Underwater Object Detection

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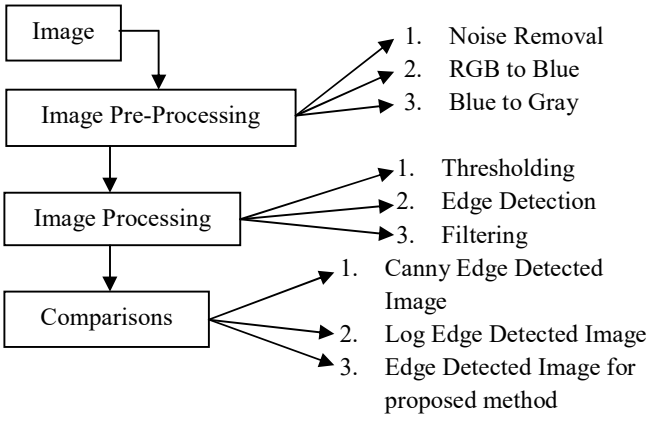
ABSTRACT:- This paper presents one of the efficient methods which can be used for underwater object detection system. The most important thing in underwater image processing is selection of processing domain (like RGB, Grayscale, etc) and filters. The RGB image is captured by using an underwater waterproof camera or is taken from database. Underwater image processing for object detection is a system which loads an image, preprocesses the image, filters and scales the image to find the object.

KEYWORDS:- RGB, Detection, MATLAB, Edge, Processing, Underwater, Database.

I. Introduction

Image Processing is the analysis and manipulation of a digitized image, especially in order to improve its quality. It is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it. Usually Image Processing systems includes treating images as two dimensional signals while applying already set signal processing methods to them. Potential applications of Underwater Image Processing are in areas of Navy purpose, Maintenance of oil pipeline, Detecting aquatic life-forms, optic-fiber cable etc. 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 the boundary information and reducing noise.

II. System Block Diagram



The main aim is to develop an 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, boundaries of object are not detected due to dark color of object and also due to poor illumination. First we have to take the image from the database from the internet.

This image is first pre-processed which consists of steps:-

1. Noise Removal:- The image noise is random variation of brightness or color information in images. It is an undesirable byproduct of image capture that obscures the desired information. It can be removed by using Gaussian filter and blind de-convolution technique.
2. RGB to Blue Conversion:- The captured image is in RGB format. The blue component of the image is first extracted from the colored or RGB image because deep into the water mainly blue color is more obviously seen in the environment. This process is done because the edges using Blue image is more clearly visible and continuous rather than using any other components of the image.
3. Blue to Grayscale Conversion:- The obtained image is converted into gray scale and then to binary by using the MATLAB commands. This is done because we can only operate on 2-D images and not in 3-D format while image processing.

III. Processing

The images taken underwater are more dark and low contrast hence there is more possibility of noise being present. To remove this noise and enhance the image, processing of the image has to be done. This process is mainly divided into 4 parts:-

1. Thresholding:-

Thresholding is done for making the images more compatible while performing edge detection technique. It is the simplest method of image segmentation.

From a grayscale image, thresholding can be used to create binary images which are helpful in edge detection techniques. The simplest thresholding methods replace each pixel in an image with a black pixel if the image intensity is less than some fixed constant, or a white pixel if the intensity is greater than the constant. Here we are using automatic thresholding which is a great way to extract useful information encoded into pixels while minimizing background noise. This is accomplished by utilizing a feedback loop to optimize the threshold value before converting the original grayscale image to binary. Automatic thresholding will work best when a good background to foreground contrast into exists. Meaning the picture must be taken in good lighting conditions with minimal glare. But due to underwater environment this method sometimes gives some problems.

2. Edge Detection:-

Edge detection is an image processing technique for finding the boundaries of objects within images. It works by detecting discontinuities in brightness. Edge detection is used for image segmentation and data extraction in areas such as image processing, computer vision and machine vision. In edge detection method, specific mask and algorithm is applied on the image. Common edge detection algorithms include Prewitt, Sobel, Roberts, Canny and Log methods. In our method we are using Canny and Log algorithm for edge detection because they give the best desired output needed whose edges can be visible more appropriately.

3. Filtering:-

- Wiener filter:- In image processing, there are various filters used such as Marr-Hildreth, LoG, Wiener filters, etc. In our method we are using wiener filter as it is the best method to remove blurriness in images caused due to linear motion. Also by using this filter the edges of the image are smoothened and are made continuous. The wiener2 is an inbuilt function that applies a Wiener filter to an image adaptively, tailoring itself to the local image variance. Where the variance is large, wiener filter performs little smoothing. Where the variance is small, wiener performs more smoothing. It preserves edges and other high-frequency parts of an image.

4. Comparison:-

The images obtained are compared into three categories:-

a. Inbuilt Canny edge-detected Image.
b. Inbuilt Log edge-detected Image.
c. Object-detected Image by proposed method.

IV. Implementation of Algorithm

A. Image Pre-processing

Method Begins

Step 1: Input the image from the database which is stored in JPEG format.

Step 2: Remove the noise from the image taken.

Step 3: Convert the RGB image into Blue image.

Step 4: Convert the Blue image into Grayscale image.

B. Filtering and Processing

Step 1: Calculate size of image obtained in step 3.

Step 2: Use the automatic thresholding technique.

Step 3: Use canny and log algorithm for edge detection.

Step 4: Apply the wiener filter to reduce noise.

Step 5: Display noise filtered image.

C. Comparison

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

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

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

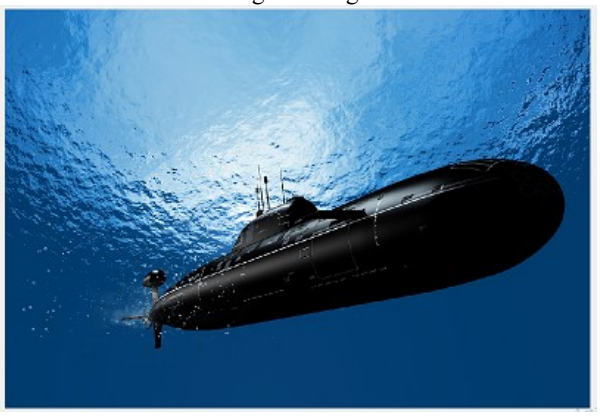
Method Ends

V. Results and Comparison

The images were processed and observed:-

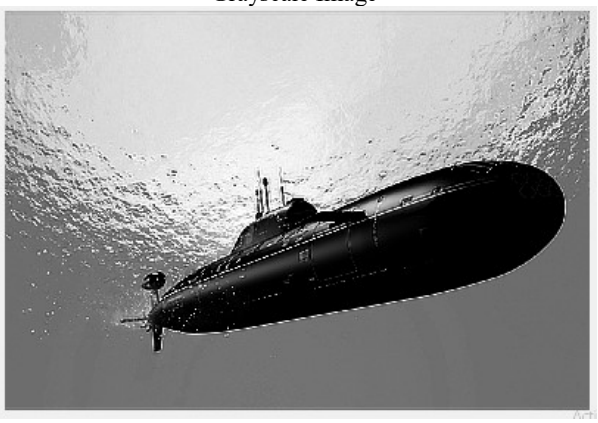
Image:-

Original Image

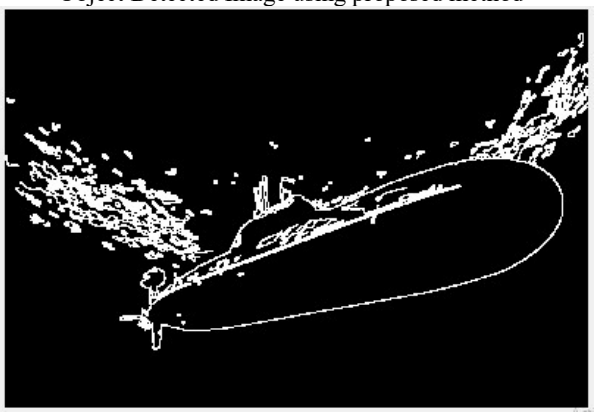


Blue Image

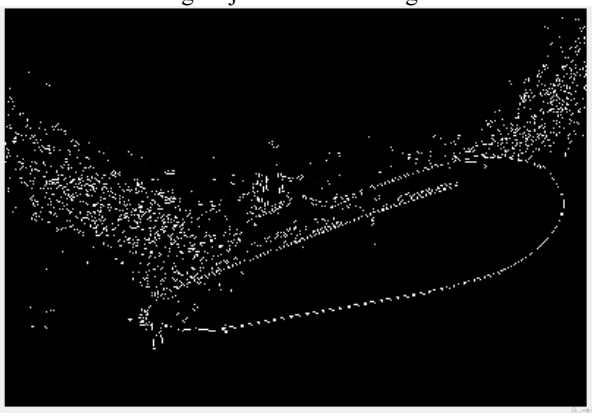
Grayscale Image



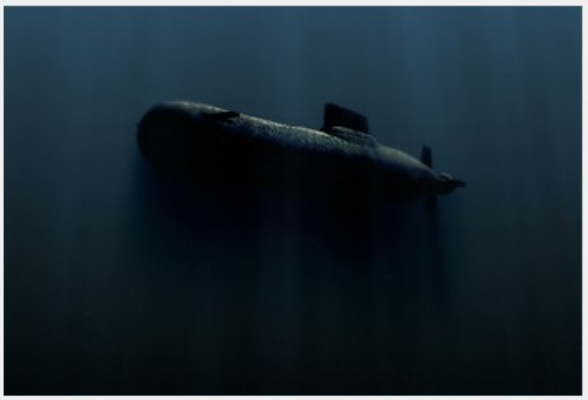
Object Detected Image using proposed method



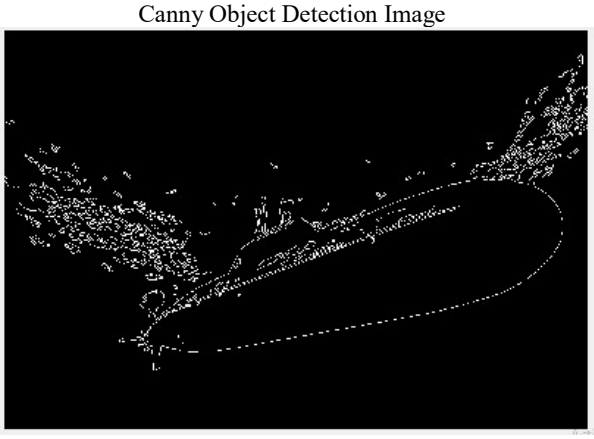
Log Object Detected Image



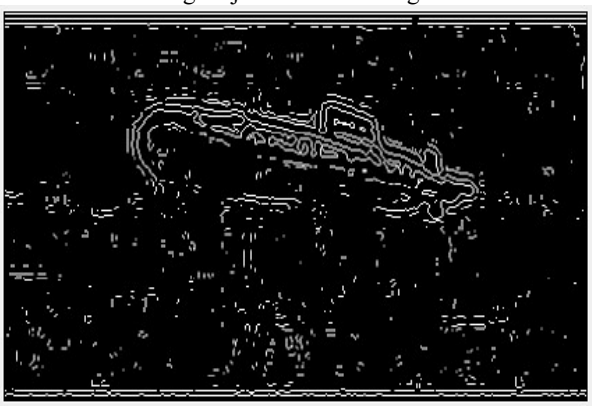
Original Image



Canny Object Detection Image

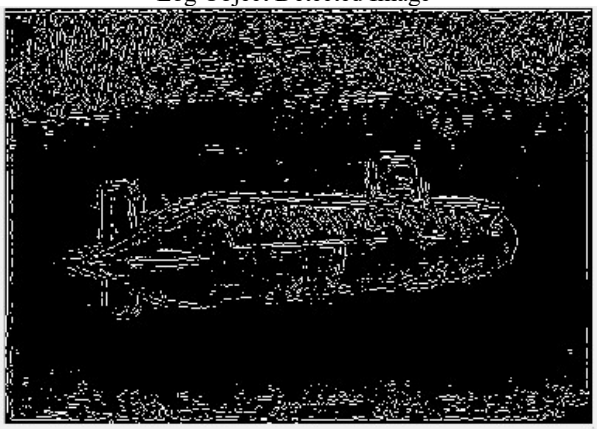


Log Object Detected Image

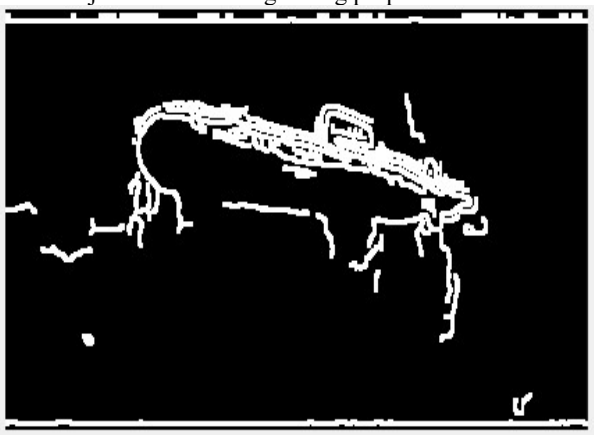


Canny Object Detection Image

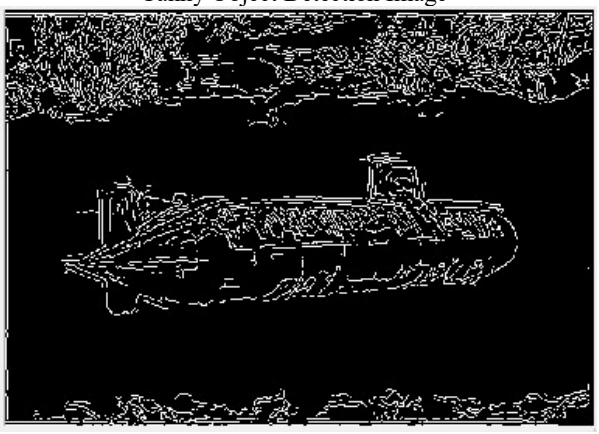
Log Object Detected Image



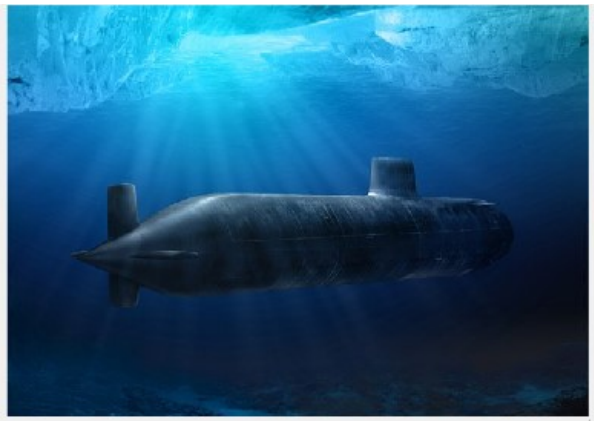
Object Detected Image using proposed method



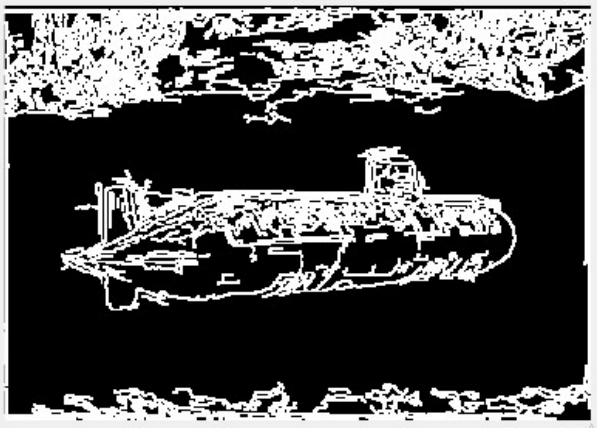
Canny Object Detection Image



Original Image

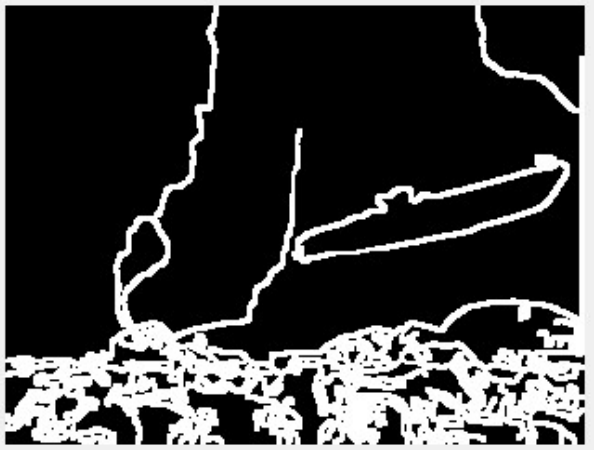


Object Detected Image using proposed method



Original Image

Object Detected Image using proposed method



Log Object Detected Image

Canny Object Detection Image

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 Blue 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 R2014b.

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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