Fake Currency Detection Using LabVIEW

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Abstract: The growing menace of counterfeit currency is very evident from newspaper reports of fake currency notes being seized appear every day. The advancements in the field of computers, photocopiers and scanners have made the process of duplicating currency note a simple task. The unsuspecting masses have no mechanism of differentiating the fake note from the genuine. The main objective of this project is fake currency detection using LabVIEW. This process can be automated in a computer using NI-IMAQ. The basic logic is developed using Image Acquisition-Laboratory Virtual Instrument Engineering Workbench (IMAQ-LabVIEW). The images of the original currencies are fed to the IMAQ database. Finally the features of the note to be tested are compared with the dataset formed from the original image and finds out whether it is fake or original. In terms of accuracy, reliability and automation, the above mentioned method of counterfeit detection is far more superior to those which already exist.

Keywords: NI-IMAQ, LabVIEW, Edge detection and ROI.

I. INTRODUCTION

With the development of sophisticated printing techniques, the counterfeit currencies have become on- par with the original currency. Digital image processing is the use of computer algorithms to perform image processing on digital images. As a subcategory or field of digital signal processing, digital image processing has many advantages over analog image processing. Digital image processing allows the use of much more complex algorithms, and hence, can offer both more sophisticated performance at simple tasks, and the implementation of methods which would be impossible by analog means. Using NI-IMAQ the process of fake currency detection can be automated using a computer. After choosing the test image it is pre-processed and converted to gray scale image. Then the edge detected image is segmented and the features such as see through register, security thread, identification mark and latent image are extracted from the test image. Finally the characteristics including mean value and standard deviation of the note to betested are compared with the dataset formed from the original image and finds out whether it is fake or original. The use of LabVIEW for the simulation provides a convenient and efficient tool for virtual implementation of various sub modules.

II. SYSTEM ARCHITECTURE

Overall Algorithm:
1. Image of paper currency will be acquired by simple scanner or digital camera.
2. The image acquired is RGB image and then it will be converted into gray scale.
3. Edge detection of the whole gray scale image will be performed.
4. After detecting edges, the four characteristics of the paper currency will be cropped and segmented.
5. After segmentation, the characteristics of the paper currency will be extracted.
6. The characteristics of test image are compared with the original pre-stored image in the system.

7. If it matches then the currency is genuine otherwise counterfeit.
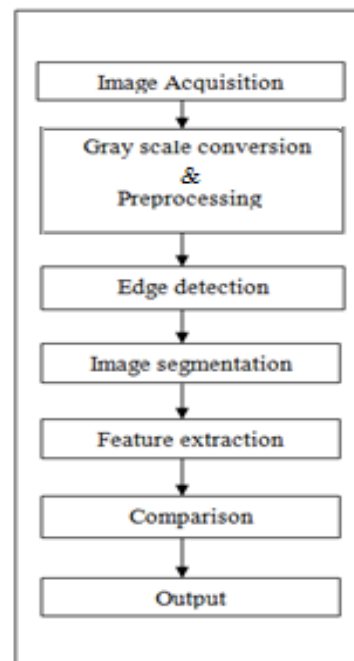

Fig.1 Basic design block diagram

III.METHODOLOGY

A. Image Acquisition

The first stage of any vision system is the image acquisition stage. After the image has been obtained, various methods of processing can be applied to the image to perform the many different vision tasks. Performing image acquisition in image processing is always the first step in the workflow sequence because, without an image, no processing is possible. There are various ways to acquire image such as with the help of camera or scanner. Acquired image should retain all the features.

B. Gray Scale Conversion and Pre-processing

The image acquired is in RGB colour. It is converted into gray scale because it carries only the intensity information which is easy to process instead of processing three components R (Red), G (Green) and B (Blue). Using IMAQ Create a temporary memory location for an image is created. The image is read and converted to gray scale using IMAQ Read file. The file format can be a standard format (BMP, TIFF, JPEG2000, PNG and AIDD) or a non-standard format known to the user.

The main goal of pre-processing is to enhance the visual appearance of images and improve the manipulation of datasets. Image pre-processing, also called image restoration, involve the correction of distortion, degradation, and noise introduced during the imaging process. After gray scale conversion IMAQ BCG lookup of NI Vision Development Module applies a brightness, contrast and gamma correction to an image. The correction is performed using computing and applying a lookup table. Brightness, contrast and gamma control the changes made to the transfer function represented by the lookup table.
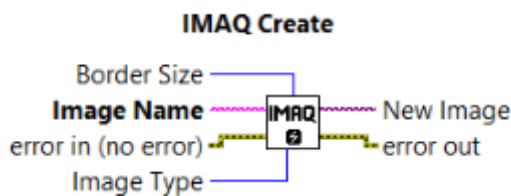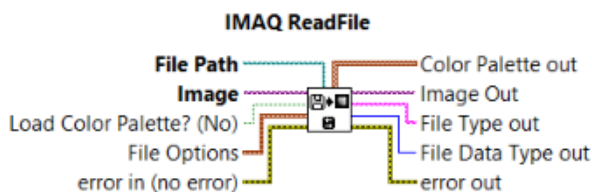
IMAQ Create

Fig. 2 IMAQ Create

IMAQ ReadFile

Fig. 3 IMAQ Read File

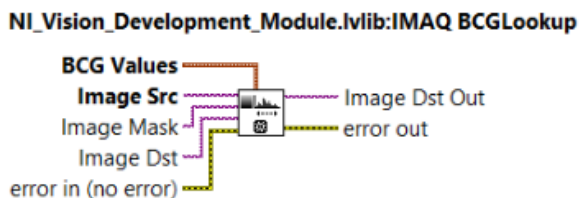**NI_Vision_Development_Module.lvlib:IMAQ BCGLookup**

Fig. 4 IMAQ BCG Lookup

C. Edge Detection

Edge detection is the name for a set of mathematical methods which aim at identifying points in a digital image at which the image brightness changes sharply or, more formally, has discontinuities. Edge detection is an image processing technique for finding the boundaries of objects within images. The gray scale image is loaded to IMAQ Image to Array which extracts the pixels from an image into a LabVIEW 2D array. This array is encoded in 8 or 16 bits as determined by the type of input image. Using an optional rectangle the entire note size is selected and fed to IMAQ Convert Rectangle ROI which converts a rectangle

to an ROI descriptor. Then the edges of an image in array format are detected using the Wavelet Analysis Multiscale Edge Detection VI. Here it uses the multi resolution Wavelet Analysis to extract the edges and convert the array back into image. This process is controlled using threshold ratio.
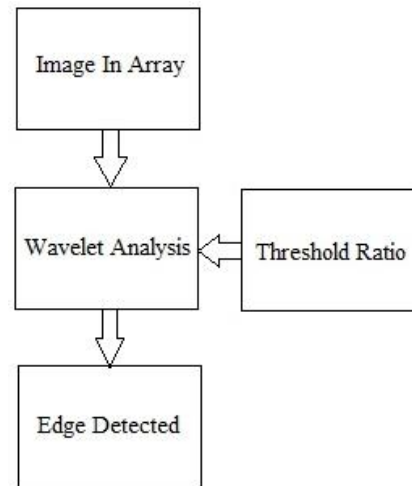
Fig. 5 steps in edge detection process

D. Image Segmentation

Image segmentation is the process of partitioning a digital image into multiple segments (sets of pixels), also known as super pixels. The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries (lines, curves etc.) in images and here it is done using ROI Descriptor that defines the rectangle around bank note features like see through register, security thread, identification mark and latent image.
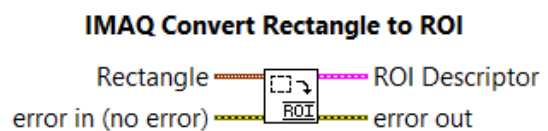
IMAQ Convert Rectangle to ROI

Fig. 6 IMAQ Convert Rectangle to ROI

E. Feature Extraction

When the input data to an algorithm is too large to be processed and it is suspected to be very redundant then the input data will be transformed into a reduced representation set of features. Here we calculate mean and standard deviation values of the bank note features like see through register, security thread, identification mark and latent image. Transforming the input data into the set of features is called feature extraction. If the features extracted are carefully chosen it is expected that the feature set will extract the relevant information from the input data in order to perform the desired task using this reduced representation instead of the full size input.

F. Comparison and Results

The mean and standard deviation values obtained i.e., the extracted features of both the original note and the note to

be tested are compared to determine whether the test note is fake or genuine. Mean value of an image gives the contribution of individual pixel intensity and variance is normally used to find how each pixel varies from the neighbouring pixel. If the mean and standard deviation values obtained from the test note matches perfectly with the values in the dataset, then the test note is said to be original else fake.
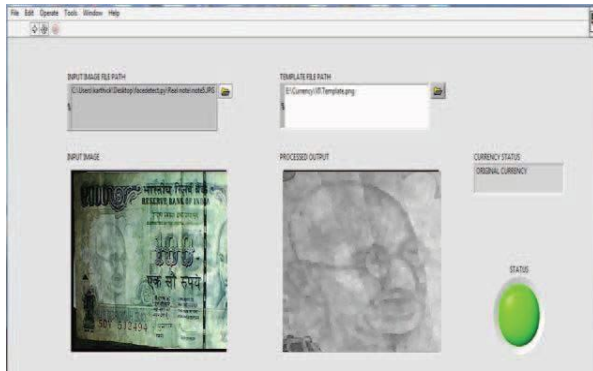

Fig. 7 Output for original currency

IV.CONCLUSION

Our paper enables a layman to identify a fake note and empower every citizen to detect fake note which may reduce corruption in our country. This project proposed fake currency detection using image processing in LabVIEW. In image pre-processing the image was cropped, adjusted and smoothed. Then the image is converted into gray scale. After conversion the edges are detected and in image segmentation the features are extracted in order to determine the mean and standard deviation values. Finally the mean and standard deviation value of the test note is compared with the values in the dataset and finds whether the currency original or fake. The above mentioned method of counterfeit detection is far more superior to those which already exist, in terms of accuracy, reliability and automation. Further this technique can also be used in detection of original and counterfeit documents.

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