Edge Detection for X-Ray Image using LabVIEW

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Abstract: Medical imaging has emerged as a new field of research in image processing which consist of image enhancement, visualization, and edge detection. The main objective is to improve medical diagnosis so that we can obtain an image-based information, which focuses on detection of pathological deformations specially for x-ray images. Medical images consist of object edges and noise, hence it is difficult to distinguish the exact edge from noise. Edge detection technique acts as a fundamental tool in feature extraction and feature detection. Edges are nothing but are changes of intensity in an image. Sobel operator, a popular operator used for edge detection algorithms is considered in this work. Sobel operator uses a derivative approximation for finding out edges and uses 2-D spatial gradient measurement for images with vertical and horizontal gradient matrices. Labview is a graphical programming language and is used for interactive applications, hardware integration and real time processing. The proposed work has been done using Labview 14.0.

Key Words: Edge detection, Sobel operator, LabVIEW 14.0.

I. INTRODUCTION

Digital image processing has become important in the areas of communication, medicine ,remote-sensing ,seismology, industrial- automation ,robotics, aerospace and education Medical imaging is an area which has gain a wide approval in healthcare industry due to advancement in technologies and software development. It plays an important role in disease diagnosis and helps medical physicians for the type of treatment. Different Image processing techniques have been developed to examine the output of medical imaging system to find out the symptoms of the patients with ease.

In medical applications edge detection has a very crucial role regarding image analysis. It facilitates the representation of anatomical structures. Edge detection is the basically finding & detecting sharp changes in brightness or discontinuities in an image. These discontinuities are rapid changes in a pixel intensity value which specifies the boundary of the objects. The available edge detection algorithm convolves an image with an operator (2-D filter). There are large edge detection operators available designed to be sensitive to different types of edges. There are many edge detection operators such as laplacian, Robert, Prewitt, canny and Sobel.The proposed work is designed using Sobel operator. Sobel operator known as Sobel Filter is used for image processing and computer vision, which creates an image and focuses edges and transitions. The Sobel operator convolves the image with an integer value filter in a horizontal and vertical direction hence it is cheaper in terms of computations. The proposed work has been done using LabVIEW 14.0, which is a graphical programming language. It is efficient for real time applications, automation applications and industrial applications. It provides a real time image processing approach with LabVIEW Fpga.

II. LITERATURE REVIEW

For medical image processing a large work is done in the area of edge detection algorithms, feature extraction, image enhancement etc. Edge detection is important and is a major step for any image processing process. It proves to be a useful for the systematic community. Edge detection changes and improves the image for human understanding and information extraction in different fields such as in satellite communication, biomedical processing, traffic monitoring, land acquisition, etc.

Image segmentation for x-ray images is done by edge detection based on a sobel operator is seen [1]. For Edge detector, its algorithm is simulated in MATLAB and then it is implemented into VHDL with the help of Xilinx ISE. Different edge detection operators such as Sobel, Log and canny operators are used on X-ray images and the results are compared[2]. License Plate Recognition System is implemented using LabVIEW 11.0 and Vision assistant 8.0.1[3]. Video edge detection for real time applications using sobel operator in labview [4]. Edge detection with different images by using LabVIEW and MatLab and implementation is easy in LabVIEW as compared to matlab and preferable[5]. A study of different edge detectors for femur bones in X-Ray images are also studied [7]. Bone fracture detection for X-Ray images morphological gradient techniques in matlab is also

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studied[6]. Enhancing Visual Diagnosis of X-Ray images has also been studied [8].For real time implementation, sea state monitoring is done using HF radar system is implemented using LabVIEW Fpga.It uses NI PXI 7833 DAQ with a reconfigurable FPGA module inbuilt and onboard memory[9]
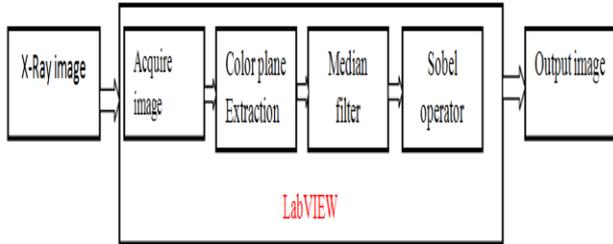
III. PROPOSED METHODOLOGY

Fig .1. Proposed model

A. X-RAY IMAGE:

X-ray of a bone produces an image of a bone in the body and a bone ailment is the fracture.Fractures are cracks in a bone.X-Ray images often consist of the important and meaningful information.The basic objective is to detect the edges in the medical X-Ray images.

B. BASIC BLOCKS IN LABVIEW

Image Acquisition:
The original image is the x-ray image. Image acquisition is the technique to acquire an image in LabVIEW This can be done using IMAQ VI. Use the IMAQ Read File VI to open and read information from a file stored in a computer into the image reference. It can be read from files stored in the format of png, jpeg, tiff etc.

Color plane extraction:
By default X-ray images are stored in the format of RGB, therefore grayscale conversion is done before an image pre-processing stage. Since the RGB information is extracted by using color plane extraction from the acquired 32-bit color image to make it into an 8-bit grayscale image.

Median filter:
Median filters do an excellent job of rejecting different type of noise. X-ray images are more noisy hence median filter is used to removed unwanted noises.For median filter an IMAQ Nth order filter block is used for designing a median filter.

Sobel operator:
Standard Sobel operator, uses 3×3 neighborhood where each central gradient approximate is a sum of a pair of orthogonal vectors.For sobel edge detection, IMAQ edge detection block is used in labview.

IV. EDGE DETECTION ALGORITHM

Edge detection using a Sobel operator is based on computations an approximating a value of the gradient of image intensity function. The Sobel operator here uses two 3x3 masks which is convolved with the original images to compute and calculate the approximations of the gradient.

The Sobel operator uses filters Hx and Hy.

$$Hx = \begin{bmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{bmatrix} \qquad ------(1)$$

$$Hy = \begin{bmatrix} -1 & -2 & -1 \\ 0 & 0 & 0 \\ 1 & 2 & 1 \end{bmatrix} \qquad ------(2)$$

Where Hx (kernel in x direction) and Hy (kernel in y direction)

These filters determine the components of the gradient along the neighboring lines or the neighboring columns.The gradient magnitude is given by (3).

$$GM(x,y) = \sqrt{Hx^2 + Hy^2} \quad -------(3)$$

The above expression is costly because different operations of square and square root is applied for every pixel.

$$GM(x, y) = |Hx| + |Hy| \qquad ------(4)$$

This above expression is easy to compute and also preserves the changes in an intensity (edges in images).

V. EDGE DETECTION IN LABVIEW

Code Development
Fig.2 shows LabVIEW block diagram for image acquisition and its sobel edge detection. A subVI is created for median filter block and sobel operator block named median sobel block in LabVIEW
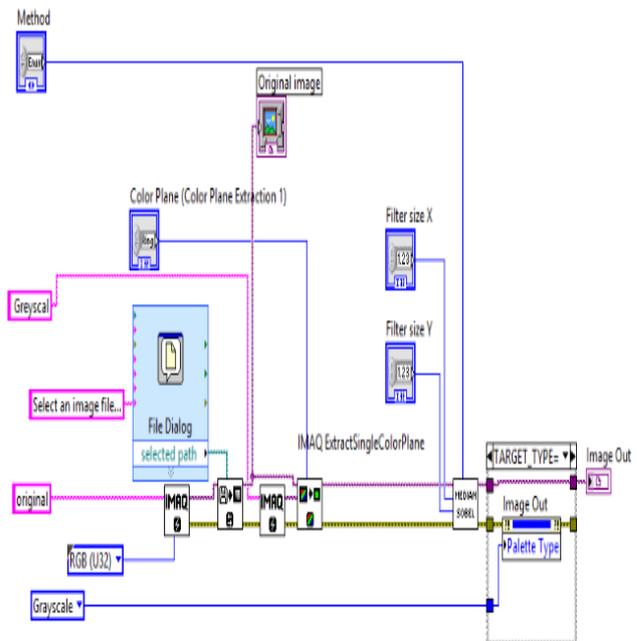

Fig 2.   LabVIEW Code

VI. RESULTS

Fractured bone X-ray image and its edge detection is shown in fig 3(a),fig3(b),fig3(c).Different X-ray images are considered here .
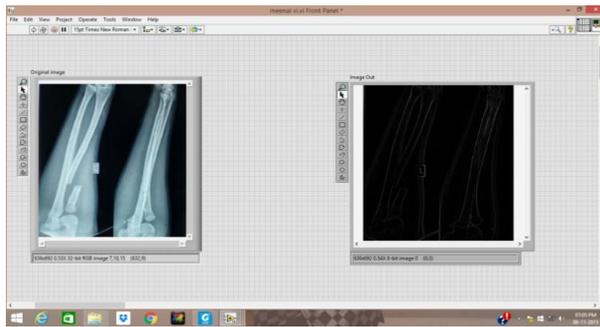
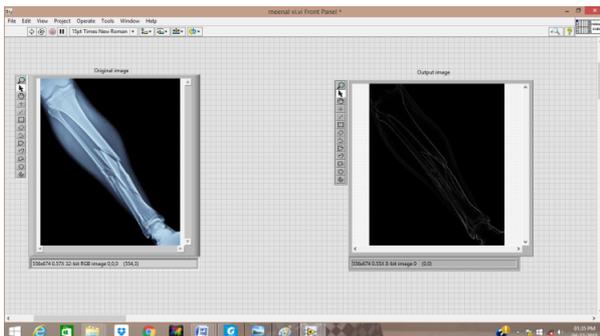Fig 3(a) Fractured bone and its edge detection of X-ray image

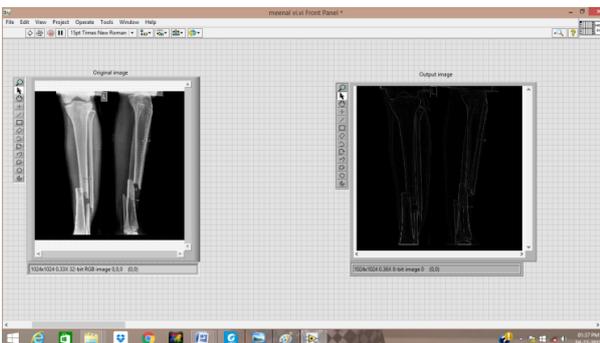Fig 3(b) Fractured bone and its edge detection of X-ray image

Fig 3(c) Fractured bone and its edge detection of X-ray image

VII. CONCLUSION

This paper describes the design of the edge-detection algorithm for X-ray on LabVIEW using sobel operator. In this work different medical images of digital X-Ray have been taken for detecting edges.The preliminary results are presented which shows edge detection which can be useful for detection of fractures in a bone.

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