Labview Based Image Fusion Using Discrete Wavelet Transform

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Abstract— **Image Processing applications have grown vastly in real world. Commonly due to limited depth of optical field lenses, it becomes inconceivable to obtain an image where all the objects are in focus. Image fusion deals with creating an image where all the objects are in focus. Image fusion is a data fusion technology which keeps images as main research contents. It refers to the techniques that integrate multi-images of the same scene from multiple image sensor data or integrate multi images of the same scene at different times from one image sensor. The image fusion algorithm based on Wavelet Transform which faster developed was a multi-resolution analysis image fusion method in recent decade. Wavelet Transform has good time-frequency characteristics. It was applied successfully in image processing field. Nevertheless, its excellent characteristic in one-dimension can't be extended to two dimensions or multi-dimension simply. Separable wavelet which was spanning by one-dimensional wavelet has limited directivity. This paper introduces the LabVIEW based Discrete Wavelet Transform and uses it to fuse images, different kinds of fusion methods are compared at last. The experiments show that the method could extract useful information from source images to fused images so that clear images are obtained.**

Keywords- **LabVIEW, Multi-focus image fusion, Discrete Wavelet Transform, Multi resolution Analysis.**

I. INTRODUCTION LABVIEW

LabVIEW stands for Laboratory Virtual Instrumentation Engineering Work Bench.NI LabVIEW is a *graphical development environment* for creating flexible and scalable design, and test applications at minimal cost. Any programming language requires problem solving skills. Problem solving skills are essential to create solutions in LabVIEW.

LabVIEW Vi mainly contains three components.

a) **Front Panel** – How the user interacts with the VI.

b) **Block Diagram** – The code that controls the program.

c) **Icon/Connector** – Means of connecting a VI to other VIs. The Figure 1 and 2 shows the Front Panel and Block Diagram of the LabVIEW.
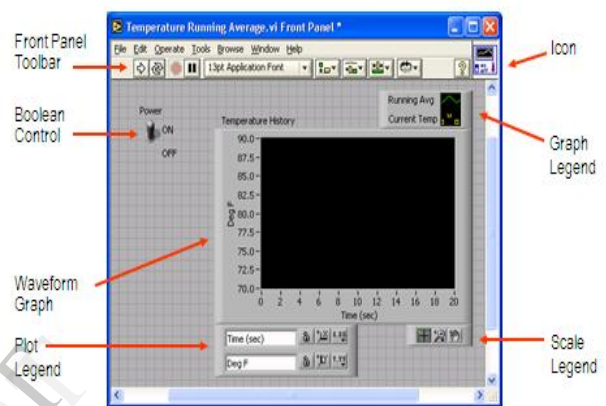
(a) Front Panel:

Figure1: Front Panel

The front panel is the user interface of the VI. You build the front panel with controls and indicators, which are the interactive input and output terminals of the VI, respectively. Controls are knobs, pushbuttons, dials, and other input devices. Indicators are graphs, LEDs, and other displays. Controls simulate instrument input devices and supply data to the block diagram of the VI. Indicators simulate instrument output devices and display data the block diagram acquires or generates.

(b) Block Diagram:

The block diagram contains this graphical source code. Front panel objects appear as terminals on the block diagram. Additionally, the block diagram contains functions and structures from built-in LabVIEW VI libraries. Wires connect each of the nodes on the block diagram, including control and indicator terminals, functions, and structures.

In this block diagram, the subVI Temp calls the subroutine which retrieves a temperature from a Data Acquisition (DAQ) board. This temperature is plotted along with the running average temperature on the waveform graph Temperature History. The Power switch is a boolean control on the Front Panel which will stop execution of the While Loop. The While Loop also contains a Timing Function to control how frequently the loop iterates.
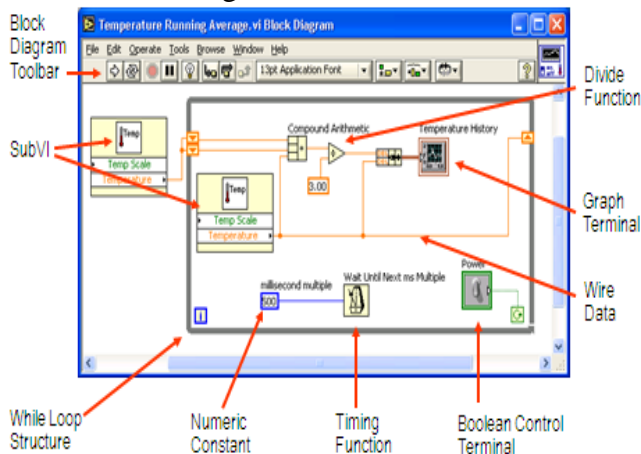
Figure1: Front Panel

Figure2: Block Diagram

In this picture, the Power switch is a boolean control. A boolean contains either a true or false value. The value is false until the switch is pressed. When the switch is pressed, the value becomes true. The temperature history indicator is a waveform graph. It displays multiple numbers. In this case, the graph will plot Deg F versus Time (sec).In LabVIEW the user Interaction takes place through the Front Panel. The Code that controls the program is nothing Block Diagram.

II. IMAGE FUSION INTRODUCTION

Image fusion utilises information obtained from a multi-focus images of the same scene. Image fusion is the process of merging two images of the same scene to form a single image with as much information as possible. Image fusion is important in many different image processing fieldssuch as satellite imaging, remote sensing and medical imaging.The process of image fusion is performed for multi-focus and multi-sensor images of the same scene. In multi-focus images, the physical objects in the scene which are closer to the camera are in focus and the far physical object gets blurred. Adverse to it, when the far physical objects are focussed then the closer objects get blurred in the image. A hierarchical idea of image fusion has been implemented for combining significant information from multiple images into single image. The process of image fusion can be accomplished either in transformed domain or spatial domain. In spatial domain operations are performed on the pixel values. In transformed domain the images are first transformed into multiple levels of resolutions.

Information fusion can be performed at any level of the image information representation corresponding to other forms of information fusion, image fusion is usually performed at one of the three different processing levels they are Pixel, Feature and Decision Level.

III. IMPLEMENTING METHOD

LabVIEW Based DWT Fusion:

The most common form of transform type image fusion algorithms is the wavelet fusion algorithm due to its simplicity and its ability to preserve the time and frequency details of the images to be fused.
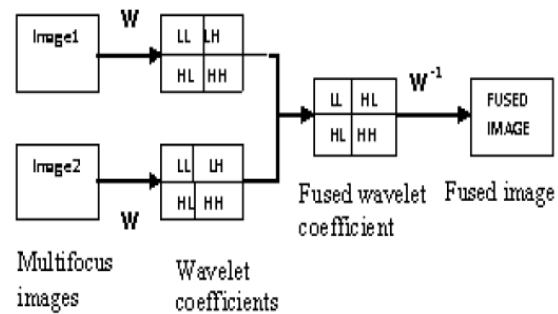

Figure3: Block diagram of Discrete Wavelet transform

A schematic diagram of the wavelet fusion algorithmof two registered images P_1 (x_1, x_2) and P_2 (x_1, x_2) is depicted in Fig.3.It can be represented by the following equation:

$$I(x_1, x_2) = W_{-1}(\phi(W(P_1(x_1, x_2)), W(P_2(x_1, x_2)))) \quad (1)$$

Where $W, W_{-1}$and ϕ are the wavelet transform operator, the inverse wavelet transform operator and the fusion rule, respectively. There are several

wavelet fusion rules that can be used for the selection of wavelet coefficients from the wavelet transforms of the images to be fused. The most frequently used rule is the maximum frequency rule which selects the coefficients that have the maximum absolute values. The wavelet transform concentrates on representing the image in multi-scale and it is appropriate to represent linear edges. For curved edges, the accuracy of edge localization in the wavelet transform is low. So, there is a need for an alternative approach which has a high accuracy of curve localization such as the curvelet transform.

IV. EXPERIMENT RESULTS

The proposed algorithm for the fusion of Multi-Focus image Fusion of farther object and closer object are tested and compared to the traditional different wavelet fusion. Three experiments are conducted for this purpose. For the evaluation of the Performances of the fusion algorithms, the visual quality of the obtained fusion result as well as the Histogram is used.
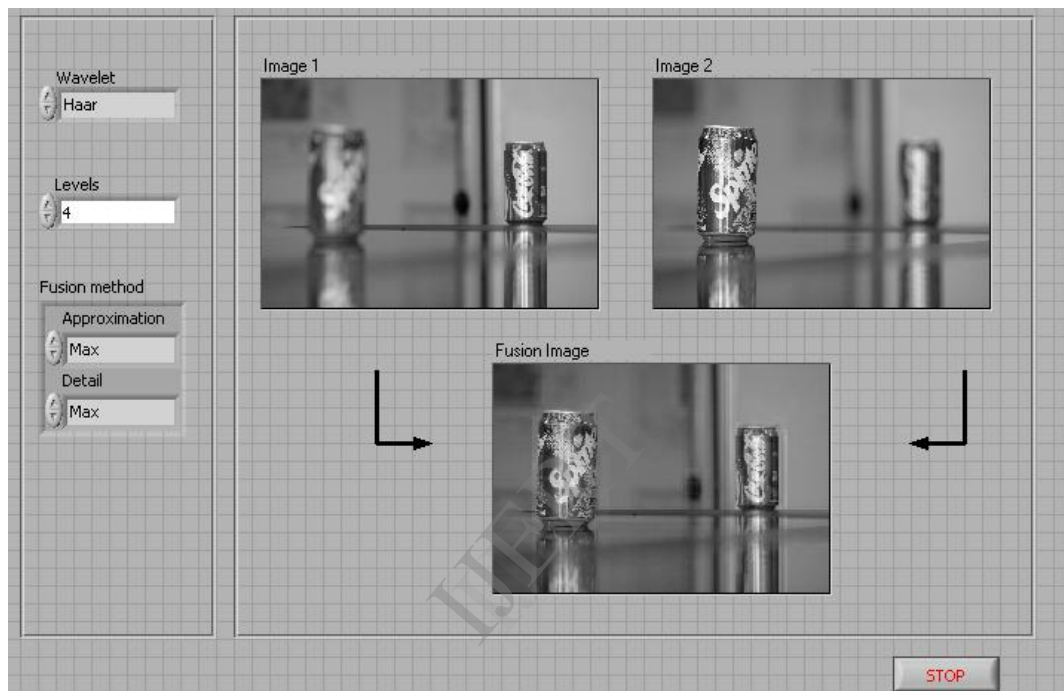

Figure4: Result of DWT Based Image Fusion Using Haar Filter
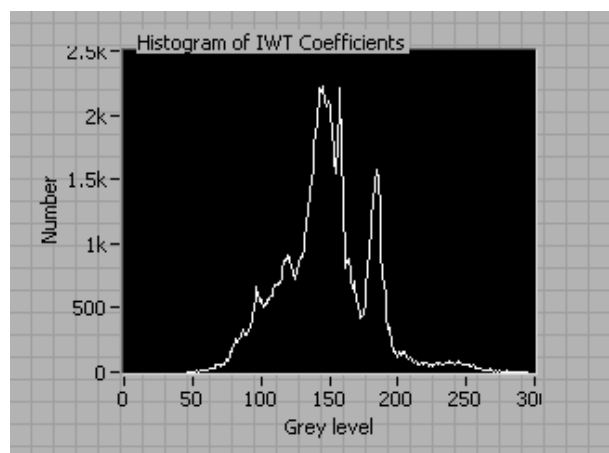

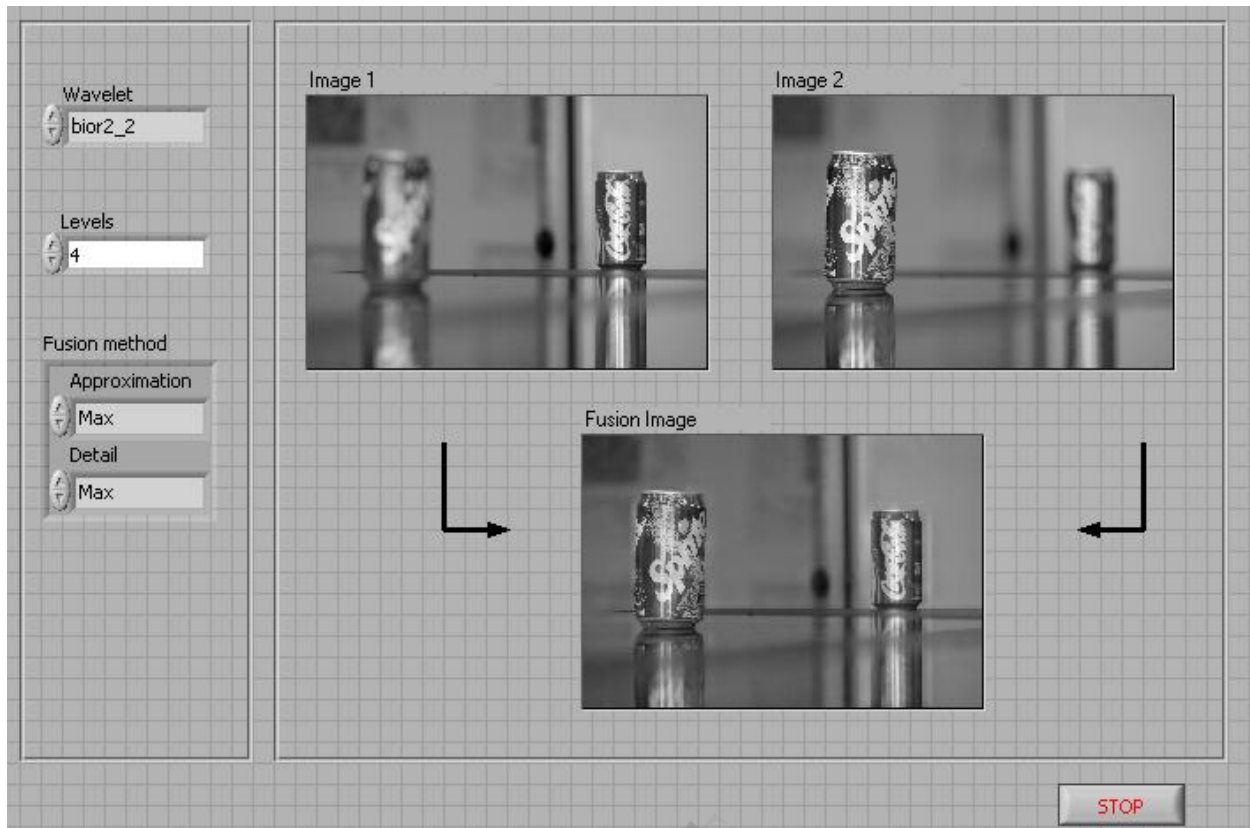Figure 5: Histogram Result of DWT Based Image Fusion Using Haar Filter

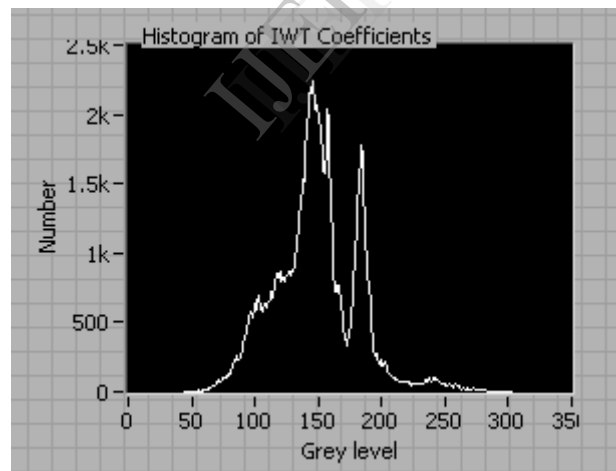Figure6: Result of DWT Based Image Fusion Using Biorthogonal

Figure 7: Histogram Result of DWT Based Image Fusion Using Biorthogonal

The Results of LabVIEW based DWT different fusion method results shown above in Figure4: Result of DWT Based Image Fusion Using Haar Filter and evaluate the quantitative measure of fusion result we have founded the Histogram of fused image in Figure 5: Histogram Result of DWT Based Image Fusion Using Haar Filter. In the same way we different results are Figure6: Result of DWT Based Image Fusion Using Biorthogonal and

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Figure 7: Histogram Result of DWT Based Image Fusion Using Biorthogonal.

Normalized Histogram:

- ✓ dividing each of histogram at gray level r_k by the total number of pixels in the image, n
- ✓ $p(r_k) = n_k / n$
- ✓ For k = 0,1,…,L-1
- ✓ $p(r_k)$ gives an estimate of the probability of occurrence of gray level r_k
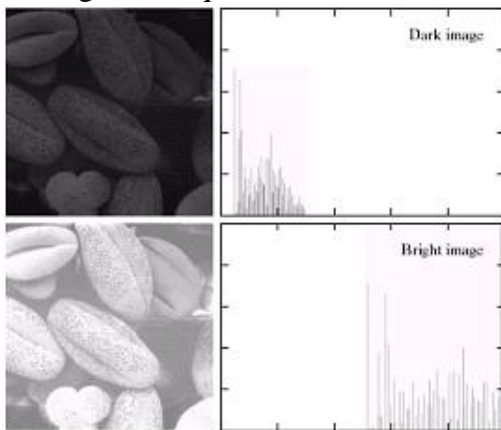- ✓ The sum of all components of a normalized histogram is equal to 1

Figure 8: Histogram of Dark and Bright Image

Dark image :
Components of histogram are concentrated on the low side of the gray scale.

Bright image:
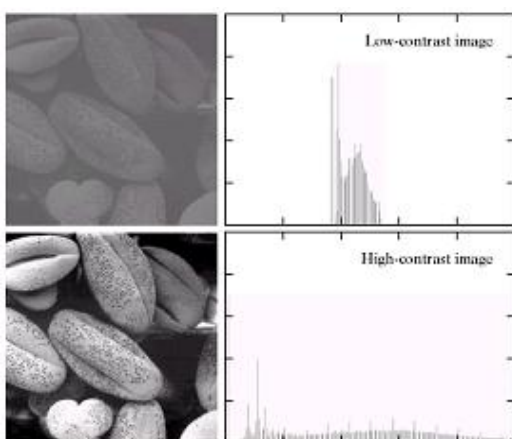Components of histogram are concentrated on the high side of the gray scale.

Figure 9: Histogram of Low contrast image and High Contrast Image.

Low-contrast image :
Histogram is narrow and centered toward the middle of the gray scale.

High-contrast image :
Histogram covers broad range of the gray scale and the distribution of pixels is not too far from uniform, with very few vertical lines being much higher than the others

V. CONCLUSION

In this implemented technique, LabVIEW based different DWT image fusion has been implemented in this paper. For different image fusion methods histogram is calculated to find the quantitative measures of the fused image. The fusion result of Discrete Wavelet Transform is implemented.

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