International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878 (Online), Volume-8, Issue-1, May 2019

Digitization of Ultrasound Images using Haze-Removal Algorithm and Enhanced Pixel Arrangement Algorithm

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Abstract—Ultrasound Image processing is faced with a number of challenges from distinct resolutions, format variations, non-uniform illuminations, distortions and noise. It is also affected by orientation and contrast differences. Conveying different resolved ultrasound images using haze removal and enhanced pixel arrangement algorithm. This is done by converting low resolution images into high resolution images. Haze-free images consists of some pixels having low intensities in at least one-color channel. Those images are then converted into high resolution imaging by usage of tools in the enhanced pixel arrangement algorithm and then resulting image obtained will be softened.

Keywords:- Haze-free images consists of some pixels having low intensities in at least one-color channel.

I. INTRODUCTION

Image clarity is considered an important aspect in all the fields. Programmed frameworks are taken into consideration to obtain the clarity. Especially in the field of medicine we require the image clarity more than anything as it is required to study the case through the image and diagnose accordingly. It is possible by using a concept of Image processing where differing algorithms are used to achieve the result. Even many images of the same content are produced sometimes. Assorted algorithms are used for obtaining image clarity because of which clarity is obtained to an extent these days. In the recent evolution of the digitization, images are considered to be important in every human life and theirclarity is an important aspect. The implemented work states a programmed algorithmic work for Ultrasound image clarity. Ultrasound images play an important aspect in most of the medical cases in the daily human life, though they are necessary in the medical field the resultant images obtained through the existing technology are hazy and require more concentration to read them and point out the problem.

Revised Manuscript Received on 30 May 2019.
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The demonstrated system implements two different algorithms with required tools through which the images go through for the pixel adjustment and removal of the hazy characteristics in the produced ultrasound image. The algorithms are Haze-removal algorithm and Enhanced pixel arrangement algorithm. The first phase of the process is by introducing the blurred or hazed image as the input through Haze-removal algorithm where the hazy particles in the Ultrasound (US) image are removed.

The input image is processed through guided filter which performs edge-preserving smoothing of the image using another Ultrasound image (i.e. Guided image). Then the smoothened image goes through Soft matting where there is extraction foreground object from an image. Soft matting uses reference of a mathematical equation for obtaining precise results based on the image, the linear equation is

$(L+ \lambda U)t= \lambda t$, where L is N*N matrix (N: image size)

After the first phase (Haze-removal algorithm) the obtained Ultrasound image enters the second phase of the digitization known as Enhanced pixel arrangement algorithm where the irregular pixels of the haze-free image are arranged accordingly for turning low resolution images into high resolution images. It even deals with some AI embedded tools for the conversion of image resolution from low to high. This works by detecting and generating patterns found in low resolution images and applying these patterns during the upsampling process to produce a good quality Ultrasound image.

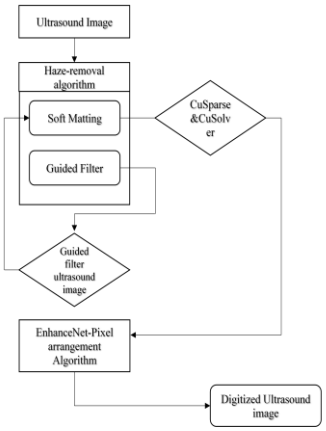
II. SYSTEM ARCHITECTURE

Haze-removal algorithm:

a) Soft matting:

It is the process of extracting foreground object from an image. Matting produces a "matte" that is used to separate foreground from the background in a given image. It uses tools such as

System Architecture



- ***cuSolver***: The cuSolver library is a high-level package to combine three separate libraries under a single umbrella, each of which can be used independently or in concert with other toolkit libraries.
- ***cuSparse***: The cuSPARSE library contains a set of basic linear algebra subroutines used for handling sparse matrices (as any image will be in the form of an even matrix i.e. in a cubical shape)

b) Guided filter:

The guided filter is used to perform edge preserving smoothing on an image, it is done using a guidance image or a second image of the same Ultrasound image (duplicate image obtained) for the image filtering. The guidance image can be the ultrasound image itself or the different version of the image. The filtering of the guidance image is similar to the other filtering operations to sharpen the edges. The image obtained after guided filtering is considered as the input for soft matting process.

Enhanced pixel arrangement algorithm

This algorithm is proposed to convert the low-resolution Ultrasound imaging into High resolution. The performance of this algorithm is measured in PSNR (peak signal-to-noise ratio). This algorithm does not focus on the image reconstruction but instead it is focused on obtaining faithful texture synthesis of the image. This algorithm works by detection and generation of patterns in the low-resolution images and then applying these patterns in the upsampling process during the pixel arrangement. Some of the AI tools are embedded in the algorithm and the convolution networks are used while image input is given. The classical approach of this algorithm is by two major processes

i. Minimizing the mean square error between the input image and produced image by taking the distance between the pixels and summing them up by both produced and input images
ii. Evaluating the peak signal-to-noise ratio (PSNR). It is most likely considered as the scaling of the mean square error

III. EXISTING SYSTEM

A real-time digital scan converter for ultrasound sector scanners, these play different roles in daily applications like satellite television, magnetic resonance, etc.
The drawbacks existing system areare:

1. A digital file cannot be enlarged beyond a certain size without compromising on quality.
2. For real-time implementation of digital image processing algorithms, the processor has to be very fast because the volume of the data is high.

IV. PROPOSED SYSTEM

In the proposed system there are two main advantages available:

1) Flexibility and Adaptability: Digital computers when compared to analog electronic and optical information processing is that no hardware specifications are necessary in order to reprogram computer digital computers to solve different tasks, this helps them process image signals adaptively.

2) Data Storage and Transmission: With the development of different of different image compression algorithms, the digital data can be effectively stored.

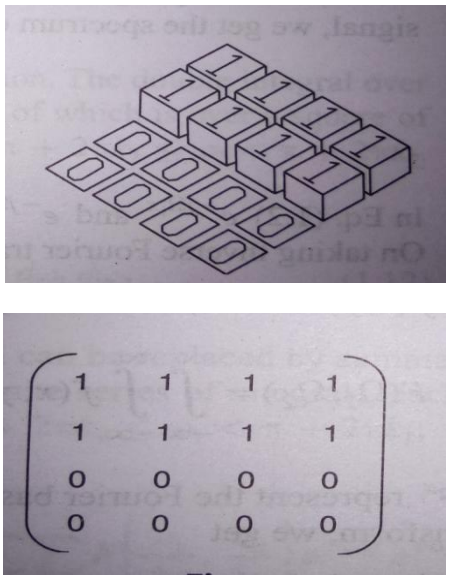
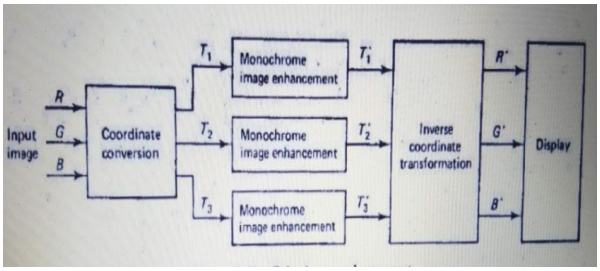


Fig: Image representation in matrix form

There are two enhancement techniques
Haze removal and Enhanced pixel arrangement, in this our system uses frequency domain methods of haze removal which include image smoothing whose aim is to diminish ,spurious pixel values, missing pixel values by edge preserving smoothing and image sharpening which is to highlight fine detail of image, or to enhance detailthat has been blurred. Color image enhancement may require improvement in color contrast or color balance in color image. The color coordinates of each pixel of the input are independently transformed into another set of color coordinates, by applying enhancement algorithm.This technique is very simple to use. In this technique we define a define square or rectangular neighborhood and move the center from pixel to pixel



V. RESULT AND DISCUSSION

The proposed system is made to implement a mechanism to improvise the recovered image quality in digital image processing using various enhancement methods.The methods we used here are to process the input ultrasound image such that the output image is preferred to the original image. It sharpens the image features such as edges, boundaries etc, to make the resultant ultrasound image more helpful for display and analysis purposes. The enhancement doesn't increase the previous information content of the input data, but increases the dynamic range of the chosen features

. This paper presents the newer techniques for ultrasound image enhancement in digital image processing. Although this paper did not discuss the computational cost of enhancement techniques it may play a critical role in Medicinal field and for choosing different techniques for future technology to improve.

The concluded aim of designed process model is to improve the information quality in produced Ultrasound images for normal viewers, or to provide 'better' input for other automated image processing techniques.

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