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Image Enhancement with Different Techniques and Aspects

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Abstract- **With the help of Image enhancement techniques we can process an image in order to make it more appropriate for certain applications. The motive of Image enhancement is to explore the detail hidden in an image or to increase the contrast in a low contrast images. The image enhancement process try to find to increase the interpretability or perception of information in the images to provide better input for other automated image processing steps. A benefactor of image enhancement either may be a human observer or a computer vision program performing some kind of higher-level image analysis, such as target detection or scene understanding. Image enhancement involves mainly two techniques a simple histogram-modifying point operations or spatial digital filtering. Some of more complex methods involve modifying the image content in another domain, such as the coefficient domain of a linear transformation of the image and in this paper we are going to do a modification in hypothesis selection filter by using the concept of global mean and global variance with localisation function.**

Keywords-Image enhancement, Image Processing , Global Mean & Variance.

1. INTRODUCTION

The main objective of image enhancement is a processing on an image in order to make it more appropriate for certain applications. Image enhancement mainly sharpens image features such as boundaries, edges or contrast and reduces the ringing artefacts. The enhancement improve the quality of the images so that the information contained in them could be extracted in a meaningful sense. The greatest difficulty in image enhancement is quantifying the criterion for enhancement and due to this, a large number of image enhancement techniques are empirical and require interactive procedures to obtain satisfactory results. Image enhancement in digital image processing plays important roles in many fields, such as industrial X-ray image processing, microscopic imaging, remote sensing, medical image analysis, high definition television(HDTV), etc. A benefactor of image enhancement either may be a human observer or a computer vision program performing some kind of higher-level image analysis, such as scene understanding or target detection. Image enhancement involves mainly two techniques a histogram-modifying point operations or spatial digital filtering. Some of more complex methods involve modifying the image content in another domain i.e. the coefficient domain of a linear transformation of the image.

Image Enhancement Methods

Spatial domain enhancement methods:

The Spatial domain techniques are those techniques which operate directly on pixels. An image processing operator in the spatial domain may be expressed as a mathematical function T[.] applied on f(x,y) to produce a new image g(x,y)=T[f(x,y)] as follows:

$$g(x,y)=T[f(x,y)]$$

Frequency domain enhancement methods:

The new image g(x,y) is formed by the convolution of an image f(x,y) and a linear position invariant operator h(x,y),i.e.:

$$g(x,y)=h(x,y)*f(x,y)$$

Simple intensity transformation:

(a). Image negatives:

Negative of a digital image is obtained by the transformation function s=T(r)=L-1-r,where L represents number of gray levels. The result of this transformation is that low intensities are made high and vice versa.

(b). Contrast stretching:

Low-contrast images can occur often due to poor or non uniform lightening conditions, or due to non linearity, or small dynamic range in the image sensor.

Contrast stretching enhance the low contrast images. The main goal of contrast stretching is to group the gray levels

(c). Compression of dynamic range

Compression expands the values of dark pixels in an image while compressing the high level values.

When a dynamic range of a processed image cannot be displayed, a way to compress the dynamic range of pixel values is to perform the following intensity transformation function: s = c log(1+|r|) where c is a scaling constant, and the logarithm function performs the desired compression.

(d) Gray-level slicing

The gray-level slicing highlights a specific range of gray levels in an image. It involves basically two methods: first give a high value for all the gray levels in the specified range and a very low value for the other gray levels and second give a high value for all the gray levels in the specified range and preserve the background and gray level tonalities in the image.

Histogram processing:

(a) Histogram equalization

The histogram represents the frequency of occurrence of the various gray levels in the image. Its objective is to map an input image to an output image such that its histogram. is uniform after the mapping.

The main advantage of this technique is that pictures with very poor dynamic range can be enhanced. The main disadvantage of this method is that visual artifacts get introduced.

(b) Local enhancement

This is often necessary to enhance details over small areas. Influence of the number of pixels in these areas may be negligible on the computation of a global transformation, so the use of global histogram specification does not necessarily guarantee the desired local enhancement.

RELATED RESEARCH

1) In 2000, **Image Enhancement By Nonlinear Extrapolation in Frequency Space** Hayit Greenspan, Charles H. Anderson, and Sofia Akber [1][2] described the technique for enhancing the perceptual sharpness of an image . This enhancement algorithm augments the frequency content of the image using shape-invariant properties of edges across scale by using a nonlinearity that generates phase- coherent higher harmonics. This procedure utilizes the Laplacian transform and the Laplacian pyramid image representation. The results are presented depicting the power-spectra augmentation and the visual enhancement of several images. The simplicity of computations and ease of implementation allow for real-time applications such as high-definition television (HDTV).
2) In 2001, **Small Vessel Enhancement in MRA Images Using Local Maximum Mean Processing** Yi Sun and Dennis Parker [3] proposed using local maximum mean (LMM) processing to enhance the detectability of small vessels. On each voxel in the original three-dimensional (3-D) data set, the LMM over the line segments in the cube centered at the voxel is taken and used to form the 3-D LMM data set. The maximum intensity projection (MIP) is then applied to the LMM data to produce the two-dimensional (2-D) LMM-MIP image. Through LMM processing, the variance of background tissue is minimized, thus increasing the detectability of small vessels. More- over, the single bright voxels are suppressed and the disconnected small vessels can be connected. However, the LMM processing widens the larger, brighter vessels. To keep the advantages provided by both the LMM-MIP and MIP images , the weight functions be used to combine them. Here, The Performance of the LMM-MIP algorithm is analyzed and compared with the performance of the MIP algorithm under three measures: The vessel voxel projection probability, the vessel receiver operating characteristic (ROC) curve and the vessel-tissue contrast-to-noise ratio (CNR).The Closed forms of the three measures are obtained. The longer the projection path and the larger the CNR of the original data, leads to the greater improvement. Confirming the theoretical analysis, the results of an experiment utilizing practical MRA data demonstrate the improved visual quality of small vessels.
3) In 2011 - **Hongchao Song, Yuanyuan Shang, Xuefeng Hou,** Baoyuan Han [4] discribed the typical image enhancement algorithms, like median filtering, average smoothing, homomorphic filtering and histogram equalization. These algorithms are also verified based on Matlab. In the last part of the paper, the pre-and post processing image using these algorithms are shown. This Paper's results reveal that median filtering has a good inhibition on salt and pepper noise than average smoothing and the homomorphic filtering has more advantages than histogram equalization in dealing with the uneven illumination image.
4) **In 2012 - Snehal O.Mundhada and Prof. V. K. Shandilya Image enhancement** is the task of applying certain alterations to an input image like as to obtain a more visually pleasing image.[6] The alteration usually requires interpretation and feedback from a human evaluator of the output resulting image. The Image enhancement is to improve the image quality so that the resultant image is better than the original image for a specific application or set of objectives. In this paper, there is a combined approach of gray level transformation algorithms, i.e. logarithmic transform and power law transform, and with alpha rooting algorithm for contrast enhancement. Enhancement techniques like alpha rooting operate on the transform domain where as grey level transformations operate on individual pixel.These techniques bring about tonal changes in the images and can also generate unwanted artifacts in some cases, and as it is not possible to enhance all parts of the image in balanced manner.
5) **In 2012 - Jatinder kaur, Onkar Chand** In this paper, a new and efficient algorithm for reshaping of histogram that is capable in enhancing local details as well as properly preserving the image brightness is presented.[5] When residual bad pixels exist in the image, dynamic range of the scene will be heavily suppressed when it displayed on a regular monitor. This proposed method reduced the dynamic range compression (DRC) and also improve the dynamic range and contrast. Also the proposed algorithm works on zero frequency components which exist sometimes in the original histogram, and can enhance the contrast by redistributing the original gray scales uniformly onto full Gray scale range. The dynamic range of the image is much improved after proposed method and the details hidden in the original image are enhanced. Results of simulation show the efficient performance of proposed weighting method in terms of Entropy and EME.
6) **In 2012 - Suprijanto, Gianto, E. Juliastuti, Azhari, Lusi Epsilawati** In this, described That dental panoramic radiography is one of dental imaging that used to visualize the entirety of the maxilla and

mandible jaws on the one image planes.. The quality of film-based image has significant limitation due to chemical processing and image enhancement cannot be done if required. Hence, digitized film-based image to digital image was required to allow image enhancements in order to improve the interpretability quality of information in the image. Digitized film-based image is performed using a flatbed scanner on transmission and reflection mode. This paper, the contrast quality of digital image that scanned using both mode is evaluated based on statistic image characteristic. and the results showed that the quality of digitized image using transmission mode is better than using reflection mode. However, if direct digital imaging is used as a standard, image enhancement on digitized image is still required. All Four methods, i.e. contrast stretching, HE, AHE, and CLAHE are used to improve the quality digitized image. The evaluation of the preference image quality is performed based on objective criterion. The preferable image quality for digitized panoramic image can be obtained by using image enhancement based on CLAHE-Rayleigh method, which is indicated by the lowest value of mean, RMSE, standard deviation, and average difference and the higher value of NAE and SAE.

7) **In 2013 – Vijay A. Kotkar, Sanjay S. Gharde** Image enhancement is a processing on an image in order to make it more appropriate for certain applications.[7] It is used to improve the visual effects and the clarity of image or to make the original image more conducive for computer to process. The Contrast enhancement changing the pixels intensity of the input image to utilize maximum possible bins. So, We need to study and review the different image contrast enhancement techniques because contrast losses the brightness in enhancement of image. By considering this fact, the mixture of global and local contrast enhancement techniques may enhance the contrast of image with preserving its brightness. We have many image contrast enhancement techniques such as HE, BBHE, DSIHE,MHE. BPDHE, RSWHE, MMBEBHE, RMSHE, GHE, LHE and LGCS. In This paper author focuses on the comparative study of contrast enhancement techniques with special reference to local and global enhancement techniques. Also proposed solution is identified to apply to this enhancement technique. Method will use in many fields, such as microscopic imaging, medical image analysis, hyper spectral image processing, remote sensing, HDTV, industrial X-ray image processing etc.

CONCLUSION AND FUTURE WORK :

As digital Imaging improves the quality of the image with software we say this is image enhancement. This is quite easy, for example, to make an image darker or lighter, or to decrease or increase contrast. The Advanced photo enhancement software also supports many filters for altering images in various ways. Image enhancement is to improve the image quality so that the resultant image is better than the original image for a specific application or set of objectives. In the current work we have presented the image enhancement techniques. We have seen that every technique has its own pros and cons.In future we will present a new concept for enhancing using the hybrid of HSF selection filter with global mean and variance for local functions

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