



Underwater Image Processing For Object Detection

Niranjan Anand Hule
Department of E&TC, MIT,Pune

ABSTRACT:

This paper presents an efficient method which can be used for underwater object detection system automation. The most important thing in underwater image processing is selection of processing domain (like RGB, Gray-scale, R, G, B etc) and filter. The RGB image is captured by a underwater waterproof camera or taken from database from internet . Underwater image processing for object detection is a system which loads a image, pre-processes the image, filters and scales the image to find the object.

Keywords: RGB, Underwater, Object, Detection, System, Automation, Database, Internet

I. INTRODUCTION

Underwater Images are of paramount importance in underwater scientific mission for applications such as monitoring sea life and assessing geological or biological environment. Underwater Image Processing has received extensive attention in academic and production fields because of its various application potentials. Some of its potential application areas are Navy purpose, Detecting new fish species, Oil pipeline, optic-fibre cable etc. The detection system should have underwater camera. Nowadays sonar is used to detect underwater submarines. The main objective of Underwater Image Processing Object Detection system is to recognize objects, which are in the form of images, without any human intervention. This is done by extracting a boundary information and reducing noise.

II. SYSTEM DEVELOPMENT

A. PROJECT SPECIFICATIONS

The main aim is to develop a Object detection and recognition system for Underwater captured images using image processing. The objects are affected by light reflection near water surface. When deep inside water boundary of object are not detected due to dark colour of object and also due to poor illumination. Following are project specification.

Software:

- ✓ PC with Windows XP/Vista/7/8 OS

Hardware:

- ✓ Waterproof Camera

OR

Database:

- ✓ Images from internet

Platform / Language used:

- ✓ MATLAB r2012a

B. SYSTEM BLOCK DIAGRAM

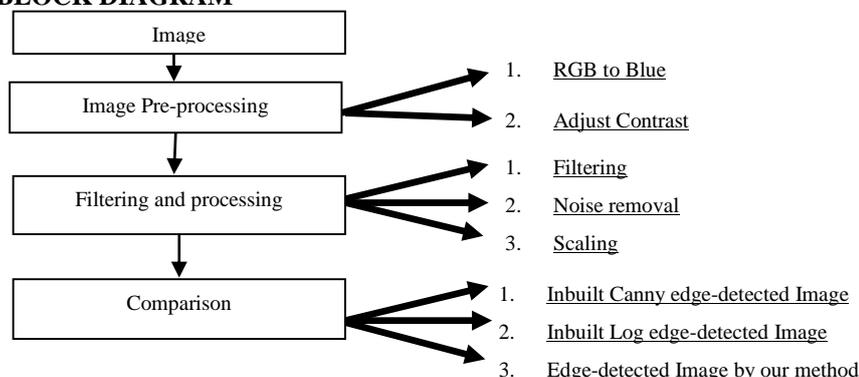


Fig. 1. System Block Diagram

III. PROCESSING

The starting point of the project was the creation of a database images that would be used for processing. Data collection for the present work has been done from internet. Collected images are of submarines and fish in water. Images in database of submarine are in darkness or near surface. All images are in JPEG format.

A. PRE-PROCESSING

Pre-processing includes the steps that are necessary to bring the input data into an acceptable form for filtering and processing. The corresponding objectives of Pre-processing methods are as follows: -

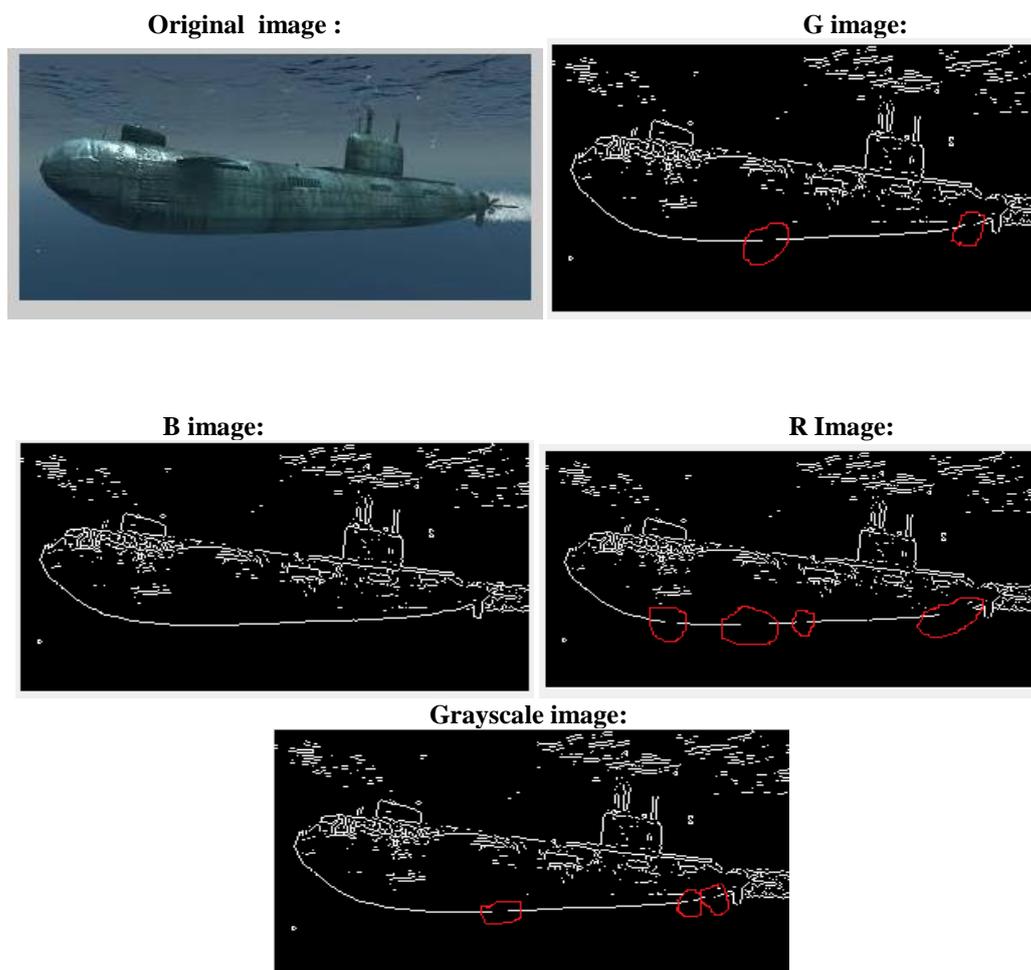
1. RGB to Blue conversion -

The RGB plane has three components red, green and blue. To deal with all three components and process them together is tedious so we extract only Blue component which will give ease in processing. We do not work in grayscale as output obtained from Blue component is better than R, G, B & grayscale.

The red marks show edge not detected.

The output for R, G, B & Grayscale when observed after application of edge detection is as follows:

Figure 2:



2. Adjusting Image - The intensity values in images are adjusted using the 'imadjust' function. It increases contrast of image.

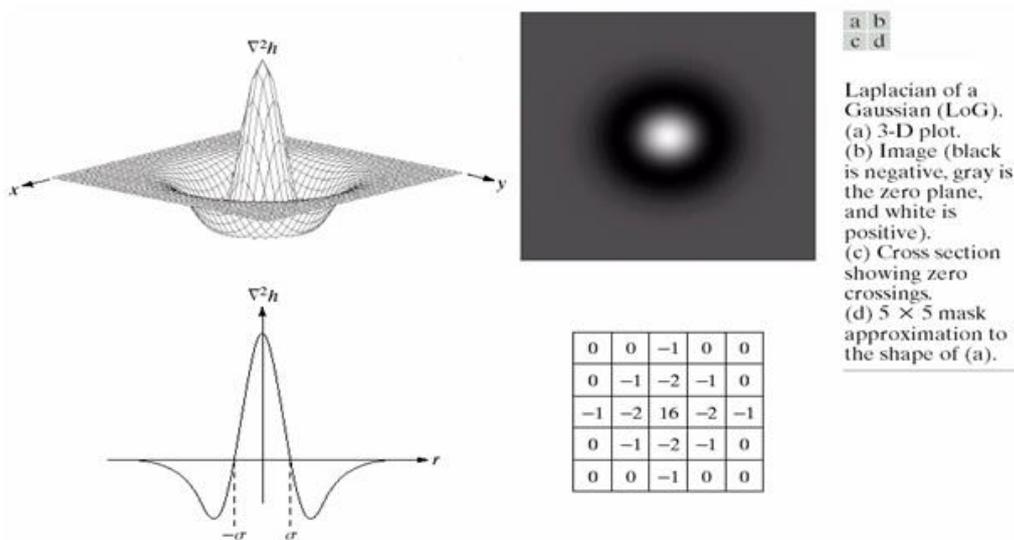
B. FILTERING AND PROCESSING

For filtering, the LOG filter is proposed on which proper noise removal filter is applied.

1. Marr-Hildreth filter for edge detection:

Laplacian of gaussian is a isotropic filter i.e. rotation invariant. Directly Laplacian filter cannot be used as it gives strong response to stray noise pixels. Hence some amount of noise cleaning is to be done prior application of Laplacian operator. Noise cleaning (Gaussian smoothening) is done. After edge detection main job is to remove noise which is done by wiener filter

Figure 3. Laplacian of Gaussian(LoG)[7]:



2. Wiener filter :

The wiener2 is an inbuilt function that applies a Wiener filter (a type of linear filter) to an image adaptively, tailoring itself to the local image variance. Where the variance is large (high frequency component), wiener2 performs little smoothing. Where the variance is small, wiener2 performs more smoothing. It preserves edges and other high-frequency parts of an image. Wiener2 estimates the local mean and variance around each pixel. Wiener2 then creates a pixel-wise Wiener filter using these estimates. If the noise variance is not given, wiener2 uses the average of all the local estimated variances [9].

3. Image Scaling:

The image obtained is scaled i.e. intensity over 255 are scaled down to 255 whereas those below 0 are scaled down to 0. Scaled image has some missing edges which are detected using 'imtool' then those pixels values are scaled to 255.

C. COMPARISON

The image obtained are compare into three categories:

1. Inbuilt Canny edge-detected Image
2. Inbuilt Log edge-detected Image
3. Object-detected Image by our method

IV. RESULT

The images were processed and observed and also compared.

Figure 4:

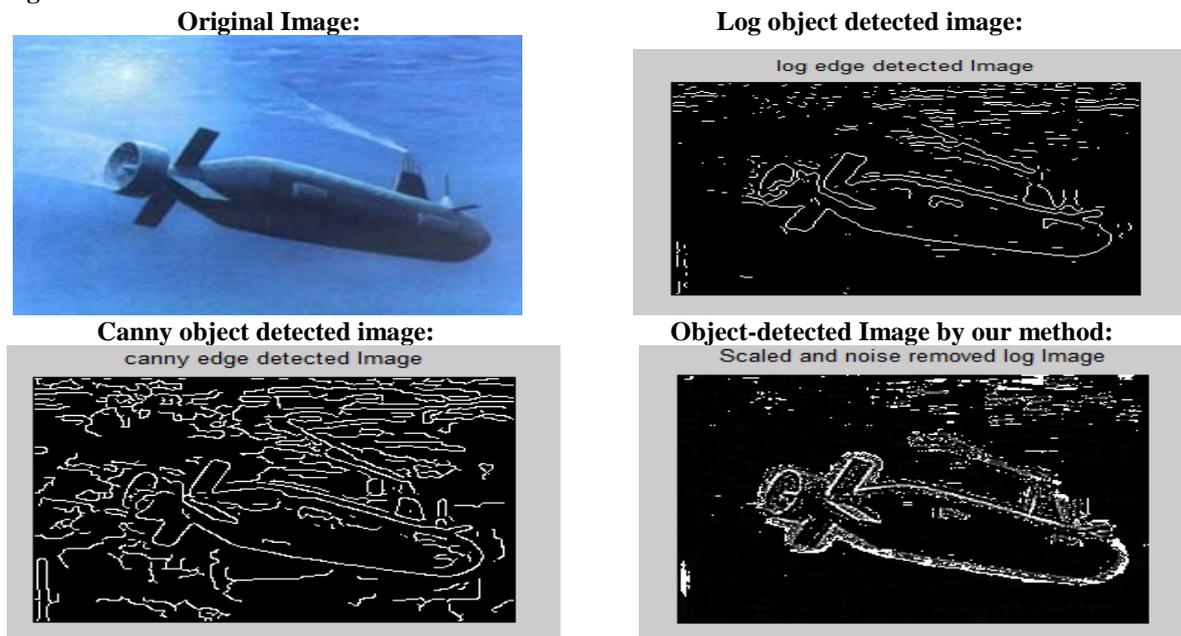


Figure 5:

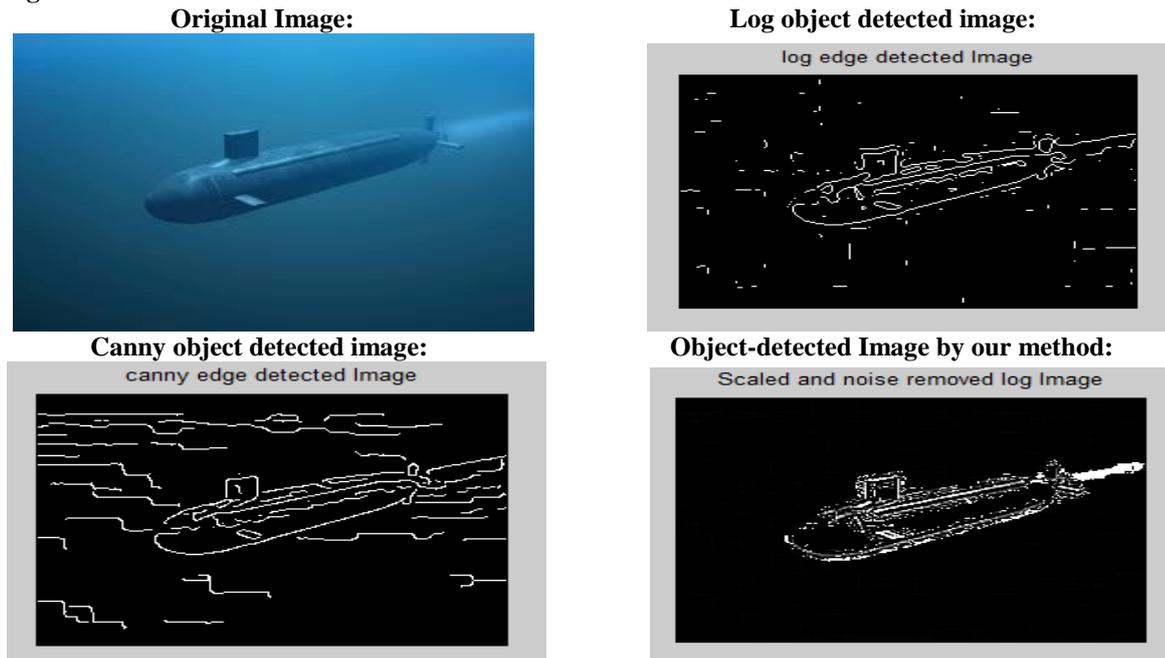
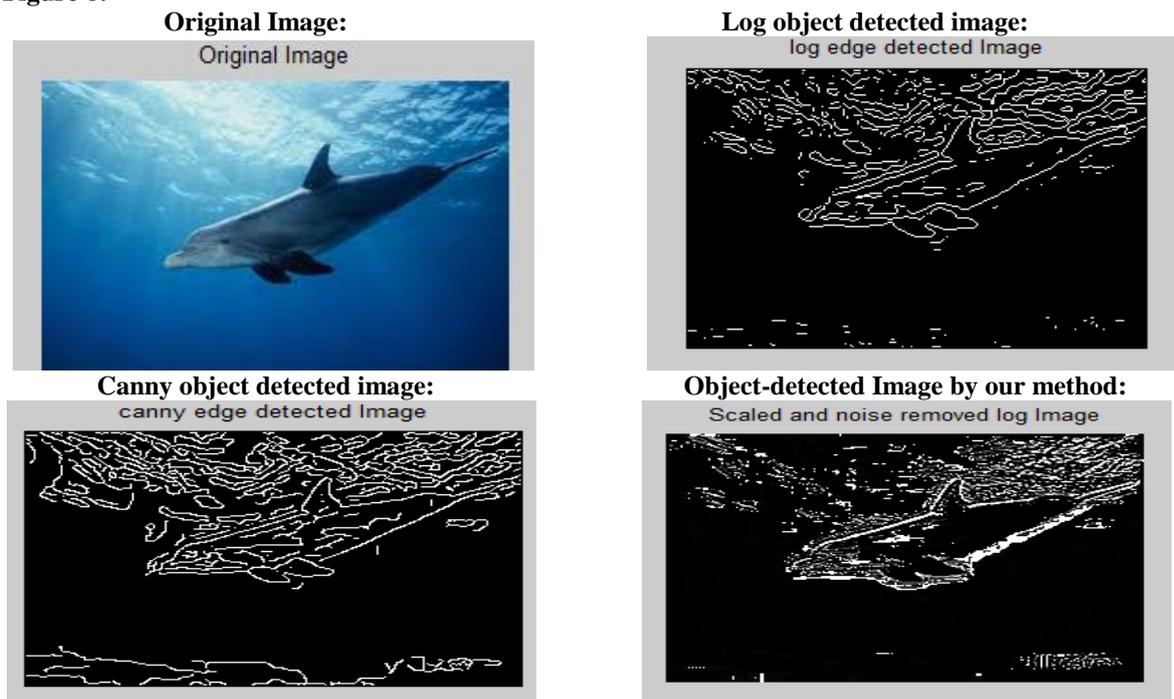


Figure 6:



V. IMPLEMENTATION OF SYSTEM ALGORITHM

A. Image Pre-processing

Method Begins

- Step 1: Input the image from the database which is stored in JPEG format.
- Step 2: Convert the RGB image into Blue image.
- Step 3: Adjust the image using imadjust function.

B. Filtering and Processing

- Step 1: Calculate size of image obtained in step 2.
- Step 2: Apply the LoG mask throughout the image.
- Step 3: Display above filtered image.
- Step 4: Apply the wiener filter to reduce noise.
- Step 5: Display noise filtered image.

Step 6: Scale image intensity above 255 scale down to 255 and below 0 are scaled up to 0.

Step 7: Scaled image has some missing edges which are detected using 'imtool' then those pixels values are scaled to 255.

C. Comparison

Step 1: Display the edge detected image by using inbuilt 'canny' operator.

Step 2: Display the edge detected image by using inbuilt 'log' operator.

Step 3: Display the edge detected image by using our method.

Method Ends

CONCLUSIONS

This paper proposes about Under Image Processing for Object Detection. It has found that recognition of underwater object is difficult task. Following are achievements of paper:

A. If we extract only B component from RGB image and process it then result obtained would be better than Grayscale or any other domain.

B. The code written as proposed by paper produce better result than inbuilt 'canny' and 'log' edge detection function which are inbuilt in MATLAB R2012a.

C. In most cases output given by code proposed in paper is comparable to inbuilt 'log' function abut in some cases superior to inbuilt 'log' function and is always superior to inbuilt 'canny' function.

D. The code written also provides good result for earth images.

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