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Contrast Enhancement Image Fusion With Using Gaussian Filter

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***Abstract*—** Contrast enhancement has an important role in image processing applications. Conventional contrast enhancement techniques either often fail to produce satisfactory results for a broad variety of low-contrast images, or cannot be automatically applied to different images, because their parameters must be specified manually to produce a satisfactory result for a given image. This paper proposes a new automatic method for contrast enhancement with Gaussian Filter. The basic procedure is to first group the histogram components of a low-contrast image into a proper number of bins according to a selected criterion, then redistribute these bins uniformly over the grayscale, and finally ungroup the previously grouped gray-levels. The proposed approach is abbreviated as DACE/LIF. Two main stages are involved in the DACE/LIF approach: the conventional histogram equalization (CHE) and linear image fusion (LIF). Though the CHE has the problem of over enhancement, it is noted that the details which is not obvious in the original image are generally revealed after the CHE. Interesting enough, the details shown in the original image and in the equalized image are of a kind of complementary property.it is called detail complementary property (DCP) between the original image and the equalized image. The DCP suggests that the details in the original image and the equalized image may be combined to form an image with better contrast and visual quality. In the light of DCP, details are aware and the LIF is employed to combine the original image and its equalized image by the CHE. Simulation results indicate that the enhanced image by the proposed DACE/LIF with Gaussian approach has better visual quality than that in the original image.

Keywords-- Contrast Enhancement , Linear image fusion (LIF), Conventional histogram equalization (CHE), Gaussian Filter, Image fusion.

I. INTRODUCTION

CONTRAST Enhancement has an important role in image processing applications. Numerous contrast enhancement techniques exist in literature, such as gray level transformation based techniques (e.g., logarithm transformation, power-law transformation, piecewise-linear transformation, etc.) and histogram processing techniques (e.g., histogram equalization (HE), histogram specification, etc.). Conventional contrast enhancement techniques generally yield satisfactory results if the proper technique is selected for a given application along with the proper processing parameters. However, conventional contrast enhancement techniques often fail in producing satisfactory results for a broad range of low-contrast images, such as images characterized by the fact that the amplitudes of their histogram components are very high at one or several locations on the grayscale, while they are very small, but not zero, in the rest of the grayscale. This makes it difficult to increase the image contrast by simply stretching its histogram or by using simple gray-level transformations. The high amplitude of the histogram components corresponding to the image background also often prevents the use of the HE techniques, which could cause a washed-out effect on the appearance of the output image and/or amplify the background noise. An objective of image enhancement is to improve the visual quality of images. Among image enhancement schemes, contrast enhancement is a popular approach and has been widely used in many display related fields, such as consumer electronics, medical analysis, and so on. It is well-known that the contrast in an image is related to its dynamic range of histogram distribution. That is, an image with wider histogram dynamic range generally has better contrast. Consequently, to enhance the contrast in an image can be achieved by expanding its histogram distribution. Because of its simplicity, the conventional histogram equalization (CHE) is very popular which expands the histogram to its admissible extremes. Though the image contrast is enhanced, however a poor equalized image may be obtained because of the unsuitable histogram distribution for the CHE. Note that the visual quality of histogram equalized image can be improved by restricting the dynamic range or by modifying the original histogram distribution. Recently, several HE based approaches have been presented to improve the performance of the CHE.

One of most widely used linear image contrast enhancement is Histogram

Equalization (HE) which intends to spread out the original image histogram across the entire gray level range. HE is a specific case of the more general class of histogram remapping methods. These methods seek to adjust the image to make it easier to analyze or improve visual quality (e.g., retinex). HE strategy that significantly enhances contrast by spreading out the histogram in a way that the brightest and darkest levels of brightness are always included. As a result, brightness saturation appears not only in quasi-homogeneous low gray levels but also in quasi-homogeneous high-gray levels. In this case, the problem of brightness saturation encountered in histogram linear contrast stretching can be avoided if the narrow range of the original histogram is properly spread out.

HE is one of the most useful forms of linear contrast enhancement. When an image's histogram is equalized, all pixel values of the image are redistributed. As a result, there are approximately an equal number of pixels for each of the user-specified output gray-scale classes (e.g., 32, 64 and 256). Contrast is increased at the most populated range of brightness values of the histogram (or "peaks"). It automatically reduces the contrast in very light or dark parts of the image, which are associated with the tails of a normally distributed histogram. Histogram equalization can also separate pixels into distinct groups if there are few output values over a wide range.

II. IMAGE FUSION

The process of image fusion is used to combine two or more images. The main idea behind image fusion is that different images contain different information. For example the image of the scene which is focused to the left contains different information than the one which is focused on to the right. By fusing these two images we can retain the best features of the two images. Similarly lower resolution multispectral images can be fused with higher resolution panchromatic images to get high resolution images which can provide insightful information about the scene under consideration. This type of image fusion is most commonly used in remote sensing. Thus there can be different sources for image fusion.

Image fusion can be divided into signal level fusion, pixel level fusion, feature level fusion and decision level fusion [7]. In signal level fusion the main idea is to improve the signal to noise ratio by combining the information from different sources. In pixel level fusion the pixel set from all the source images is fused. This process is repeated for all the pixels. In feature level fusion salient features are extracted from a given set of images and then these features are fused together. Finally decision level fusion involves the extraction of information from the given set of images. The extracted information is then combined using decision rules. For image fusion to take place the set of source images needs to be registered i.e. the images needs to be aligned spatially. For our fusion algorithm we use pixel based fusion of source and it's histogram equalized image. Conventional histogram equalization is used for the purpose of equalization because of it's over enhancement. An expression to obtain a fused image If with two source images is given as

$$If = w * I1 + (1-w) * I2$$

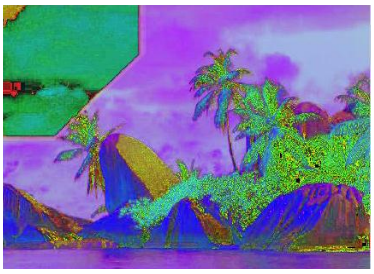
where I1 and I2 are the two images and $0 \le w \le 1$.

III. LINEAR IMAGE FUSION

The main objective of image fusion is to integrate information or details from different source images of a scene to form an image with better visual quality. A general expression to obtain a fused image f I with two source images is given as I f = f (I1, I2), --- (1) where 1I and 2 I are two source images and f (.) is a function to fuse the source images. Eq. (1) suggests that the fused image f I is significantly affected by function f (.) and source images 1I and 2I. Therefore, how to find an appropriate fusion functions and source images is a fundamental issue for a successful image fusion. In this thesis I will employ the linear interpolation as f (.) in Eq. (1). With 1I and 2I, the fused image f I by the linear interpolation is found as- f 1 (1) 2 I = αI + α I ----(2) where 1 ≤ ≤ 0 α is a weighting factor.

The image fusion based on linear interpolation is called linear image fusion (LIF). Though simple, LIF generally has satisfactory performance if appropriate source images can be found. Two ways to obtain appropriate source images are introduced. Interesting enough, the fused image f I can be considered as a morphed image when source images 1I and 2I are different object images, e.g. face images of different persons. Since fI is somewhere between 1I and 2I , and different from either 1I or 2I , it thus can be used to hide 1I or 2I . The idea will be described and applied to steganography.

Origional Image



Fused Image

IV. ISSUES AND CHALLENGES

Linear Image Fusion aims to enhance contrast of an Image. Several algorithms have been proposed for Image Fusion previously but there have been always need for better algorithm to improve contrast. The existing Linear Image Fusion Technique doesn't consider the Filter Technique. The existing Image Fusion Technique is less accurate and their results needs enhancement by using Gabor Filter. To develop an algorithm for loading the input image. Firstly we develop an algorithm for the loading the image in the MATLAB window. If any problem comes then I do code for the removing it. It is an important work for this paper implementation. Designing and implement the developed algorithm for the two main stages are involved in the DACE/LIF approach: the conventional histogram equalization (CHE) and linear image fusion (LIF). Though the CHE has the problem of over enhancement, it is noted that the details which is not obvious in the original image are generally revealed after the CHE. This paper presented the LIF with Gabor approach to image enhancement where the linear image fusion (LIF) was applied. The process of image fusion is used to combine two or more images. The main idea behind image fusion is that different images contain different information. For example the image of the scene which is focused to the left contains different information than the one which is focused on to the right. By fusing these two images we can retain the best features of the two images. Similarly lower resolution multispectral images can be fused with higher resolution panchromatic images to get high resolution images which can provide insightful information about the scene under consideration. This type of image fusion is most commonly used in remote sensing. Thus there can be different sources for image fusion. Image fusion can be divided into signal level fusion, pixel level fusion, feature level fusion and decision level fusion. In signal level fusion the main idea is to improve the signal to noise ratio by combining the information from different sources. In pixel level fusion the pixel set from all the source images is fused. This process is repeated for all the pixels. In feature level fusion salient features are extracted from a given set of images and then these features are fused together. Finally decision level fusion involves the extraction of information from the given set of images. The extracted information is then combined using decision rules. For image fusion to take place the set of source images needs to be registered i.e. the images needs to be aligned spatially. For our proposed algorithm we use pixel based fusion of source and its histogram equalized image. Conventional histogram equalization is used for the purpose of equalization. In this section, we propose a Linear Image Fusion Technique Using Gaussian Filter technology.

V. PROPOSED WORK & METHDOLOGY

- The principle objective of image enhancement is to process an image so that the result is more suitable than the original image for a specific application. The word specific is important, because it establishes that the techniques are problem orientated. The methods and objectives vary with the application.
- The general solution of the histogram transformation problem is not always possible in the continuous case (approximations can always be made in the discrete case) but there is one particular transformation which produces an important result for applications involving the comparison of images digitized under different conditions. This particular transformation produces an approximation to a uniform histogram for the image in question and its application is known as histogram equalization.
- The main objective of linear image fusion (LIF) using Gaussian Filter is to integrate details from the original image and its equalized image to form an image with better contrast and visual quality.

- This paper presents the LIF with Gaussian Filter approach to image enhancement where the linear image fusion (LIF) was applied.

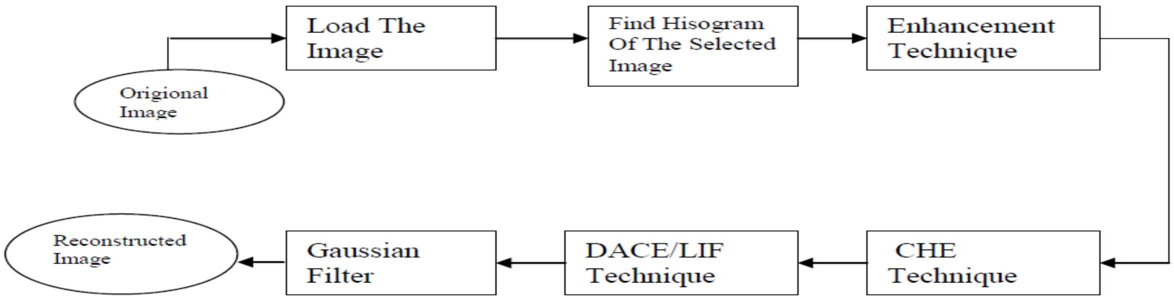


Fig. VI (a) System Model to be implemented

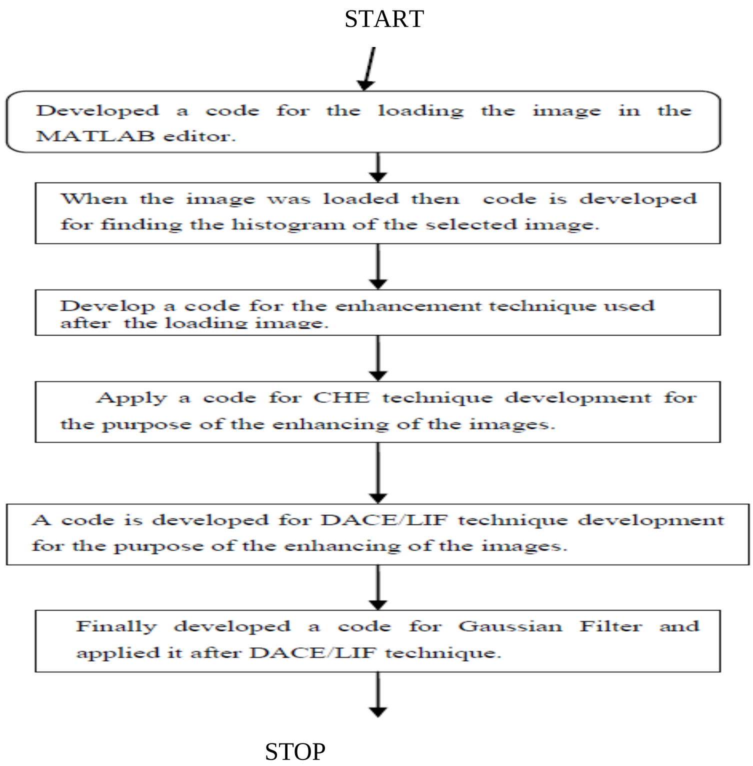


Fig. VI (b) Flow Chart Of The Implementati

VI SIMULATION RESULTS

Image A

Origional Image

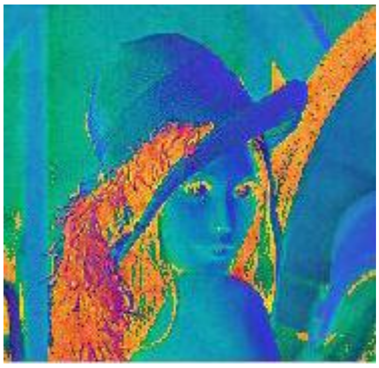
Image B

Origional Image

Enhanced Image By CHE

Enhanced Image By CHE

Fused Image

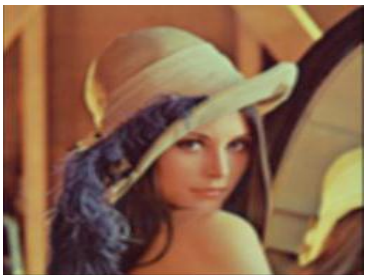


Fused Image

Enhanced By The DACE/LIF

Enhanced By The DACE/LIF

Filtered Image With Gaussian Filter



Filtered Image With Gaussian Filter

In this section, the proposed DACE/LIF approach is verified by examples. In the simulation, three images, Taj Mahal, Girl are given as examples. The parameter a in the proposed DACE/LIF approach is set to 0 .9 for all simulations. The original images, the equalized images by the CHE, and the enhanced images by the proposed DACE/LIF approach, for thethree images are shown in Fig. . Moreover, to compare the results by the DACE/LIF with HE based approach, one recently reported approach in isemployed to enhance the images as well.

For image Taj Mahal, Image A is obtained by the linear image fusion of Image B. As expected, the visual quality of the enhanced Taj Mahal is better than the original image, since it is clearer and of more details. As compared with ImageB , the enhanced image Taj Mahal by the DACE/LIF is of more details and a Gaussian filter is also used at the end point.

As for the image Girl in Image B, the image was taken indoors under fluorescent light. By the CHE, the enhanced image is given in Image where some details are revealed and some details, like the cake, are lost. Fortunately, the details lost in the equalized Girl by the CHE can be found in the original image. By fusing the two images, the Girl with better visual.In the enhanced Girl image by the DACE/LIF, the original image provides the details of brighter area while the equalized Girl by the CHE contributes the details of darker area in general. This results in better visual quality of the enhanced Girl by the DACE/LIF.

The Gaussian filter used is the proposed methdology in the implementation.Gaussian filter remove the redundancy from developed and enhanced image.Which gives the better results than developed image As expected, the enhanced image by the proposed DACE/LIF approach has better visual quality. Consequently, the objective of contrast enhancement is achieved by the proposed DACE/LIF approach

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VII CONCLUSION & FUTURE WORK

This paper presented approaches to image enhancement on linear image fusion (LIF) with Gaussian Filter. Though simple, LIF showed its effectiveness on image enhancement. In image enhancement, LIF has been shown having good performance when source images are of detail-complementary property (DCP). This observation motivated the idea to fuse the original image and its equalized image by the CHE such that more details and better visual quality can be obtained in the fused image. In the light of OCP, the LIF was employed in the proposed approach. By the LIF, the original image and its equalized image by the CHE were fused and better visual quality was obtained. This was verified by simulation results. The simulation results indicated that the proposed LIF with Gaussian Filter was able to effectively improve the visual quality for the given examples and had better visual quality of enhanced image than that by the compared HE-based approach. In the further research, we will find a way to adaptively adjust parameter a in the LIF for improving the performance of LIF approach.

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