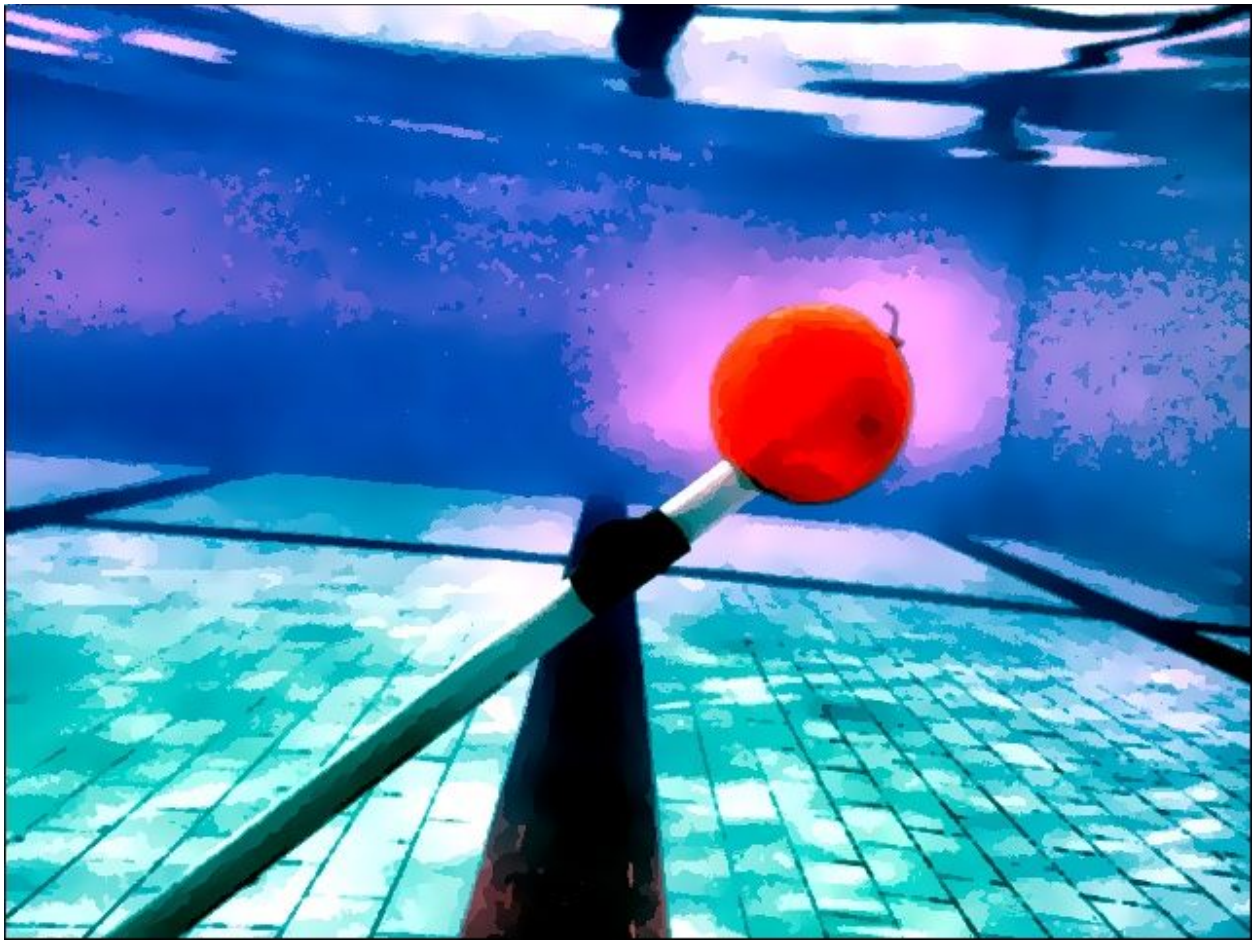
2. To write the code for three buoy tasks.

3. To apply machine learning for object detection.

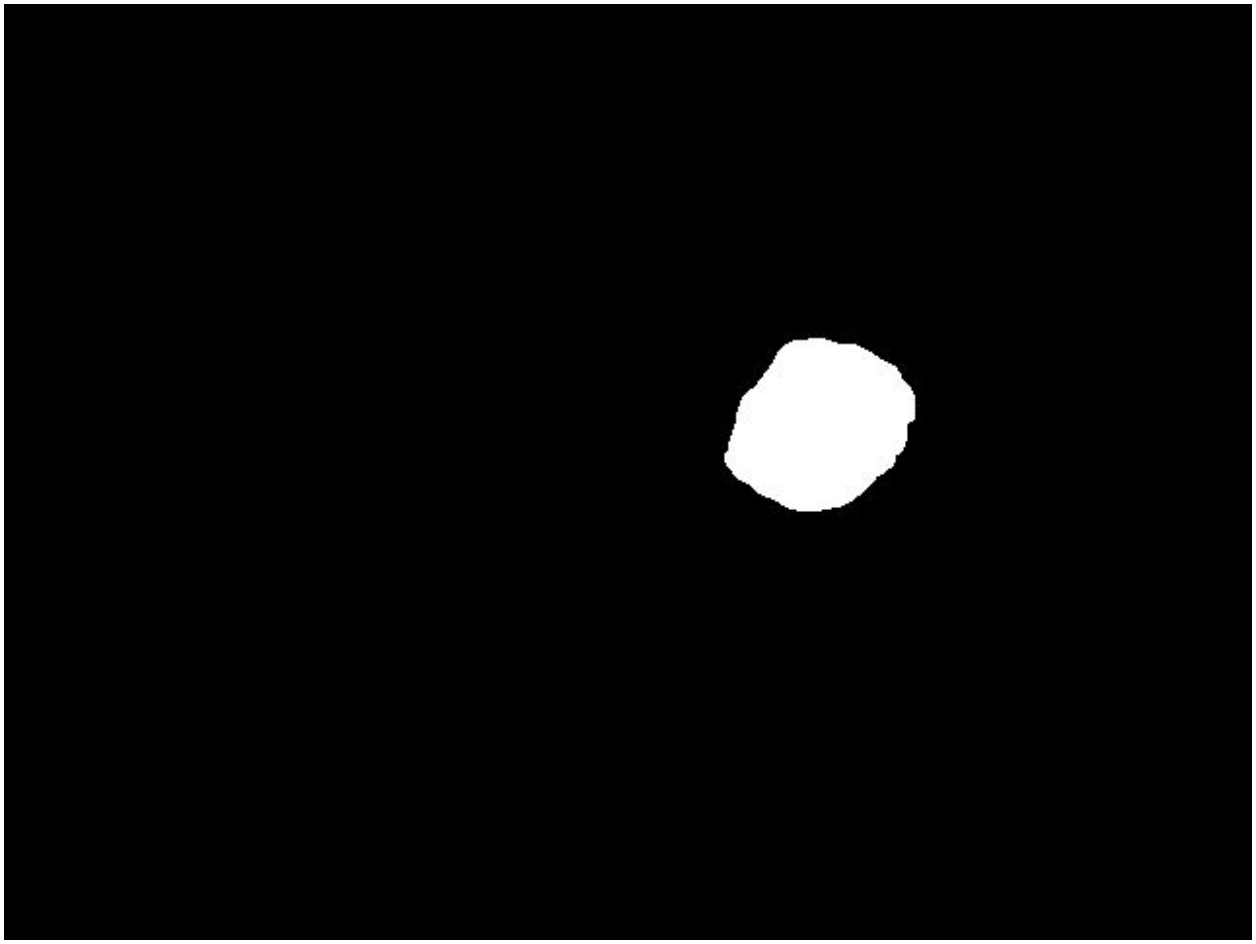
4. To apply fusion framework for image enhancement



INPUT IMAGE



AFTER ENHANCING



THRESHOLDED IMAGE