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An analysis of various Image Pre-Processing techniques in Butterfly Image

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ABSTRACT

Image processing technique is a method of improving the quality of an image. Many image processing operations can be grouped into some method. These are image representation, image preprocessing, image enhancement, image restoration, image analysis, image reconstruction and image data compression. Many images contain a lot of irrelevant and unwanted parts. The process of enhancing pixel intensity and image quality are also carried out after preprocessing. Image preprocessing is enhancement the quality of the image because it is eliminating noise and reducing the distortions of the input images. Thus, preprocessing techniques require for images because it is contained annoying parts in an image. Image filtering is a standard process used in almost every image processing system. In this paper, we describe the various images filtering techniques and filtering algorithms used for image filtering or smoothing. Image smoothing is one of the most important in image processing and it is widely used in image application and which algorithm is the best for smoothing and filtering the images. Image smoothing is to reduce noise and improve the visual quality of the image. The proposed system describes the median filtering, Gaussian high filtering and Gaussian low filtering in preprocessing techniques. The median filter used to remove noise and it is a nonlinear digital filtering technique. Gaussian High pass filters are usually used for sharpening. The filtering techniques have been simulated using Matlab 2018a. In performance of this filtering technique, low pass filtering technique is better and its takes less processing time than other filtering methods. After the preprocessing, the image quality is increase.

Keywords: *Gaussian high pass filter, Median filter, Gaussian low pass filter*

1. INTRODUCTION

Digital image processing analyzes image data, and is widely used in much application. Various image techniques have been developed in image processing during the last five decades. The noise is usually separated into Gaussian noise, the balanced noise and the impulse noise. The most challenges raised in processing the image is noise. Noises present in the images have to be removed and unclear objects have to be enhanced. Pre-processing technique was implemented for enhancing the quality of the image. Two dimensional images are represented with digital image containing finite set of picture elements. Classification of image Processing techniques are image representation, image preprocessing, image enhancement, image analysis and image compression. Enhancement of the image quality is obtained by implementing filtering technique, removal of noise and contrast enhancement methods. Smoothing image is to reduce noise and improve the visual quality of the image. For noise removal we use various filters such as median filter, Gaussian filter etc. The main purpose of filtering is to improve the visual quality of image. Median filters use median value in its filtering process. Furthermore, this filtering algorithm has good noise-reducing effects.

Preprocessing includes removal of unwanted to make obvious by increasing the contrast. There are two types of filtering. They are Linear and nonlinear in image processing. Image processing is applied in various applications such as remote sensing, medical imaging, textiles, material science etc. In this paper, preprocessing technique for removing noise was proposed. The proposed system describes the median filtering, Gaussian high filtering and Gaussian low filtering in preprocessing techniques. Gaussian filtering is more effective at smoothing images. The median filter used to remove noise and it is a nonlinear digital filtering technique. Gaussian High pass filters are usually used for sharpening. This research paper is organized as follows. Section 2, discusses about related works. Section 3, explains about preprocessing techniques. Section 4 addresses research methodology carried throughout the preprocessing process. Section 5 addresses the experimental results of the system. Finally, section 6, presents the conclusion.

2. RELATED WORK

S. Perumal et al.in [1] discussed the Preprocessing by Contrast Enhancement Techniques for Medical Images. This paper analyzed the various filtering techniques. Various image filtering techniques are wiener filter, median filter and Gaussian low and high pass filter. In this filters, median filter is for best pixel result than other two methods.

S. Anitha et al.in [2] presented Comparison of Image Preprocessing Techniques for Textile Texture Images. Author discussed the performance of four preprocessing methods. Contrast adjustment, Intensity adjustment, Histogram equalization, Banalization and Morphological operation are compared their performance.

R. Beaulah Jeyavathana et al.in [3] addressed Analysis on Pre-processing and Segmentation Techniques for Medical Images. Gabor Filter is used for edge detection. The global contrast of many images is usually increased by Histogram Equalization method. Adaptive Median Filter is used to reduce impulsive noise. Weighted Median Filter is used to remove salt and pepper noise. Weiner Filter It is used for the restoration of blurred image. In this preprocessing filters, Gabour, Histogram Equalization have been used to improve the various imaging modalities and it also used in better diagnosis.

Mr. P. RAVI et al.in [4] proposed Analysis of Various Image Processing Techniques. Author discussed image representation, ima ge preprocessing, image enhancement, image restoration, image analysis, image reconstruction, and image data compression. The performance of four preprocessing methods are compared namely Contrast adjustment, Intensity adjustment, Histogram equalization, Binarization and Morphological operation. The performance of four preprocessing methods are compared namely Contrast adjustment, Intensity adjustment, Histogram equalization, Binarization and Morphological operation.

Biju Bajracharya et al.in [5] discussed A Preprocessing Method for Improved Compression of Digital Images. In this paper, first stage, histogram intensity counts are reduced and mapping table identified by level of operation is created. In the second st age, each pixel's intensity is mapped to the closest intensity of in the mapping table from first stage.

3. PREPROCESSING

Pre-processing is an important step in many image applications. Preprocessing enhances the quality of the image because it is eliminating noise and reducing the distortions of the input images. Preprocessing functions involve those operations that are normally required prior to the main data analysis and extraction of information and are generally grouped as radiometric or geometric corrections [4]. In this paper, preprocessing methods involved RGB to gray scale image, image resize, noise removing and quality of an image produced. Image technique is as a process of an image processing such that the result is much more suitable than the original image for a specific application [1]. The distribution of dark and light pixels of an image is used contrast of an image. A low-contrast image appears small differences between its light and dark pixel values [2]. Image enhancement techniques can be divided into two methods. They are spatial domain methods. Histogram equalization is a common technique for enhancing the appearance of images. Usually Histogram equalization improves the global contrast of images, especially when the usable data of the image is represented by close contrast values. Low pass filtering is in blurring of an image and its involve the elimination of the high frequency components.

The improvement of an image used the enhancement techniques. In image processing, many preprocessing techniques. These preprocessing methods are (a) Contrast adjustment (b) Intensity adjustment (c) Histogram equalization (d) Banalization (e). Morphological operation. In this system, we discuss the Gaussian filtering and median filtering in image preprocessing.

4. RESEARCH METHODOLOGY

We propose preprocessing techniques that consists of three techniques. These are Gaussian high pass filter, medial filter Gaussian low pass filter. This proposed technique is implemented using Matlab 2018a software. The database contains RGB images.
The proposed system is following steps:

(i) Preprocessing techniques
- ❖ input image RGB convert to gray image
- ❖ median filtering
- ❖ Gaussian high pass filter
- ❖ Gaussian low pass filter

(ii) Performance of each filtering technique

Gaussian function is defined as:

$$G(x,y)=\frac{1}{2\pi\delta 2}\exp\left(\frac{-x2+y2}{2\delta 2}\right)$$

Where x is the distance from the origin in the horizontal axis, y is the distance from the origin in the vertical axis, and σ is the standard deviation of the Gaussian distribution.

4.1 Gaussian high pass filter (Sharpening)

Gaussian noise is statistical noise that has a probability density function (PDF) of the normal distribution, also kno wn as Gaussian distribution [1]. High-pass filter encourages high spatial frequencies and enhances contrast within the image. Also, the high-pass filter is characterized by the presence of a core that surrounded the central pixel of image with negative values. High pass filters are usually used for sharpening. The function of high-pass filter is represented by *HPFF*.

$$HPFF = 1 - LPFF$$

Where; *LPFF* represents the low-pass filter.
Algorithm of Gaussian high pass filter pseudo code

Function highpass (*real [0...n]* x, *real* dt, *real* RC)
var *real[0..n]* y
var *real* α:= RC / (RC + dt)
y [0] := x[0]
for i from 1 to n
y[i] := α × y[i−1] + α × (x[i] − x[i−1])
Return y
Where, *dt*= time interval, RC= time constant
α =smoothing factor

4.2 Gaussian low pass filter (smoothing))

Low pass filter is usually used for smoothing images. it will eliminate noise better. But it is more blur the original image.
Algorithm of Gaussian low pass filter pseudo code
Function lowpass (*real [0...n]* x, *real* dt, *real* RC)
var *real[0..n]* y
var *real* α := dt / (RC + dt)
y[0] := α * x[0]
for i from 1 to n
y[i] := α * x[i] + (1-α) * y[i-1]
Return y
Where, *dt*= time interval, RC= time constant
α =smoothing factor

4.3 Median Filter

Mean filter is simple sliding windows that replace the center value with the Median of all pixel values in the window. The window or kernel is usually a square but it can be of any shape.
Function of median filtering is defined as following:
q(x,y)= med{ f(x-a , y-b) , a,b € W }
Where f(x,y) is ordinary image and q(x,y) is output image.
Algorithm of median filtering
1. J=P
2. while J≥G go to step 3 and 4.
3. AS [J+1] =AS[J].
4. J=J-1
5. AS[G]=item
6. P=P+1;
7. Exit. Where a linear array AS, P is elements and G is positive integer.

5. RESULT

Many image filtering algorithms can be effectively implemented with a reduced number of operations per pixel. In this section, three filtering techniques have studied. Low pass filter is usually used for smoothing images. High pass filters are usually used for sharpening image. The median filter used to remove noise. The different images have been tested with internet. Ordinary images are RGB image and its size is 225*225 images. The original image of butterfly is shown in Fig (1). Fig (2) is RGB to converts gray scale image. Fig (3) is using median filtering technique. Fig (4) used Gaussian high pass filtering image. Fig (5**)** analyze using Gaussian low pass filtering image. Performance of an image analyzed on Matlab2018a. The result of filtering image are following figure. Median filters are preferred for removing impulse noise. In this result, low pass filter is finds to produce better quality and computational time is less than other two methods.

Fig. (1): Original image

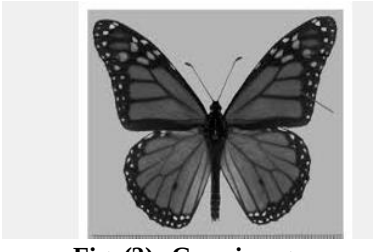

Fig. (2): Gray image

Fig. (3): Median filtering image

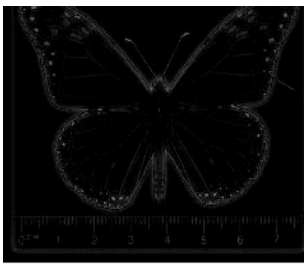

Fig. (4): Gaussian high pass filtering image

Fig. (5): Gaussian low pass filtering image

Table 1: Comparison of execution time in three filtering method

Filtering method	Execution time (Second)
Gaussian high pass filtering	0.184040
Gaussian low pass filtering	0.128407
Median filtering	0.302785

6. CONCLUSION

This paper analyzed on preprocessing. Preprocessing used RGB to convert gray scale image and three filtering methods. They are median filter, Gaussian high pass filter and Gaussian low pass filtering. The proposed system was tested with image from the internet by using 100 images of different natures. This RGB image size is 225*225 images. In preprocessing technique, median filter removes the unwanted noise. Gaussian filtering is produced sharpening image, and smoothing image. Performance of each image evaluated using Matlab 2018a. In filtering methods, low pass filtering finds to produce better quality and computational time is less than other two methods. Furthermore, we will be analyzed in image segmentation using filtering methods.

7. REFERENCES

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