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Underwater Image Enhancement Using Fuzzy Logic

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Abstract

Image enhancement is the process of adjusting digital images so that the results are more suitable for display or further image analysis. Many popular enhancement technique fail to work in some application due to background noise generated in the image. To ad- dress this problem,we apply the fuzzy logic and adjust the each pixel values to obtained derided results.Experiment result are shown for different underwater image along with performance. we also have taken help offuzzy histogram equalization techniques. Rather than using conventional fuzzy logic which includes fuzzi fication, modification of member- ship function and defuzzification ,wehave modified the pixel values by fuzzy logic..

Keywords: Fuzzy,Underwater,Image,Enhancement.

Introduction

Image Enhancement is the process use to improve the image quality. Also to modify the image from light to dark or to enlarge or to reduce contrast. Image or contrast enhancement is traditionally based on either spatial or transform domain techniques. InFuzzy logic method for gray image enhancement and smoothing, two merits havebeen considered.

Motivation

The world is moving towards Artificial Intelligence neural network and fuzzy logic . The motivation was to develop a algorithm based to such technology to improve the current method available in the world. The concept behind the techniques of image enhancement is turn the low quality image into high imagequality, so that the picture look can be enhanced. The enhancement increases therange of the selected element, instead of in- creasing the data's inherent information material, so they can be easily detected. During the process of enhancement several features can be altered. For different application the output of an image is more suitable.

Objective

Techniques for enhancing images are important in the fields of medical imaging, art stud- ies, forensics and atmospheric science. Image enhancement means enhancing the con-sistency of an input picture to solve the human visual system's limitations. The main objective of the techniques for image enhancement is to obtain better visual quality ofan image.
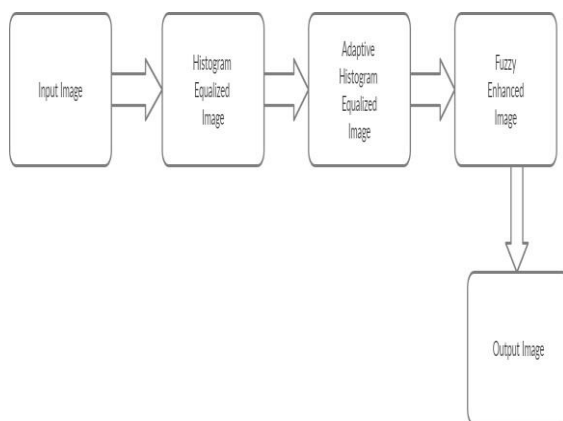
Enhancement of the image provides better

performance for other automated imageprocessing techniques.

System Design

A. Software Design

1.   IMAGE ENHANCEMENTSYSTEM:

The block diagram for image enhancementsystem is shown as below:

*Fig 1:*The block diagram for imageenhancemest process system.

In this block daigram, we have to used an image which have low visibility quality. Then the following image will undergo Histogram equalization Process, then it will go undergo Adaptive histogram Equalization system and futher it will undergo fuzzy logic for an Clear visible image.

Histogram Equalization

Histogram Equalization is a computer image processing technique used to improve con- trast in images. It accomplishes this by effectively spreading out the most frequent in- tensity values, i.e. stretching out the intensity range of the image. This methodusually increases the global contrast of images when its usable data is represented byclose con- trast values. This allows for areas of lower local contrast to gain a higher contrast. A color histogram of an image represents the number of pixels in each type of color compo- nent. Histogram equalizationcannot be applied separately to the Red, Green and Blue components of the image asit leads to dramatic changes in the image's color balance. However, if the image is first converted to another color space, like HSL/HSV color space, then the algorithm can be applied to the luminance or value channel without resulting in changes to the hue and saturation of the image.

Adaptive Histogram Equalization

Adaptive Histogram Equalization differs from ordinary histogram equalization in the re- spect 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 im- age. It is therefore suitable for

improving the local contrast and enhancing the definitions of edges in each region of an image.

FUZZY Enhanced Image

To overcome the unwanted image enhancement and noise amplifying ,the fuzzy logic based histogram technique used for both gray scale and image color .It preserve image brightness and also improve the local contrast of image.

2.   SOFTWARE REQUIREMENT:

MATLAB is an interactive system whose basic information part is an array that doesn't need orienting . This permits you to solve several technical computing issues, especiallythose with matrix and vector formulations, in an exceedingly fraction of the time it might go for write a program in an exceedingly scalar non interactive language like C or al- gebraic language. The name MATLAB stands for matrix laboratory. MATLAB was originally written to supply quick access to matrix package developed by the LINPACK and EISPACK comes, that together represent the progressive in package for matrix com- putation. MATLAB has evolved over aamount of years with input from several users. In university environments, it's the quality tutorial tool for introductory and advanced courses in arithmetic, engineering, and science. In trade, MATLAB is that the tool of selection for high-productivity research, development, and analysis. MATLAB features a family of application-specific solutions referred to as toolboxes. vital to most users of MATLAB, toolboxes enable you to be told and apply specialised technology. Toolboxes square measure comprehensive collections of MATLAB functions (M-files) that stretch the MATLAB surroundings to resolve explicit categories of issues. Areas during which toolboxes square measure accessible embody signal process, management systems, neural networks, symbolic logic, wavelets, simulation, and plenty of others.

MATLAB could be a superior language for technical computing. It integrates com- putation, image, associate degreedprogramming in an easy-to-use surroundings wherever issues and solutions square measure expressed in acquainted notation. Typical uses in- clude: science and computation algorithmic program development Modeling, simulation, and prototyping information analysis, exploration, and image Scientific and engineering graphics Application development, together with Graphicalcomputer program building.

Application

MATLAB are often used as a tool for simulating varied electrical networks however the recent developments in MATLAB create it a really competitive tool for Artificial intel- ligence, Electric vehicles coming up with, Control systems, Electric vehicles coming up with, Robotics, Image processing, Wireless communication, Machine learning, knowledge analytics and knickknackery. Although its principally utilized by circuit branches and mechanical within the engineering domain to unravel a basic set of issues its application is immense. It's a tool that allows computation, programming and diagrammatically visualizing the results.

The basic knowledge component of MATLAB because the name suggests is that the Matrix or an array. MATLAB toolboxes square measure professionally engineered and change you to show your imaginations into reality. MATLAB program- ming is kind of the same as C programming and simply needs a touch brush of your basicprogramming skills to begin

operating with Matlab Software
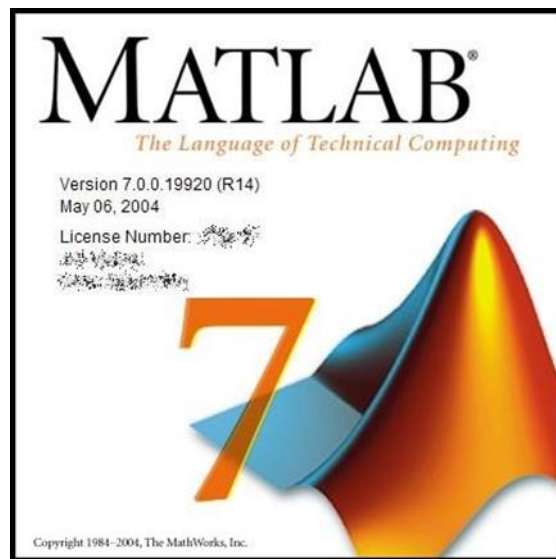
Methodology

The following Flowchart describe the path ofimage processing:
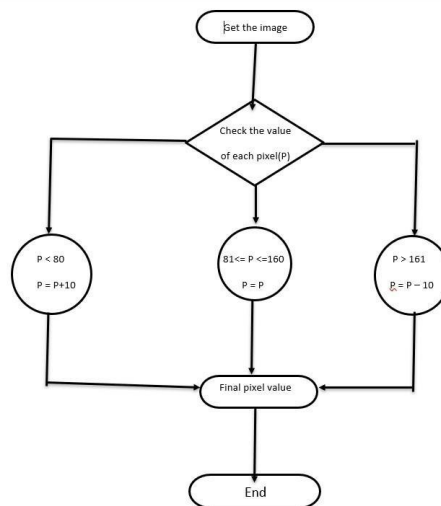
Flowchart

First main thing to do is to select an image for process, then the following algorithm willcheck its pixel value. If the following image pixel value ranges less than 80, then the system will add the following pixel value by

10. if it pixel value ranges more than161,then the system will decrease the value of pixel by 10. and if the pixel value ranges from 81 and between 161 then the system will keep the pixel value as it is and will give the final output.

Algorithm

The algorithm used for proposed work givenbelow:

Step 1- Get the image of enhancing it.

Step 2- Separate all three RGB planes Step 3-Calculate the value of each pixel.

Step 4- Do Fuzzy Modification :

if pixel value(P) less than 80 P=P+10

if pixel value(P) less than and greater thanequal to 80 then(P)=P

if pixel value(P) greater than equal to 160then (P)=P-10

Step 5-Combine all 3 planes.Step 6- Output is obtained.

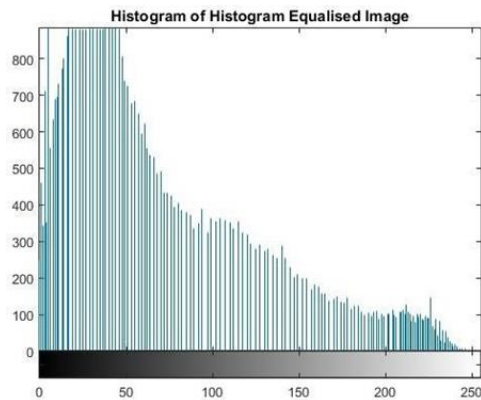**Result**

SR. NO.	Input Image	Adaptive Histogram Equilization	Fuzzy Enhanced Image
PS NR	25.515 3	32.59 73	32.2701
MSE	184.05 81	36.03 68	19.4748
ME AN	119.98 84	123.1 716	122.9651

Input Image

Fuzzy Enhanced Image
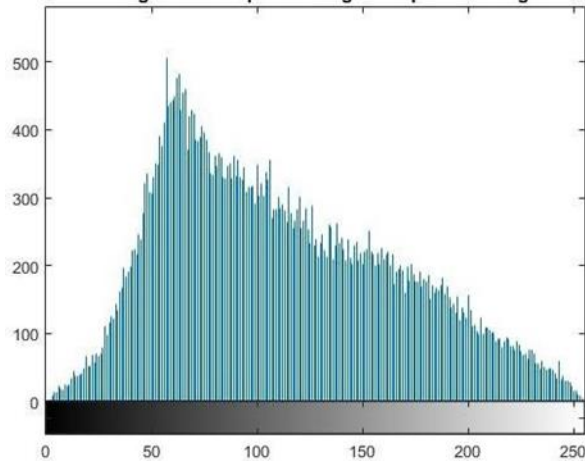

Input Image Histogram

Adaptive Histogram Equalised Image

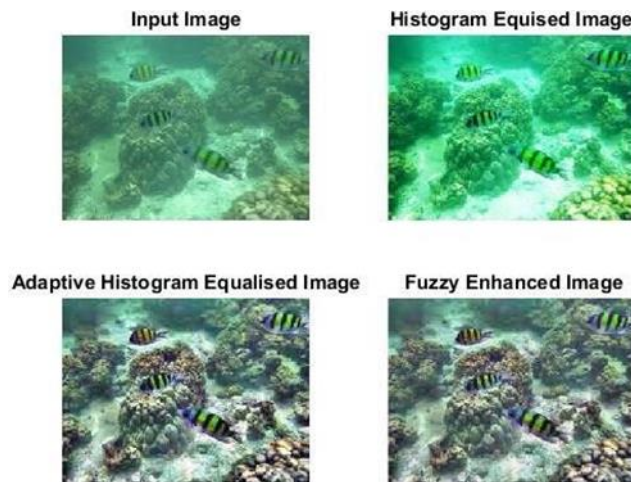Adaptive Equilised image

Histogram of Adaptive Equalized Image

Histogram of Fuzzy Enhanced Image
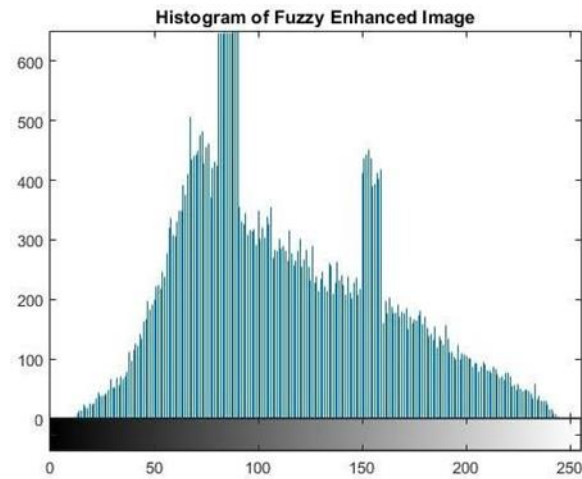
Fuzzy Enhanced Image Histogram

Complete Output

Conclusion

The fuzzy logic based image enhancementhas capability to increase the brightness,boostconstrast in digital in efficient manner with the help of histogram based fuzzy image enhancement technique which in alreadyknown technique used by many to get clear vision image. The overall objective of this work is to to show effect of histogram and fuzzy based enhancement in various blur or invisible images.

With the help of this technique,with is underwater robotics, underwater explo- ration has become more easier and less inconvinent.but looking at the cost , these robots are highly expensive mainly because of high end cameras that are mounted on them . with the help of this research in this field we can look for technique and with better algorithm that the technique or the robots which will be used will be independent of cameras.by this algorithm this will not only help us to get better enhanced images during underwater exploration, but also bring down the cost of these robots simultaneously.

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