RESEARCH ARTICLE   OPEN ACCESS

Digital Image Processing Filtering with LABVIEW

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ABSTRACT

Digital image processing is a topic of great relevance for practically any paper. Image denoising is a key issue in all image processing researches. It is the first per processing step in dealing with image processing where the overall system quality should be improved. Generally, the quality of an image could be corrupted by a lot of noise due to the undesired conditions of image acquisition phase or during the transmission. The great challenge of image denoising is how to preserve the edges and all fine details of an image when reducing the noise. In this paper is to apply many types of image noise by using two specified types of noise (salt & pepper noise and Gaussian noise) using MATLAB program. And presented different digital image processing Smoothing Butter Worth filter (Low Pass, High Pass) filter, Smoothing-Median filter, Smoothing- Gaussian Filter using LABVIEW and image vision toolbox, image vision toolbox presents a complete set of digital image processing and acquisition function that improve the efficiency of the paper and reduce the programming effort of the users obtaining better results in shorter time.

Keywords:- Image Processing, salt & Pepper Noise, Gaussian Noise, Butter worth Filtering, Median Filter, Gaussian Filter, LABVIEW.

I.   INTRODUCTION

This section explains the general introduction and the theory needed in this paper.

A. Digital Image Processing

The digital image is sampled and mapped as a grid of dots or picture elements (pixels). Digital images play an important role in research and technology such as geographical information system as well as it is the most vital part in the field of medical science [1].

Types of Image Noise

Applied two types of image noise only are the following:

1. Gaussian *Noise:*

It is also called as electronic noise because it arises in amplifiers or detectors [1]. Gaussian noise caused by natural sources such as thermal vibration of atoms and discrete nature of radiation of warm objects [2]. Gaussian noise generally disturbs the gray values in digital images. That is why Gaussian noise model essentially designed and characteristics by its PDF or normalizes histogram with respect to gray value. This is given as eq. (1).

$$PDF_{Gaussian} = \frac{1}{\sqrt{2\pi}\,\sigma} e^{-\frac{(g-\mu)^2}{2\sigma^2}}$$

Eq. … (1)

Generally Gaussian noise mathematical model represents the correct approximation of real world scenarios. In this noise model, the mean value is zero, variance is 0.1 and 256 gray levels in terms of its PDF, as shown in Fig. 1 [3].
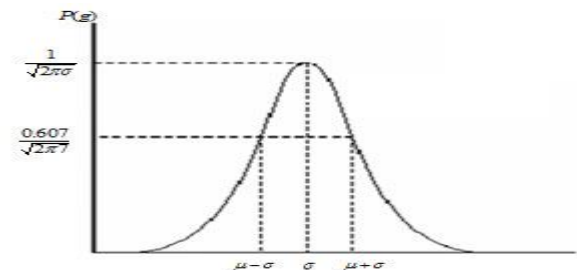

Fig. 1 Gaussian Noise PDF

2. Impulse Noise (salt & pepper) Noise:

This is also called data drop noise because statistically its drop the original data values [1]. Other terms are spike noise, random noise or independent noise, and also the term impulse noise used for this type of noise referred as salt and pepper noise [4]. In the salt and pepper noise model only two possible value are possible, a (starting range) and b (ending range), and the probability of obtaining each of them is less than 0.1 (otherwise, the noise would vastly dominate the image). For an 8bit/pixel image, the typical intensity value for pepper noise is close to (Black = 0) and for salt noise is close to (white = 255) appear in the image as a result of this noise and hence salt and pepper noise. This noise arises in the image because of sharp and sudden changes of image signal. Dust particles in the image acquisition source or over heated faulty components can cause this type of noise [4], this is given by

eq. (2), The Probability Density Function (PDF) of a impulse noise as shown in Fig. 2.

$$PDF_{Salt\&Piper} = \begin{cases} A & Pentru\ g = a\ ("Piper") \\ B & Pentru\ g = b\ ("Salt") \end{cases}$$
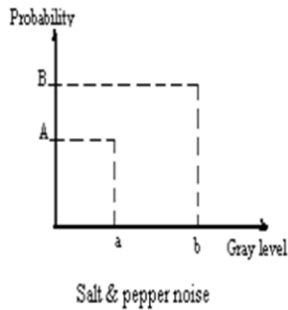
Eq. … (2)

Fig. 2 The Salt and Pepper Noise PDF

B. Image Filtering

In this paper involves three types filters to reduce the effect of noise, and these filters are: Smoothing-Median filter, Smoothing- Gaussian Filter, Smoothing Butter Worth filter, and mutation as follows:

1. Smoothing Butter worth Filter:

Butter worth Low Pass Filter (BLPF) is a filter that "cuts off" all high-frequency components of the Fourier Transform that are at a distance greater than a specified distance D from the origin of the Transform. Design frequency-domain filter to remove high-frequency noise with minimal loss of signal components in the specified pass-band with order (n) [5], as shown in Fig. 3.
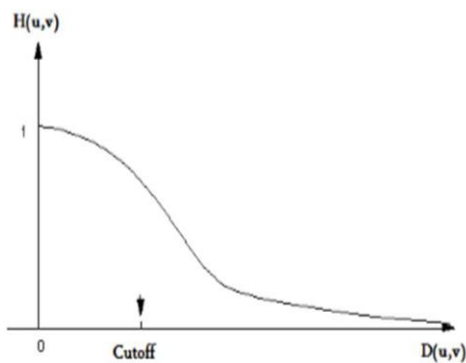

Fig. 3 Butter worth Low Pass Filter Frequency

2. Smoothing-Median Filter:

The most useful the order filters its selects the middle pixel value the order set. The median filter selects the central pixel (e.g. the value 104 in the above example) because there are 4 values above it and 4 values below it. The median filtering operation is performed on an image by applying the sliding window concept, similar to what is done with convolution [6].

3. Smoothing- Gaussian Filter:

Gaussian filters are a class of linear smoothing filters with the weights chosen according to the shape of a Gaussian function. The Gaussian smoothing filter is a very good filter for removing noise drawn from a normal distribution [7].

II. LABVIEW PROGRAM

LABVIEW is a graphical programming environment developed by National Instruments. LABVIEW program consists of two major components: Front Panel (FP) and Block Diagram (BD). A Front Panel provides a graphical user interface while a Block Diagram contains building blocks of a system resembling a flowchart [8], many Icons applied in this paper are:

 : IMAQ Create VI to create or edit new image.
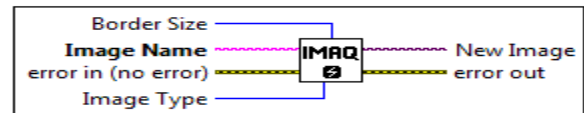
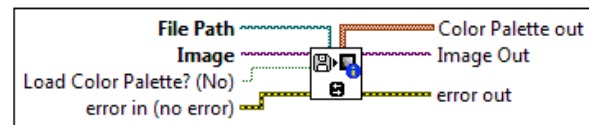 : Reads an image file, including any extra vision information saved with the image.

 : Image Type to choose types of image (Gray Scale (U8), Gray Scale (I16), RGB (U32), HSL (U32)).

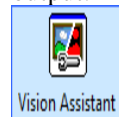 : File Path to choose the path of image (.png) only.

 : Image information indicator to display the image output.

 : Vision Assistance Block (Creates, edits, and runs vision applications using NI Vision Assistant).
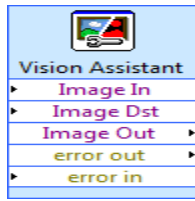
III. CASE STUDY

In this paper used original image (.png) and shows the implementation of image noise by using two specified types of noise (salt & pepper noise and Gaussian noise) using MATLAB program, after that applied many filters of image denoising using LABVIEW toolkits 2013.

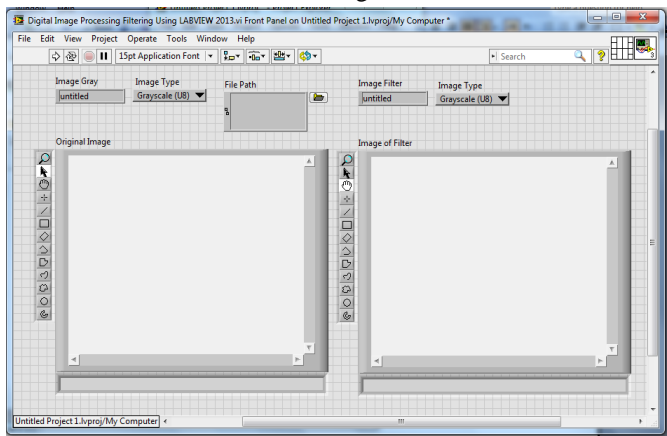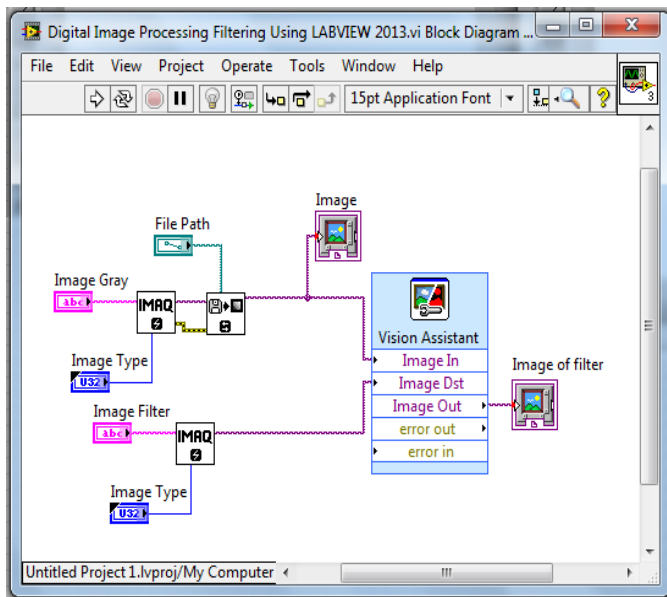The Block diagram of general digital image filtering using LABVIEW 2013, as shown in Fig. 4.

Fig. 4 Block Diagram of General Image Filtering

The simulation of general digital image filtering using LABVIEW program 2013, as shown in Fig. 5.

Fig. 5 Front Panel of General Image Filtering

IV. SIMULATION AND RESULTS

Applied the simulation of the system with different type of image noise by using two specified types of noise (salt & pepper noise and Gaussian noise), and presented different digital image processing Smoothing Butter Worth filter (Low Pass filter, High Pass filter), Smoothing-Median filter, Smoothing- Gaussian filter are shown here. The represented of the system using MATLAB & LABVIEW and image vision toolkits 2013 program are being applied.

- *Image Noise Result:*

To create an original image (RGB) and convert to image gray scale with salt & pepper noise using the MATLAB codes, as shown in Fig. 6.

(a) Original Image in form (RGB)

(b) Image in form (GS)

(C) Image with Salt & pepper Noise

Fig. 6 Create Image with 0.025 Salt & pepper Noise using MATLAB (a) Original Image in form (RGB) (b) Image in form (GS). (c) Image with Salt & Pepper Noise

The output an original image (RGB) and convert to image gray scale with Gaussian noise using the MATLAB codes, as shown in Fig. 7.
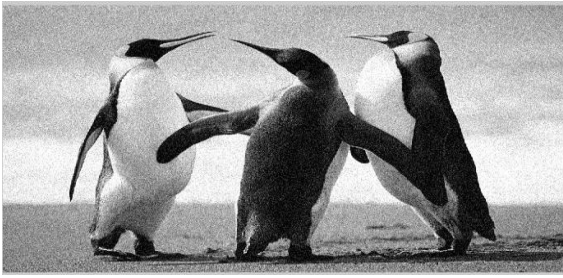
Fig. 7 Create Image with 0.025 Gaussian Noise using MATLAB

- *Image Filtering Results:*

Many filters have been used to reduce the effect of noise.

* Image with Salt & Pepper Noise & Three Types filter:

The output to create an original image and convert to image gray level with salt & pepper noise and smoothing butter worth filter (type for low pass filter) using the LABVIEW toolkits 2013, as shown in Fig. 8.

Fig. 8 Filtering Image with 0.025 Salt & pepper Noise with smoothing Butter worth Filter

The output to create an original image and convert to image gray level with salt & pepper noise and median filter using the LABVIEW toolkits 2013, as shown in Fig. 9.

Fig. 9 Filtering Image with 0.025 Salt & pepper Noise with Smoothing Median Filter

The output to create an original image and convert to image gray level with salt & pepper noise and Gaussian filter using the LABVIEW toolkits 2013, as shown in Fig. 10.

Fig. 10 Filtering Image with 0.025 Salt & pepper Noise with Gaussian Filter

* Image with Gaussian Noise & Three Types filter:

The output to convert original image to image gray level with Gaussian noise & smoothing butter worth filter (low pass filter) using LABVIEW toolkits 2013, as shown in Fig. 11.
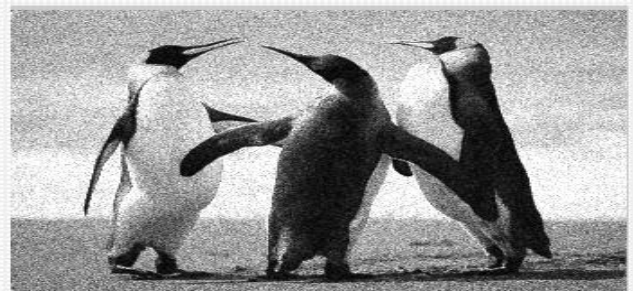

Fig. 11 Filtering Image with 0. 025 Gaussian Noise with Smoothing Butter worth Filter (LPF)

The output to convert original image (RGB) to image gray level with Gaussian noise & smoothing median filter using LABVIEW toolkits 2013, as shown in Fig. 12.

Fig. 12 Filtering Image with 0.025 Gaussian Noise with Smoothing Median Filter

The output to convert original image to image gray level with Gaussian noise & Gaussian filter using LABVIEW 2013, as shown in Fig. 13.

Fig. 13 Filtering Image with 0.025 Gaussian Noise with Gaussian Filter.

V. CONCLUSIONS

In this paper the digital image processing using two types noise (Salt & Pepper Noise, Gaussian Noise), and three types filter (Smoothing Butter worth Low Pass Filter, Smoothing Median Filter, Gaussian Filter). The results are obtained to two types of image noise using MATLAB program, after that using LABVIEW and image vision toolkits 2013 program to obtain image filtering. The results show compare between three types filter and control performance has been improved greatly by using PSO algorithm for tuning the parameters of PID controller. The output of the image filter has low noise and high density when using Gaussian noise and Gaussian filter, but when using low pass filter take high noise and low density than using Gaussian filter and median filter.

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