Image Enhancement and Its Techniques- A Review

Gurpreet kaur¹, Rajdavinder Singh²

Research Scholar¹, Assistant Professor²
¹,²Department of Computer Science and Engineering
Chandigarh Group of Colleges,
Gharuan(Mohali), Punjab, India

Abstract- Now days applications require various kinds of images as sources of information for interpretation and inspection. Image enhancement is method of applying different alterations to an input image to make the resultant image more pleasing or to provide a better transform presentation for future automated image processing techniques. Many images like medical images, images of satellites, and even real life photographs suffer from poor sharpness and noisy effects. This is essential to enhance the contrast and remove the noise to increase picture standard. One is presenting a review on various image enhancement techniques for sharpening enhancement. However, these techniques are able to bring noticeable changes in the images and sometimes also produces unwanted artifacts in many cases. These problems need to be resolved so that better enhancement may be performed in future work. This paper proposes a new work for enhancement by using artificial intelligence schemes.

Keywords: Medical images, Image enhancement techniques, Spatial domain techniques, Frequency domain techniques, Artificial Intelligence.

I. INTRODUCTION

Digital image processing is the field which is used for large scale experimental work by using different techniques and algorithms. In digital image processing, wide variety of algorithms can be applied to the input image and output image can be made more pleasing for viewers by using image processing techniques. Image enhancement is the one part of image processing. [1] Image enhancement allows the techniques for upgrading the quality of image to make the resultant image more effective than the original image. The basis of image enhancement is to highlight the hidden details in an image and increase the contrast in a low contrast image. While the conversion of image from one form to another such as digitization of image can cause some form of degradation at output so there is requirement of some technique to be used to remove that degradation[13]. Medical image enhancement technologies have catched much consideration as advanced medical instruments are being used in medical applications or fields. Medical practitioner also desires the enhancement in medical images as it would be easy for them to examine and interpret the medical images, that are pleasant than the images that are distorted due to poor contrast and noisy factors. One should mainly emphasize on the issues like poor contrast and higher level noise in medical images.

Image enhancement is one of the basic and most promising field of digital image processing. Fundamentally, the key idea behind the enhancement techniques is to show out the details that are not visible to viewers. Enhancement is primarily done to restore an image that was deteriorated while converting it from one form to other[2]. The main objective of image enhancement depends on the application context and the norms for image enhancement are very cumbersome to be easily changed to meet objective measures, image enhancement algorithms must be easy to understand and qualitative. However, in any application one algorithm which is performing well for one class of the images may not perform as well for some other classes [3]. The techniques are of two types that are spatial domain techniques and transform domain techniques.

II. RELATED WORK

Image enhancement process is composed of number of techniques that are used for improving the visual appearance of a picture or to transform it for better representation by a human or machine. Digital image enhancement techniques has number of choices for making the images more approachable. An example is shown below in fig. 1 when we increase the sharpness of the image and enhance it starts looking much better. Enhancement is a very good area for
research and by using techniques of image enhancement, image standard can be upgraded.

Image enhancement has a number of techniques that are used to enhance the occurrence of a picture or to transform the image to a form which is better suitable for analysis by a person and instrument. Digital image enhancement techniques has many options for the improvement of image quality. One must choose appropriate technique by the imaging modality and viewing conditions, [6]. An illustration of enhancement is presented in Fig. 1 when we increase the contrast of the picture and uses filter for removing the noise effect then it looks much better. By using different enhancement techniques, improvement in the image quality can be attained.

Contrast enhancement has considerable importance in digital image processing.

![Image of Low contrast and High contrast](image1.png)

**Fig.1: Image enhancement**

Various researchers has done a lot of work on image enhancement till now which is discussed as follows

Bedi [3] has suggested that image enhancement is the essential and demanding techniques in image research work. Any image can suffer from poor sharpness and noise while capturing or transmitting it and images can be medical images or real life pictures. So there is requirement to improve the contrast and removal of noise is also important to achieve better results. As image enhancement upgrades the clarity of pictures for human vision, reduces the blurring effect and noise, increases the contrast and highlight the details, so it is necessary stage in medical image identification and interpretation. Image enhancement techniques are varied from one another according to their objective. The available techniques are frequency and spatial domain enhancement. Bedi categorized the processing methods based representative techniques of image enhancement. Classification and review has been done on image enhancement techniques through this paper, shortcomings were evaluated and general needs in the field of active research like the noise was not completely removed from the medical images and pointed out that promising directions for image enhancement in future.

Arulmozhi [10] presented that the digital Image enhancement has number of choices for upgrading the radiographic images to make it more pleasing in human vision. Sometimes, the specific details of radiographic images gets lost due to any reason then image enhancement is applied. There are many algorithms that has been proposed till now in the past years. Sharpening algorithm are being used for enhancingment of image contrast and some algorithms has some limitation like while enhancement, there is loss of small details, addition of noise, undesired and unnatural look of the images that were processed. They proposed a new algorithm for contrast enhancement for radiographic images in spatial domain. Proposed algorithms provided a flexible and good way for contrast enhancement but they did not achieve natural looking processing result which can be enhanced in future which will demonstrate the superiority rather tha traditional high pass filter.

Mundhada [8] suggested that many alterations are applied to the original image to make it more visibly effective in image enhancement task. Human evaluator provides the interpretation that are needed by alterations that are applied to an image. Image enhancement is done to make the resulting image better than the input image for particular applications or to meet some objectives. The techniques for enhancement like alpha rooting usually works on the transform domain which is based on the frequency content of the pictures and so edge and subtle information can be made better. All these techniques are able to change the tone of pictures and sometimes also give undesired effects, so it is not always possible to improve every part of picture in the same manner.

Tang [7] presented global histogram equalization in which intensity histogram is adjusted to approximation uniform distribution. In global histogram equalization technique, histogram amendments takes all the parts of the image in equal manner and therefore not able to get high yield and performance is also poor as specific details are lost which is not acceptable. Global image properties are not directly applied in the local context or part in global histogram equalization method. So there are many image enhancement techniques that have been introduced till now, but still there is more
requirement to improve enhancement to get better qualitative results.

III. IMAGE ENHANCEMENT TECHNIQUES

Image enhancement is defined as: input image is given having low quality such as low contrast and noise and we need to improve it for better output for many useful applications. Basically these can be categorized into two types spatial domain and frequency domain techniques that are explained in the following section.

Fig.2: Image enhancement techniques

3.1 Spatial Domain Techniques:

Spatial domain techniques are operated on pixels. The values of pixels or pels are modified to get the intended improvement. It involves the techniques such as log transformations, power-law(gamma) transformations, histogram equalization and Matching(Specification) that are dependent on the direct operation on the pixels in the image. These are basically used for the direct alteration of the gray values of the pixels individually and also for the sharpness of the image. However the problem in it is sometimes it also generates the unacceptable results because it works in the uniform way in the whole picture that was taken. So this method is not suitable for the images that need to improve the selected region or the intended information.

3.1.1 Point Operation

In this type of operation, the individual pixels are operated by image processing operation or the point operations that is

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

in which \( f(m, n) \) is the input or original picture, \( g(m, n) \) is the processed or resultant picture, and \( T \) is used for modification process that is operated on a single pel or pixel.

3.1.2 Mask Operation

Every pel or pixel is changed as per their values in a close or small neighborhood in this operation.

3.1.3. Global Operation

All the pixel values are taken into account of the image to perform the global operation.

3.2 Frequency Domain Techniques

Frequency domain techniques are suitable for the images that are based on frequency components and works on the orthogonal transformation of the image rather than the image itself. The principle of these techniques is composed of 2D discrete unitary transformation, for illustration the 2-D discrete fourier transform that replaces the coefficients by the operator and then perform the inverse process. It has two components namely magnitude and phase. Magnitude is composed of frequency component and phase is for restoring the image back to the spatial domain. These are straightforward techniques. Firstly, the fourier transform of the image is computed which is to be computed and result is multiplied by a filter and inverse transform is taken to generate the output image. In low pass filtering, high frequency components of image are eliminated and as a result, image would be blurred associated with noise. An ideal filter also has two issues: blurring of image and ringing of image.

IV. PROPOSED WORK

There are techniques which are being used for the enhancement of the images that are spatial and frequency domain techniques which has further categories that are giving satisfactory results to some extent, but the only problem with these techniques is that they treat the whole image in a equal manner. As a result, these techniques produces the unwanted effects in the image while performing the required enhancement. So there is a requirement for the new work to be introduced to overcome this problem. This can be resolved by using artificial intelligence scheme as artificial intelligent system perceives its own environment and take actions that maximizes the chance of success. Nature-inspired search algorithms have proved to be successful in solving realistic optimization issues.

The objective of research work in Artificial Intelligence is to make a technology in which computers behave according to their environments and take actions. The basic goal of artificial intelligence is the replication of human intelligence. It is able to make an intelligent connection between perception and action. There are many techniques for artificial intelligence namely Pollination based optimization(PBO), Intelligent waterdrop (IWD),

---

ISSN: 2231-2803  http://www.ijcttjournal.org  Page150
Neural network, Biogeography based optimization (BBO), Bacterial foraging optimization (BFO), Genetic Algorithm (GA), and Membrane Computing. These techniques give appropriate results and are useful for various purposes. The techniques for Artificial Intelligence are useful for the optimization in the field of Image processing, Wireless networks and other Biometric fields. From all these techniques mentioned above, any artificial intelligence scheme can be used in the image processing for achieving better results. Medical images are being taken for sharpening enhancement and wavelet decomposition is done for the partitioning and merging of images. Any artificial intelligence scheme might be used for the optimization. Enhanced image is obtained after applying the optimization technique.

![Image](image_url)

**Fig.3: Proposed Work**

### V. APPLICATIONS

Image enhancement has applications in many fields like aerial imaging, satellite images, digital camera pictures, remote sensing applications, forensic labs, astrophotography, fingerprint or face recognition etc. Image Enhancement is a important tool for highlighting areas to improve the visual representation of the picture. It has a considerable application in medical imaging like in MRI, Ultrasound and X-Rays.

### VI. CONCLUSION

Image enhancement techniques have variety of approaches for altering images to get desirable pictures. The review of Image enhancement techniques in Spatial domain and frequency domain have been successfully accomplished. Based on the type of image and type of noise with which it is corrupted, a slight change in individual method or combination of any methods further improves visual quality. In this paper, both spatial domain and frequency domain techniques and advantages and disadvantages have been emphasized. Most of the algorithms are useful for changing the gray values of individual pixels in an image and contrast is also changed of the whole image. The only limitation with image enhancement is they enhance the image in a uniform manner and as a result they give undesirable results. There are various techniques that have been developed till now for enhancement but still there is more requirement for enhancement which might be achieved by using artificial intelligence schemes for optimization that can produce satisfactory result. The future scope will be the development for effective image enhancement using artificial intelligence so that enhancement might be performed in balanced manner which would be able to provide promising directions on research for optimization.

### References:


[5]. Dr. Muna F. Al-Samarai And Dr. Nedhal Abdul Majied Al Saiyid “Medical colored image enhancement using wavelet transform followed by image sharpening” Applied science university, amman-jordan, volume 6, number 5, march 2004.


