Image Enhancement Techniques- A Review

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ABSTRACT

Digital image processing is the field which is being employed on large scale for the development and research in the field of images by using different types of algorithm processes. Image enhancement is a technique which is implemented to alter the input image so that the resultant image has higher quality and helps in the better interpretation.These techniques, no doubt, enhances the quality of an image but sometimes results in the results in the unwanted artifacts, which needs to be resolved. This paper presents a review on image enhancement technique.

KEYWORDS

Image enhancement, Digital Image Processing, Spatial based domain image enhancement, Frequency based domain image enhancement

INTRODUCTION

With advancement in the technology, images play an important role as source of information for the process of interpretation and inspection. The vital and complex technique in image research is image enhancement.Image enhancement is basically a process in which the alterations or the changes are made in an output image to improve the quality of the image. In other words it is basically better transformation for future automated image processing methods.

The main aim of image enhancement method is to enhance the different image characteristic feature. These features may include the boundaries,edges,contrast,background, sharpness and many more. This result in the display which has more clarity for analysis as compared to the actual image. It is seen in the last decade that the image enhancement has been an active topic in the medical field.

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The aim of Image enhancement process is to improve the visuality of the image or to give an updated transform representation for future automated image processing which would be helpful for analyzing, detecting, segmenting and recognizing a particular image. Also, it aims at analyzing the background information which is much more important to understand the object behavior without taking into consideration the human visual inspection. Since, it involves the enhancement of background of the images or highlighting the hidden details in an image or increasing the contrast of an image, during this process of conversion of image from one stage to another, there is some degradation at the resultant level. So there is requirement to remove this degradation with the help of various techniques.

On the basis of available techniques for image enhancement, they can be broadly classified as

(i)   Spatial based domain image enhancement
(ii)   Frequency based domain image enhancement

RELATED WORK

Image enhancement comprises/involves the rise of various techniques which are being used to improve the visuality of an image or to convert it to better form for improved representation. It has number of techniques which are being used to improve the quality of picture which is of higher quality that can be analyzed more accurately by a person or an instrument. Digital image enhancement techniques have vast variety of options to increase/enhance the quality of an image. An appropriate technique is required to be adopted for image modality and viewing conditions [5].

A number of researches have been done on image enhancement and their researches have been discussed as follows:-

Bedi and khandewal [7] suggested that the image enhancement is the technique that improves the quality of an image for human viewing. It aims at removing blurriness, noise, increasing contrast, revealing background details etc. Since therefore said parameters are important in medical field so image enhancement technique is necessary for medical image identifications and interpretation.

As per Bedi et al the technique available for image enhancement are broadly classified as frequency domain enhancement and spatial domain enhancement. The review has been done on image enhancement techniques in this paper. The paper also discussed about the shortcomings related to this technique and to conclude some of the applications alongwith the promising directions for the image enhancement are discussed.

Arulmozhi et al[4] suggested that the radiographic images can be upgraded by various digital image enhancement technique to make it more clear for interpretation. One of the major limitations that has been highlighted in this review article is that some of specific data gets lost, when some enhancement techniques are applied. To overcome this problem a large number of algorithms are applied. It was also discussed that earlier algorithms too results in the lose of some data/details during the image processing. So that proposed some new algorithm in spatial domain for radiographic image enhancement.

Mundhada and shandilya[8] highlighted that the image enhancement technique are mainly applied to an image to make actual image more visible. For this the alterations implemented depends upon the requirement of the person interpreting the image. The review article suggested that the image enhancement technique for alpha rooting works in transfer domain that further depends upon the frequency of the picture. So the edges and the subtle information can be made better. As per author, these techniques sometimes results in understanding changes that depicts that every part of an image cannot be improved.

Tang and scott[3] highlighted global histogram equalization, which adjusts the intensity histogram to approximate uniform distribution. The global histogram equalization is that the global image properties may not be appropriately applied in a local context. In fact, global histogram modification treats all regions of image equally and thus, often yields poor local performance in terms of detail preservation. Therefore, several local image enhancement algorithms have been introduced to improve enhancement.

Madhu[10] presented that the adaptive histogram equalization resulted in a better image transformation but the image still has washed out appearances. The sharpness of the image was found to be poor and the background image was still found to befogged after the implementation of the techniques.

Image Enhancement Techniques

Basically, image enhancement techniques are classified as follows:-

(i) Spatial Domain technique:- It deals with the pixels of an image. The modifications are made in the pixels of an image to get the improved version of the image. Various technique involved in this method are log transformation power law or gamma transformation, histogram equalization and matching that are dependent upon the direct variations in the pixels. Spatial techniques are generally used to alter the gray level values of a particular pixel and finally the overall contrast of the image which sometimes gives the undesirable results as the whole image gets enhanced. To overcome such kind of problems histogram equalization is more effective.

Point operations also called Intensity transform function. It is the simplest spatial domain operation performed on single pixel only. The point operation can be given as :

$$g(m,n)= T[f(m,n)]$$

where ,
f(m,n) is the processed picture.
T is the gray level transformation.
g(m,n) is input on original picture.
Mask operations:- In this, each pixel is altered as per the value in a close or small neighborhood in the operation.
Global operation:- All the pixels are taken into consideration to alter the image quality.
(ii) Frequency Domain Techniques:- These are used for the images that takes into account the frequency components and performed the function

on the fourier transformation of the image. The principle of this, compensating computing 2D discrete unitary transformation is to manipulating the transform coefficient by an operation and then performs the inverse transform.Image Enhancement has a wide range of applications in the field of technology. Most importantly, it is being used in the field of Medical Imaging, Digital camera, remote sensing and others. There are many other areas as well where image enhancement is playing its vital role such as forensics, fingerprintmatching etc.

CONCLUSION

The image enhancement techniques have a variety of approaches that are being implemented to obtain the desirable results. In this paper, the image enhancement techniques have been reviewed. These techniques include spatial domain and Frequency domain. The limitation of image enhancement which has been highlighted is that they sometimes enhance the image in such a manner that the undesirable changes are obtained in the picture. To overcome this problem various algorithms are implemented. As far as the future scope is concerned, it will be the development for effective image enhancement that the image may be altered in the appropriate manner as per the requirement.

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