Basic Image Processing Toolbox Functions in MATLAB for Implementation of Image Enhancement Application GUI

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Abstract:

Image enhancement plays a fundamental role in vision applications. Enhancement is the manner of improving the superiority of an electronic digital stored image. Recently much work is completed in the field of images enhancement. Many techniques have previously been proposed up to now for enhancing the digital images. This paper describes the basic technological aspects of Digital Image Processing with reference to Enhancement in image processing. Image enhancement techniques help in improving the visibility of any portion or feature of the image, suppressing the information in other portions or features. The enhancement procedures are applied to image data in order to effectively display the data for subsequent visual interpretation. It involves techniques for increasing the visual distinction between features in a scene. There exists a wide variety of techniques for improving image quality. In this paper, we present an overview of image enhancement processing techniques in spatial domain and developed its Graphical User Interface (GUI) in MATLAB.

Keywords: Graphical User Interface, Histogram Processing, Image Enhancement, MATLAB

I. INTRODUCTION

A digital image is a representation of two-dimensional images as a finite set of digital values, called picture elements or pixels. Digital Image Processing (DIP) involves the modification of digital data for improving the image qualities with the aid of computer. The processing helps in maximizing clarity, sharpness and details of features of interest towards Information enhancement and further analysis. Digital image processing is a broad subject and often involves procedures which can be mathematically complex, but central idea behind digital image processing is quite simple. These results form a new digital image that may be displayed or recorded in pictorial format or may it be further manipulated by additional computer programs.

II. LITERATURE REVIEW

In this we make a short overview of most popular image enhancement methods. But we mainly focus on the functional aspects of the methods. A brief summary of the literature is given below: Aimi et al. (2010) [1] presented a two phase methodology to manage to obtain a totally segmented abnormal white blood cell (blast) and nucleus in acute leukemia images. In the initial phase, the three contrast enhancement techniques which are partial contrast, bright stretching and dark stretching were used to enhance the image quality.

Contrast enhancement techniques enhanced the region of interest of acute leukemia for easing the segmentation process. Within the next phase, image segmentation based on HSI (Hue, Saturation, and Intensity) color space has been proposed. The proposed technique helps to boost the image visibility and has successfully segmented the acute leukemia images into two primary components: blast and nucleus. The combination b/w contrast enhancements and image segmentation has good effect on improving the accuracy of segmentation. Hence, information gain from the resultant images would become useful for hematologists to help analysis the type of acute leukemia. Ahmed et al. (2012) [2] aimed to discover the factual nature of transformation functions employed by HE. To comprehend these mathematical calculations thoroughly, the paper dismantles HE into it building blocks. These blocks are, then, critically analyzed to comprehend the actual relationship between HE fundamentals and contrast. This analysis’ determines that HE manipulates density - not contrast - which, consequently, achieves density changes but no contrast enhancement. Cao et al. (2014) [3] proposed two novel algorithm detect the contrast enhancement involved manipulations in digital images. First, they dedicated to the detection of global contrast enhancement placed to the previously JPEG-compressed images, which are widespread in real applications. The positions of detected block-wise peak/gap bins are clustered for recognizing the contrast enhancement mappings placed on different source regions. The consistency between regional artifacts is checked for discovering the image forgeries and locating the composition boundary. Extensive experiments have verified the effectiveness and efficacy of the proposed techniques. Celik et al. (2014) [4] proposed a work of fiction algorithm which enhanced the contrast of an insight image using spatial information of pixels. The algorithm introduced a brand new method of compute the spatial entropy of pixels using spatial distribution of pixel gray levels. Different set alongside the conventional methods, this algorithm considered the distribution of spatial locations of gray degree of a picture in the place of gray-level distribution or joint statistics computed from the gray degrees of an image. For each gray level, the corresponding spatial distribution is computed employing a histogram of spatial locations of most pixels with the exact same gray level. Furthermore, this technique is along side with transform domain coefficient weighting to attain both local an global contrast enhancement at the exact same time.

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Experimental results prove that the proposed algorithms produce better or comparable enhanced images than several state-of-the-art algorithms.

Cheng et al. (2012) [5] proposed a work of fiction approach for the detection of over-enhancement. The main element contributions of the paper are as follows. The causes for generating over-enhancement are investigated and analysed deeply. An objective criterion for detecting over-enhancement is proposed. The experimental results demonstrate that the proposed approach can locate the over enhanced areas accurately and effectively, and offer a quantitative criterion to gauge the over-enhancement levels well. The proposed approach is probably be great for dynamically monitoring the grade of the enhanced image, and optimizing the parameter settings of the contrast enhancement algorithms. Chen et al. (2013) [6] proposed a competitive contrast enhancement algorithm, which combines histogram equalization based methods (HEBM) and a multi-scales un-sharp masking based methods (UMBM). This proposed algorithm uses HEBM to attain global contrast enhancement and UMBM to attain local multi-scales contrast enhancement. First, they reviewed the techniques developed in the literature for contrast enhancement. After then, they introduced the modern algorithm in details. The performance of the proposed method is studied on experimental IR data and equate to those yielded by two well established algorithms. The developed algorithm has good performance in global contrast and local contrast enhancement with noise and artifact suppression Huang et al. (2014) [7] proposed a work of fiction hardware-oriented contrast enhancement algorithm that will be often implemented effectively for hardware design. The proposed h/w -oriented contrast enhancement algorithm achieves good image quality by measuring the outcomes of qualitative and quantitative analyses. To decrease hardware cost and improve hardware utilization for real-time performance, a decline in circuit area is proposed through utilization of parameter-controlled reconfigurable architecture. The experiment result proved that the proposed hardware-oriented contrast enhancement algorithm provides the typical frame rate of 48.23 frames/s at hd resolution 1920 × 1080. Jha et al. (2013) [8] if A contrast enhancement technique using scaling of internal noise of a dark image in discrete cosine transform (DCT) domain. This transition is effected by the inner noise present because of not enough sufficient illumination and could be modelled with a general bit able system exhibiting dynamic stochastic resonance. The proposed technique adopts a near adaptive processing and significantly enhances the image contrast and color information while ascertaining good perceptual quality. When compared with the existing enhancement techniques such as for instance like adaptive histogram equalization, modified high-pass filtering, multi-contrast enhancement, multi-contrast enhancement with dynamic range compression, color enhancement by scaling, the proposed technique gives remarkable performance with regards to relative contrast enhancement, colourfulness and visual quality of enhanced image. Kil et al. (2013) [9] proposed a dehazing algorithm predicted on dark channel prior and contrast enhancement approaches. The typical dark channel prior method removes haze and thus restores colors of objects in the scene; nonetheless it doesn’t consider the enhancement of image contrast.

On the contrary, the image contrast method improves the local contrast of objects, nevertheless the colors are generally distorted consequently of to the over-stretching of contrast. The proposed algorithm combines the advantages of those two conventional approaches for keeping the colour while dehazing. On the basis of the experimental results, the proposed approach compensates for the disadvantages of conventional methods, and enhances contrast with less color distortion. Madhu et al. (2013) [10] If discussed various enhancement schemes are used for enhancing A new fuzzy logic and histogram based algorithm for enhancing low contrast color images has been proposed here. It is based on two important parameters M and K, where M is the average intensity value of the image, calculated from the histogram and K is the contrast intensification parameter. The given RGB image is converted into HSV color space to preserve the chromatic information contained in the original image. To enhance the image, only the V component is stretched under the control of the parameters M and K. The performance of the different contrast enhancement algorithms are evaluated based on the visual quality, CH and the computational time. On the basis of the performance analysis, we advocate which our proposed Fuzzy Logic method is suitable for contrast enhancement of low contrast color images. Maragatham et al. (2013) [11] proposed an algorithm to model images which include local contrast measure to classify and distinguish relating to the images having different contrast level. The input image is classified either as low contrast or high contrast image used the model. If the classified image is low contrast it will be enhanced utilizing the Stochastic Resonance principle. The outcomes demonstrate that the proposed automated procedure enhances the low contrast image better in comparison to conventional enhancement methods. Nercessian et al. (2013) [12] proposed an enhancement procedure. The advantages of the proposed method included the integration of both lumiance and contrast masking phenomena; the extension of non-linear mapping schemes to human visual system inspired multi-scale contrast coefficients; the extension of human visual system-based image enhancement approaches to the stationary and dual-tree complex wavelet transforms, and an immediate way of; adjusting overall brightness; and achieving dynamic range compression image enhancement direct multi-scale enhancement framework. Experimental results demonstrated the ability of the proposed algorithm to attain simultaneous local and global enhancements. Reshmalakshmi et al. (2013) [13] managed with a new contrast enhancement algorithm, which maps elements from pixel plane to membership plane and to enhancement/transform plane. Shortcomings of existing contrast enhancement techniques are rectified to the help of mathematical tools is called ` Fuzzy set `. These fuzzy sets could be modules to handled the uncertainty and/or vagueness linked to images. To assess the performance, this new algorithm is applied on different images and few evaluation parameters are calculated, which proved the improvement over several other existing contrast enhancement techniques predicated on fuzzy sets. Schouhan et al. (2013) [14] proposed an energetic stochastic resonance (DSR)-based technique in spatial domain for the enhancement of dark- and low-contrast images. Stochastic resonance (SR) is really a phenomenon in that your performance of a method (low-contrast image) could be improved by addition of noise.
When compared with the existing enhancement techniques such as for example adaptive histogram equalization, gamma correction, single-scale retinex, multi-scale retinex, modified high-pass filtering, edge-preserving multi-scale decomposition and automatic controls of popular imaging tools, such as for example adaptive histogram equalization the proposed technique gives significant performance in terms of contrast and color enhancement alongside perceptual quality. Sundaram et al. (2014) [15] proposed the Histogram Modified Contrast Limited Adaptive Histogram Equalization (HM CLAHE) to regulate this level of contrast enhancement, which regularly give you the resultant image a strong contrast and brings the location details for more relevant interpretation. It incorporates both histogram modifications as an optimization technique and Contrast Limited Adaptive Histogram Equalization. This method has been tested for Mias mammogram images. The performance of this method is set utilizing the parameter like Enhancement Measure (EME). From the subjective and quantitative measures it's interesting this proposed technique provides better contrast enhancement with preserving the neighbourhood information of the mammogram images.

III. METHODOLOGY
The image processing techniques are implemented using image processing functions in MATLAB Image Processing Toolbox. Image Processing Toolbox™ provides a comprehensive set of reference-standard algorithms and graphical tools for image processing, analysis, visualization, and algorithm development. You can perform image enhancement, image deblurring, feature detection, noise reduction, image segmentation, geometric transformations, and image registration. Many toolbox functions are multithreaded to take advantage of multi-core and multiprocessor computers.

Load File: Use this button to load an image file. In the developed GUI only JPEG, GIF, TIFF and BMP image formats are supported.

Save File: Use this button to save the current secondary image.

Copy: This button copies the original image in the secondary one.

Grayscale: This button generates the grayscale version of the original (loaded) image.

Median: This button applies a median filtering in the original image.

Motion: This functionality applies a filter that approximates the linear motion of the camera.

Sharp: This button executes a sharpening of the original image.

Filter Colors: This functionality creates a gray-scaled version of the original image with colored areas.

Color Emphasis: This functionality lets the user emphasize particular coefficients of the RGB space.

Invert Colors: This button is used for inverting the colors of the image.

Change Contrast and Brightness: Use this button after having set the contrast and brightness factors (using the provided sliders).

IV. RESULTS AND DISCUSSIONS
The developed MATLAB GUI for Image Enhancement System along with all the operations is shown in Figure 2.
V. CONCLUSION
The Image enhancement is very vital for making images better and interpretable. Usually images contain noise or have low contrast. So they are difficult to understand and interpret. The image enhancement techniques are divided into spatial domain and frequency domain. But frequency domain techniques are better than spatial domain techniques. Now, more researches have been made in the frequency domain techniques.

VI. REFERENCES