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Image Enhancement on OpenCV based on the Tools: Python 2.7

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Abstract : In the vast area of digital image processing and high resolute transmission approach, this paper describes the image enhancement techniques which are based on OpenCV. OpenCV is the latest emerging approach in the area of image processing. Open CV initially introduced by Intel, which has its own inbuilt library for image and video analysis. This paper includes three applications of OpenCV library. The coding of all three approaches is done by Python 2.6. The first method is Histogram specification of an image in python language, second technique is live edge detection of a video which is accessed along with current time using webcam, and the third approach is live face detection. First approach is histogram specification of an image using ClacHist command using CV2, CV2 is imported into python 2.6 for image manipulation. Second approach is current time edge detection. For the current access of video frame, webcam is used using the python command "Cv2VideoCapture(0)". Third approach is live face detection. This is done by using the Haar- case-code which is the machine based feature.
Keywords: Single Bit Upsets (SBUs), Multiple Bit Upsets (MBUs), Error Correction Code (ECC), Modified Decimal Matrix Code (MDMC), Encoder-Reuse Technique (ERT)

I. INTRODUCTION

Digital image processing is a process which formulates the original image through various technologies. It applies many operations on an input image which result matches the desired image.[1]These processing approaches implement some set of process which result an enhanced image or extract some useful data from the image. [2]Image processing and enhancement techniques nowadays adapted mostly in industries like 3D mapping, object movement detection, radar targeting, color processing, face detection, restorations, and many others fields. All the above applications involve research and processing and implanting different filtering technologies to get the desired results.

The objective of image enhancement is to restore the image that is distorted during the transmission from one form to another form. The whole techniques centered upon the detailed formations and characteristics norms of image and according to the desire of applications and tools the algorithm can be changed at any stage of the process. Adaption of all the algorithms in the image enhancement is easy. But with all the key features we need to care that one algorithm which is best for particular application may be not suitable for other classes of applications.

In this paper concludes three approaches, all three approaches are processed through Open CV Library. First method is based on image thresholding that describe the histogram specification of an image in python language. Histogram describes the information and data of image along with its properties [1]. The basic concept behind the histogram specification is the matching of original histogram with specified histogram. Second method is based on edge detection of image frames. Sobel edge detection method is used here to track the edges. It uses mathematical calculation to detect the points where the brightness, color and other indexes of image change distinctly [2]. Third method relayed on Face or particular object tracking. All three methods proposed in MATLAB as well as Open CV. Here a pre-organized function is asserted from positive and negative images[3]. This pre organized function is used for detect face or other feature. To do this process live, webcam is used in python coding after the detection this detected portion of images is highlighted.

This paper summarize as, the section1 gives the introduction, section 2 describes the literature review, in the section 3 Problem identification and formulation,4 section Methodology, Section 5 gives the Results and the last section 6 and 7 describes Conclusion and future work respectively.

II. LITERATURE SURVEY

At present various advanced software like OpenCV, Java, Matlab, Vivado Hls, etc are present in the programming area Open CV is one of the most important Computer vision library. In an Open CV tool there are so many algorithms according to different

applications but all this algorithms contain comprehensive set of both classic and state of the art computer vision and machine learning algorithms. These algorithm cab be applied to identify faces, geometric transformation of images, in Watershed algorithms detect objects, foreground extraction, video transmission, recognize movements of object, subtract red eye from the image and increase the contrast, in edge detection and feature detection, extraction of 3D models of objects, in the production of the 3D point clouds from stereo cameras, in search of similar images using database. Stitch images together to produce a high resolution image of an entire scene, in capturing the eye movements. All these previously discussed application conclude that there are more than 3000 optimized algorithm in Open CV.

III.   METHODOLOGY

This paper contributes three methods of image processing. They are : 1) Histogram Specification 2) Edge Detection. 3) Face Detection.

A.   Histogram Specification

Transform an image to get the desired shape for the matching is the basic feature of histogram specification [1]. In this process histogram counts each pixel data at all intensities. To get the accurate histogram, it is needed to maximize a measure which shows more information. This process is gone through the calculation of local mean pixel values so it can be estimated that the method of histogram specification is a path of entropy maximization. Some time it may happen that the background and image cannot be easily distinguishable for that hysteresis thresholding is used [2].

At the time of histogram calculation if there is no clear deviation in the pixels intensities which means that background pixels also possess similar values with object. At this stage we create two boundaries one of which high threshold value and other with lower threshold value. The pixels value which are above the high threshold value can be consider as object and the pixels which have lower intensities value than low threshold point can be consider as background. Histogram specification has features like 1) pixel's characteristics of the objects 2) shape of the image. 3) Describe the portion which is occupied by the image. 4) Even also calculate how many different objects are presented in the image.

B.   Edge Detection

Edge detection and segmentation is an approach to create the boundary of an image. This detection of boundary of the image helps to understand the feature of the object which is useful at the time of image transmission and restoration. this process will eliminate the irrelevant information of the object which will reduce its size that helps during the transformation time and sustain only the important data of the image. [1] It requires lesser amount of space in memory. There are various type of edge detection techniques like Canny Edge Detection, Sobel Edge Detection, Prewitt Edge Detection, Fuzzy Edge detection, etc. among all of these sobel edge detection is the widely adopted by the emerging techniques.

The sobel edge detection approach is discovered by Sobel in 1970. This method evaluate the boundaries using sobel approximation derivative. It creates the boundary where the deviation is maximum.[2] This approach shows a 2-D spatial deviation values of an image and generate the high spatial frequency which creates the edges. This is a discrete derivative function which computes the intensities of pixel that locates on the surface of the image.

Fig 1: Original image   Fig2: Hist-Specified image

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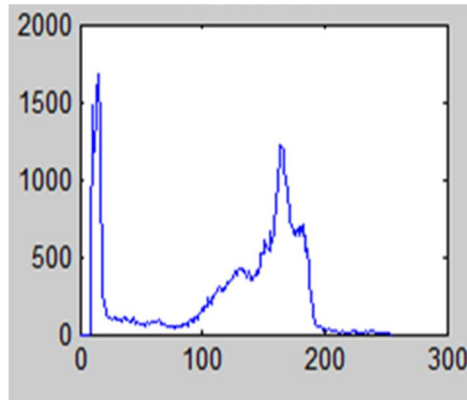*Volume 5 Issue VII, July 2017- Available at www.ijraset.com*

Fig 3 : Histogram plot of the image

All the point of object divide into two portions one is gradient of vector and another one is norm of the vector. It performs convolution of the filtered values in horizontal and vertical directions. To detect the edges of the images, Sobel filter is designed. In general the Edge detection path adopt the assumption that edges can be drawn at the place where the discontinuity in the pixels' intensities are present. According to this concept if we calculate the derivative of the pixels values and locate the point where gradient vales are maximum. The x and y directions pixels are changing in measure through this gradient and derivative function. So the factor of the derivative function are found from this equation

$$\frac{\delta f(x,y)}{\delta x} = \Delta x = \frac{f(x+dx,y) - f(x,y)}{dx}$$
$$\frac{\delta f(x,y)}{\delta y} = \Delta x = \frac{f(x,y+dy) - f(x,y)}{dy}$$

Here the dx and dy calculate the distance with respect to x and y origins.

If we define **A** as the source image, and **G**x and **G**y are two images which at each point contain the horizontal and vertical derivative approximations.

$$Gx = \begin{vmatrix} +1 & 0 & -1 \\ +2 & 0 & -2 \\ +1 & 0 & -1 \end{vmatrix} * A \text{ and}$$

$$Gy = \begin{vmatrix} +1 & +2 & + \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{vmatrix} * A \qquad [3]$$

Sobel edge detection gives boundaries of the object but the accuracy is lesser due to the contradiction between the horizontal and vertical pixels values. To improvise this issue laplacian operator is used . this operator will do second time derivation of both vertical and horizontal

points which will increase the accuracy of the object's boundary. Here is the laplacian function

$$\text{Laplace (f)} = \frac{\partial f}{\partial x} + \frac{\partial f}{\partial y} \qquad [3]$$

C. Face Recognition

Face recognition is actual based on the face detection technique and to do so one should be able to mark the facial landmark and its relative geometrical position of facial elements. Generally for extraction of face, the background and other irrelevant pixels must be subtracted from the image. Static image face detection is done by running a window across the image. But to do real time face detection a sequence of image frames from video is extracted to detect the face from moving object. Static image face detection is less efficient than real time face detection because the movement of object is in continuation. To do face detection we need to have a face recognition scheme, there are generally to types of face recognition method are present which are 1) Geometrical structure 2) template matching [1]. Here we are taking automatic geometrical facial detection. The benefit of this process is when   the resolution video frame is low still it can detect the facial features clearly. This process extracted the physical position of nose ears chicks, etc. To do this automatic extraction of feature we are using Haar-Case-coding [2].

Haar-like features are digital image feature used in object recognition. They owe their name to their intuitive similarity with Haar wavelets and were used in the first real-time face detector. A Haar-like feature considers adjacent rectangular regions at a specific location in a detection window, sums up the pixel intensities in each region and calculates the difference between these sums. This difference is then used to categorize subsections of an image. Haar-like features are digital image feature used in object recognition. They owe their name to their intuitive similarity with Haar wavelets and were used in the first real-time face detector. A Haar-like feature considers adjacent rectangular regions at a specific location in a detection window, sums up the pixel intensities in each region and calculates the difference between these sums. This difference is then used to categorize subsections of an image.
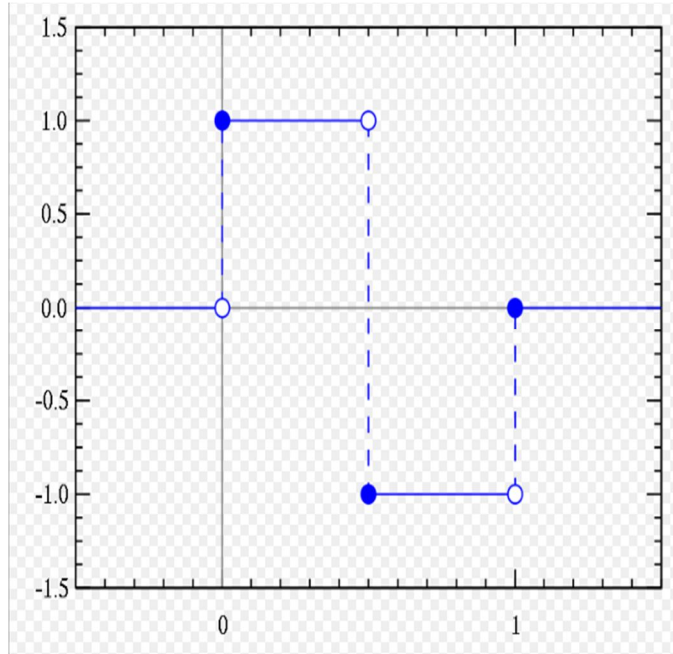

Fig 4 : Haar-case-code's Normalize Graph

IV. IMPLEMENTATION AND RESULTS

Tool Descriptions: OpenCV 2.4.9 Programming language: python in python 2.6 version
Imported Function in Python library: import CV2, Import numpy, Import matlob lib.
Few results of this paper is taken live from the webcam of my laptop.
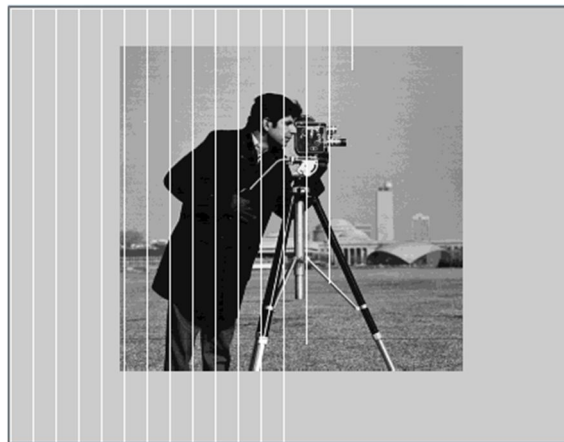
A. Thresholding

Fig 5:Image with its Histogram after the Thresholding

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Fig 5 shows the histogram graph over the cameraman image which is taken from the in built Library of OpenCV.

B. Edge-Detection

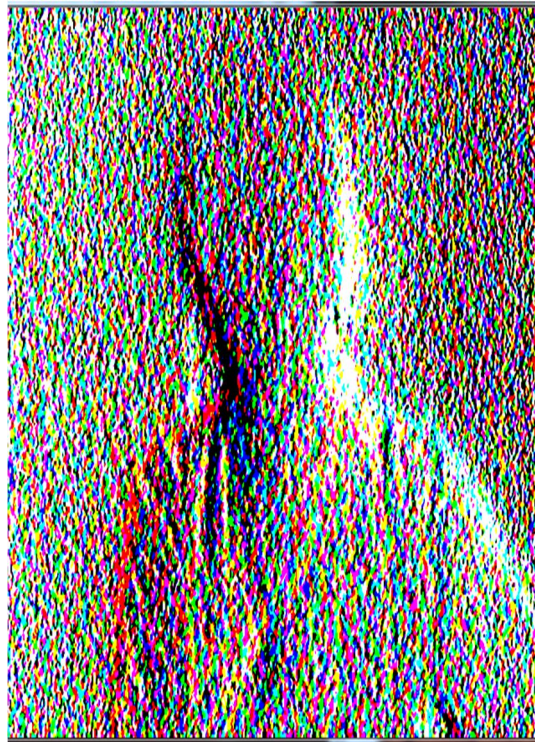Fig 6: snapshot of Video frame capturing live.

Fig 7 :Snapshot of Live frame Edge Detection.

The live edge detection of image which was taking from the webcam in Fig 6 is shown in the Fig 7. The sobel detection technique is used here.

C. *Face Detection*

Face detction using haar-case-code is shown in the Fig 8. This instant live face detion is decribe the speed of OpenCV. And without converting into any other color index the result is displyed in the OpenCV Face detection technique.

Fig 8: Snapshot of Live face detection of noisy image

V.   CONCLUSION AND FUTURE WORK

All the above applications of image processing are more efficient and faster in OpenCV as comparison with Other image processing tol like Matlab. Here it can be concluded that OpenCV give faster results this is because it OpenCV automatically transfers machine language code to the system or computer. So as a result there is no interpretation which results faster images and video frames. On the time of face detection and edge detection OpenCV generated at least 35 fps while the same process in MATLAB would generate only 3-4 frames. So this can be concluded that OpenvCV has faster speed.

A. *Future Work*

As it concluded that Opencv has Faster in speed which is better for fast going videos but along with this there is one drawback here that is,OpenCv has issues related to memory management and lower level programming factors. The reason behind this is openCV library is written in C language, but if we can succeed to build this library based on java this memory related issue may overcome to some extend.

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