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Enhancement of Side Scan Sonar Image For Object Recognition in Underwater

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ABSTRACT: The main objective of this system is to enhance the quality and effectiveness of the underwater sonar image as well as to improve the image clarity by using the filtering methods. In the modern world predictions are most important in case of emerging scenarios such as earthquake, tsunami and so on. Underwater Sonar Image analysis is the major concern to capture the sonar images and predict the natural disasters as well as abnormal condition alarming. Lots of issues raises while analyzing underwater sonar images such as forward and backward scattering, sound, sea snow and many more. A new methodology is required to resolve these issues and provide the better image clarity. Reconstruction principle allows us to improve the accuracy of image by reducing the noise level by using dehazing model. Modified Sonar Image Mode Filtering model eliminates the underwater issues in the captured image by means of descattering principles.

KEYWORDS: Sonar Images, Underwater Image Clarity Enhancement, Sonar Image, Filtering Model.

I. INTRODUCTION

Sonar (originally an acronym for Sound Navigation and Ranging) is a technique that uses sound propagation (usually underwater, as in submarine navigation to navigate, communicate with or detect objects on or under the surface of the water, such as other vessels. The image reconstruction principle allows us to improve the accuracy of image by reducing the noise level by using filtering model. For all our proposed results guarantees the accuracy and clarity of the underwater images for clear predictions and provide resolving to the existing issues. Sonar (initially an acronym for Sound Navigation and Ranging) is a procedure that utilizes sound engendering (generally submerged, as in submarine route to explore, speak with or identify questions on or under the surface of the water, for example, different vessels.

Two kinds of innovation share the name "sonar": detached sonar is basically tuning in for the sound made by vessels; dynamic sonar is transmitting beats of sounds and tuning in for echoes. Sonar might be utilized as a methods for acoustic area and of estimation of the resound attributes of "focuses" in the water. Acoustic area in air was utilized before the presentation of radar. Sonar may likewise be utilized as a part of air for robot route, and upward looking in-air sonar is utilized for climatic examinations. The term sonar is likewise utilized for the hardware used to create and get the sound. The acoustic frequencies utilized as a part of sonar frameworks shift from low infrasonic to a great degree high ultrasonic.

The investigation of submerged sound is known as submerged acoustics hydro acoustics One of the most punctual utilization of ADP precious stones were hydrophones for acoustic mines; the gems were indicated for low-recurrence cutoff at 5 Hz, withstanding mechanical stun for sending from air ship from 3,000 m (10,000 ft), and capacity to survive neighboring mine blasts. One of key highlights of ADP unwavering quality is its zero maturing attributes; the precious stone keeps its parameters even finished delayed stockpiling.

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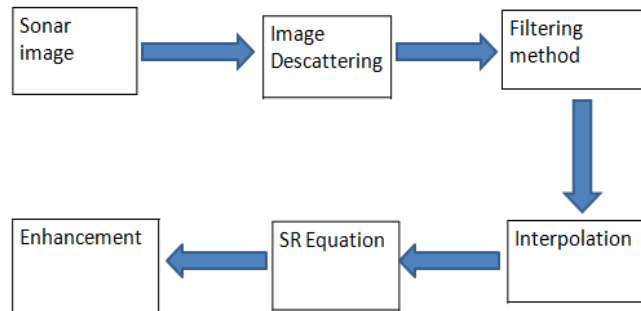


Fig.1 System Block Diagram

Another application was for acoustic homing torpedoes. Two sets of directional hydrophones were mounted on the torpedo nose, in an even and vertical plane; the distinction signals from the sets were utilized to guide the torpedo left-right and up-down. A countermeasure was created: the focused on submarine released a bubbling synthetic, and the torpedo pursued the noisier fizzy fake. The counter-countermeasure was a torpedo with dynamic sonar a transducer was added to the torpedo nose, and the receivers were tuning in for its reflected occasional tone blasts. The transducers included indistinguishable rectangular precious stone plates masterminded to jewel formed territories in stunned columns. Detached sonar exhibits for submarines were produced from ADP precious stones. A few precious stone congregations were orchestrated in a steel tube, vacuum-loaded with castor oil, and fixed. The tubes at that point were mounted in parallel clusters.

A. Image Preprocessing

The main necessity of this Image Preprocessing module is to enhance image quality. Image pre-processing can significantly increase the reliability of an optical inspection. Several filter operations which intensify or reduce certain image details enable an easier or faster evaluation. The following are the examples of image pre-processing method Normalization, Edge filters, Soft focus, selective focus, User-specific filter, Static/dynamic Binarization, Image plane separation and Binning. This modules comprises many internal works include: Include plane separation and Binning. This modules comprises many internal works include: Includes several functions for image processing, Contrast increase by static or dynamic Binarization, look-up tables or image plane separation, Resolution reduction via binning, Image rotation and Conversion of color images to gray value images.

B. Side-Scan Sonar

Side-scan sonar (also sometimes called side scan sonar, side scan sonar, side imaging sonar, side-imaging sonar and bottom classification sonar) is a category of sonar system that is used to efficiently create an image of large areas of the sea floor. Side-scan sonar may be used to conduct surveys for marine archaeology; in conjunction with seafloor samples it is able to provide an understanding of the differences in material and texture type of the seabed. Side-scan sonar imagery is also a commonly used tool to detect debris items and other obstructions on the seafloor that may be hazardous to shipping or to seafloor installations by the oil and gas industry. In addition, the status of pipelines and cables on the seafloor can be investigated using side-scan sonar. Side-scan data are frequently acquired along with bathymetric soundings and sub-bottom profiler data, thus providing a glimpse of the shallow structure of the seabed. Side-scan sonar is also used for fisheries research, dredging operations and environmental studies.

It also has military applications including mine detection. Side-scan uses a sonar device that emits conical or fan-shaped pulses down toward the seafloor across a wide angle perpendicular to the path of the sensor through the water, which may be towed from a surface vessel or submarine, or mounted on the ship's hull. The intensity of the acoustic reflections from the seafloor of this fan-shaped beam is recorded in a series of cross-track slices. When stitched together along the direction of motion, these slices form an image of the sea bottom within the swath (coverage

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width) of the beam. The sound frequencies used in side-scan sonar usually range from 100 to 500 kHz; higher frequencies yield better resolution but less range.

C. Feature Extraction

The main motto of this feature extraction module is to extract the important data's from the image. This is the statistical feature and geometric like edge, brightness, skewness, contrast, area, perimeter. The function of feature extraction is to obtain new variables from the matrix of the image in order to create distinct classes. The feature extraction procedure involves the use of the wavelet decomposition process. These features are then classified in the next stage. Features extraction comprises five processing steps as illustrated as above, by which the features in the system are extracted from the wavelet coefficients. In this module clearly allows the user to get the background and foreground of the inputing image separately to further better process.

D. Image Descattering with MIMF

In this Image Descattering module, the color of the input image is enhanced and the raw data present into the image is extracted for further usage as well as the content size is arranged, so that the user can provide any kind of input images into the system for processing. Along with the depth map reconstruction model Modified Image Mode Filtering illumination is proposed, which eliminates the underwater issues in the captured image by means of the above mentioned Descattering principles, which improves the quality and accuracy level of the underwater images to provide better predictions to the people.

II. LITERATURE SURVEY

In the year of 2016 the authors "R. A. Hamzah and H. Ibrahim" proposed a paper titled "Literature survey on stereo vision disparity map algorithms [7]" in that they described such as: this system presents a literature survey on existing disparity map algorithms. It focuses on four main stages of processing as proposed by Scharstein and Szeliski in a taxonomy and evaluation of dense two-frame stereo correspondence algorithms performed in 2002. To assist future researchers in developing their own stereo matching algorithms, a summary of the existing algorithms developed for every stage of processing is also provided. The survey also notes the implementation of previous software-based and hardware-based algorithms. Generally, the main processing module for a software-based implementation uses only a central processing unit. By contrast, a hardware-based implementation requires one or more additional processors for its processing module, such as graphical processing unit or a field programmable gate array. This literature survey also presents a method of qualitative measurement that is widely used by researchers in the area of stereo vision disparity mappings.

In the year of 2005 the authors "C. S. Tan, A. L. Sluzek, G. Seet, and T. Y. Jiang" proposed a paper titled "Range gated imaging system for underwater robotic vehicle [6]" in that they described such as: the work that has been done to improve the underwater visibility from underwater robotic vehicle (URV) for sub-sea inspection and repair missions. It is undertaken as part of a research program to develop an underwater imaging system in turbid water condition. Images associated with underwater imaging systems are frequently degraded due to absorption and scattering effects from its underwater environment. The absorption effect reduces the signal strength, and the latter effect reduces both signal strength and image resolution. In order to improve the underwater visibility in turbid conditions, general design considerations of the imaging system are planned in two stages, namely: hardware upgrading and system optimization. We demonstrate this concept by improving the underwater visibility with an advanced technique -range gated imaging system (hardware upgrading), and the optimization stage in terms of tail-gating and image processing techniques. Tail-gating is realized by a delay in camera gating towards the tail of reflected image temporal profile (RITP). It is followed by contrast limited adaptive histogram equalization (CLAHE) to further enhance the range-gated images. A quantitative image quality measure, modified fidelity index (MF), is used to evaluate the enhanced imaging techniques. The measure is based on 2 dimensional grayscale images of USAF (United State Air Force) targets. These targets have been used extensively in underwater imaging system development. It has resolution bars in various frequencies and arrangement, which enable spatial frequencies and signal strength analysis. In the first stage, the MF

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index shows at least 40% improvement from non-gated to gated images in increased turbidity. By comparing images between Front-gated to the Tail-gated RITP quantitatively, the latter is improved by about 4% -22% (based on MF index) in various turbidity levels. Finally, the CLAHE technique further improves the gated images in terms of contrast gain.

In the year of 2010 the authors "J. F. Fish, C. S. Johnson, and D. K. Ljungblad" proposed a paper titled "Sonar target discrimination by instrumented human divers [4][5]" in that they described such as: a series of sonar discrimination experiments has been performed using instrumented human divers wearing a helmet with a sending and two receiving transducers. Porpoise like broad-band clicks, with energy centered about 60 kHz, were projected and the returning echoes stretched electronically in time by a factor of 128 to enable the divers to hear them. Data were collected using metallic plate targets and targets of different geometrical shapes that were previously used in experiments with a porpoise. A comparison of scores indicated that the instrumented divers performed as well as, and in some cases better than, the porpoise.

III. EXISTING SYSTEM SUMMARY

In the past system classical depth map estimation with image filtering techniques are highly encouraged to resolve the issues happened in underwater image clarity enhancements. Generally depth information or depth map estimation methods can be categorized as active or passive. Passive methods use cameras to capture images and learning algorithms to recover visual depth information. Passive methods suffer from some issues for practical applications. For example, they require strict image reflection and are inefficient for texture less objects. On the other hand, active approaches, such as structured light sensors and Time-of-Flight [ToF] cameras are subject to errors, such as noise, ambiguity, scattering, and motion blurring. The existing system contains several disadvantages, some of them are listed below: (a) Low resolution and accuracy is achieved via classical algorithms, (b) Time taken process to estimate the underwater images, (c) Large number of iterations is required to process the optical images and improve the quality and (d) Performance is low.

IV. PROPOSED SYSTEM SUMMARY

In the proposed system, a new methodology is introduced to resolve the issues raised in underwater image capturing and analyzing principles, such as Gaussian, gradient and SR Equation. The proposed Depth Map reconstruction model eliminates the noise level in the captured underwater image and improves the accuracy of image by using the bicubic method. Along with the depth map reconstruction model Modified Image Mode Filtering illumination is proposed, which eliminates the underwater issues in the captured image by means of de-scattering principles. In the proposed approach we uses clarity enhancement, resizing and all the required features are done to improve the quality and accuracy level of the underwater images to provide better predictions to the people. The proposed system contains several advantages, some of them are listed below: (a) By using DMMIMF, image resolution is dynamically corrected in post-processing. Immediate resolution enhancement and accuracy evaluation without any time consumption process because of low iteration levels and (b) Performance is high because of its time efficiency.

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IV. EXPERIMENTAL RESULTS

The following figure illustrates the input image of the proposed work.

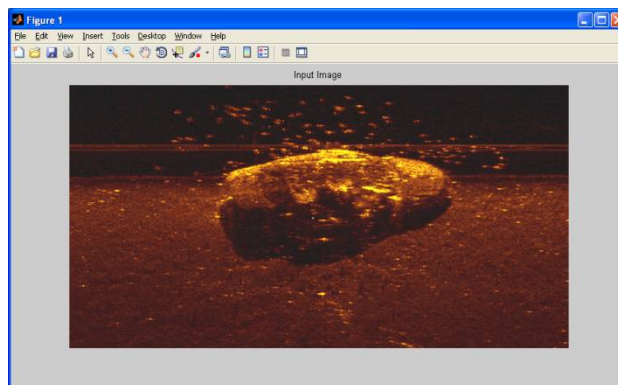


Fig.2 Input Image

The following figure illustrates the extraction of RGB of the proposed work. This is coming under the stage of Pre-Processing and this option extracts the Red, Green and Blue features from the input image and makes the input into gray scale format.

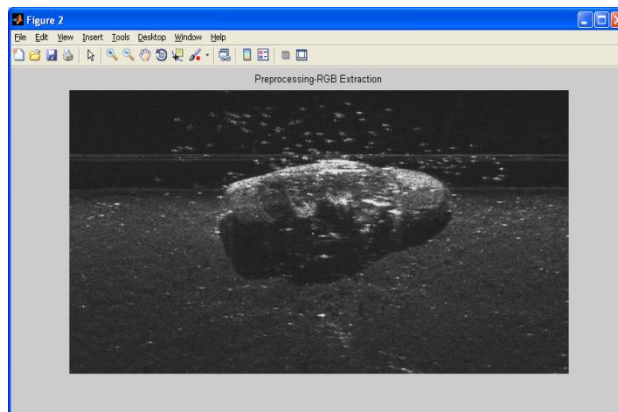


Fig.3 RGB Extraction

The following figure illustrates the image scaling view of the proposed work. This is coming under the stage of Pre-Processing and this option redefines the original input image into fixed pixel range, users can select any size of input image, the redefinition process converts the image into 256X256 pixel range for further processing.

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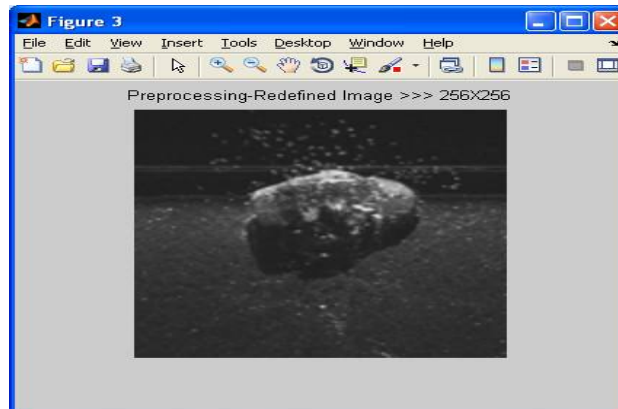


Fig.4 Image Resizing/Scaling

The following figure illustrates the Feature Selection process of the proposed work. This is process of extracting the raw features presented into the digital sonar image, which is used to select the image content such as foreground features and background feature separately from the input image. This option provides major support to improve the clarity of the image.

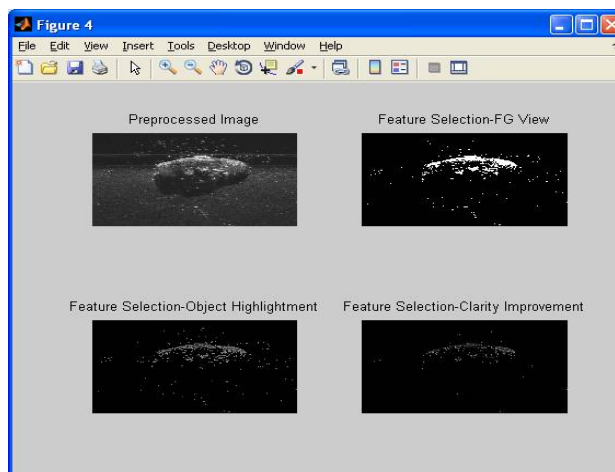


Fig.5 Feature Selection

The following figure illustrates the Image Filtration process of the proposed work. Image filtering is useful for many applications, including smoothing, sharpening, removing noise, and edge detection. A filter is defined by a kernel, which is a small array applied to each pixel and its neighbors within an image.

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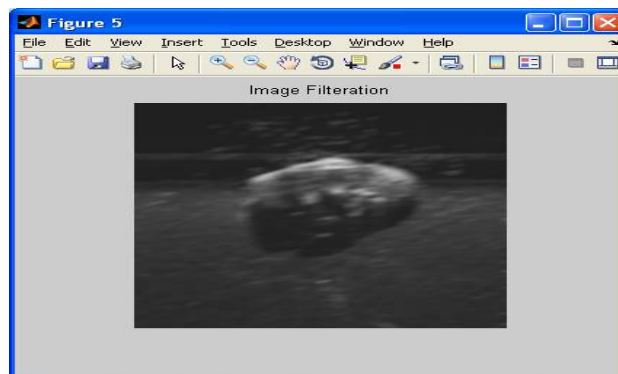


Fig.6 Image Filtration

The following figure illustrates the interpolation process of the proposed work. In texture mapping, it is also known as bilinear filtering or bilinear texture mapping and can be used to produce a reasonably realistic image.

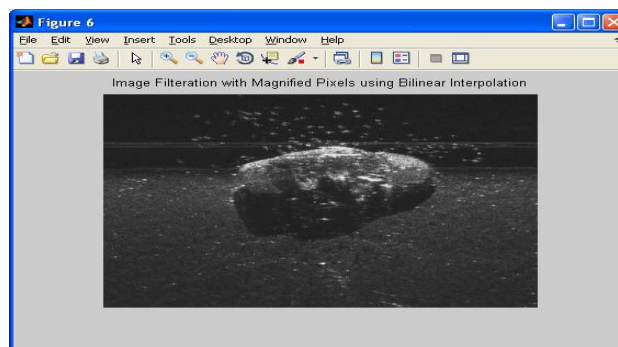


Fig.7(a) Bilinear Interpolation

An algorithm is used to map a screen pixel location to a corresponding point on the texture map. A weighted average of the attributes (color, transparency, etc.) of the four surrounding features is computed and applied to the screen pixel. This process is repeated for each pixel forming the object being textured. The Bicubic filtration strategies are frequently used for scaling images or videos for display (ex: bitmap resampling). It preserves fine detail better than the common bilinear algorithm.

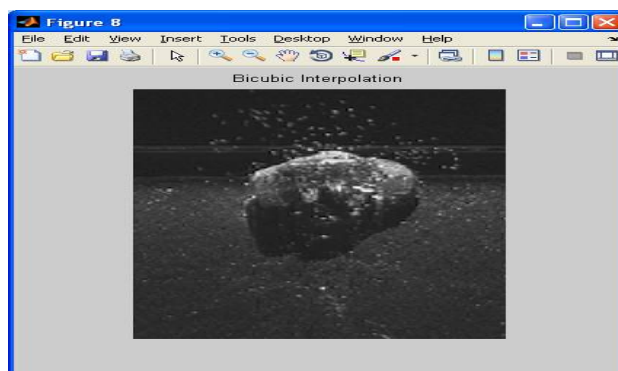


Fig.7(b) Bicubic Interpolation

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The following figure illustrates the resulting accuracy level of the proposed work.

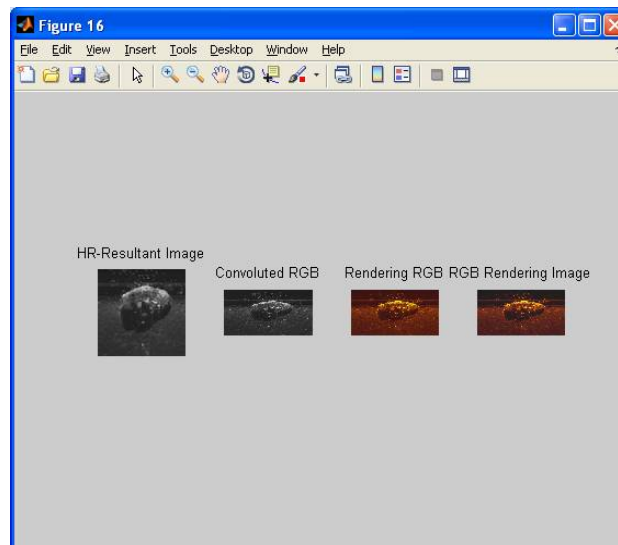


Fig.8 (a) RGB Rendering

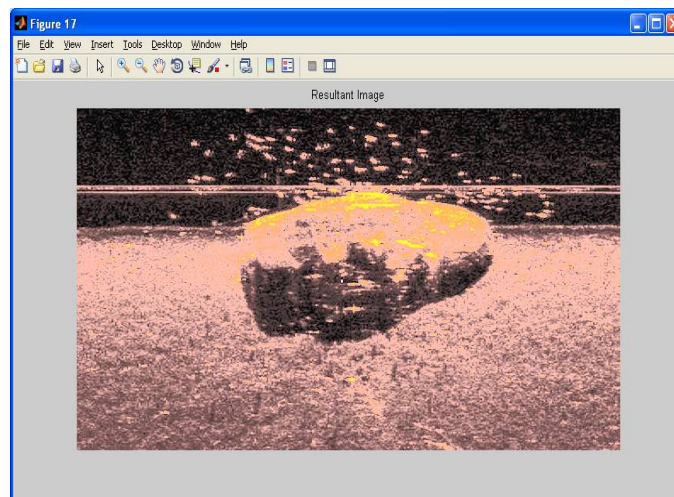


Fig.8 (b) Resultant Image

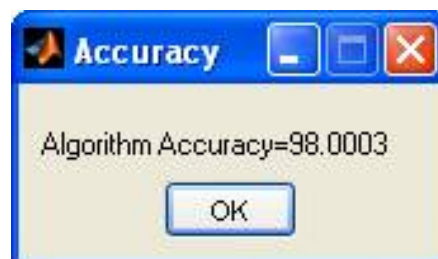


Fig.8 (c) Resulting Accuracy

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V. CONCLUSION

The new image enhancement techniques that uses Gaussian, Gradient, SR Equation was proposed for low resolution underwater sonar image. The proposed techniques interpolate sonar filtering method by using the Bicubic interpolation. Quality of sonar image was improved by the filtering methods. Different type of approach is considered from traditional depth recovery methods to recover the high-resolution depth map using images captured in turbid water. The proposed results proves that our method outperforms existing conventional methods, and is suitable for restoring underwater image depth information.

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