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An Automated Recognition of Fake or Destroyed Indian Currency Notes(Review)

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Abstract— In India Every year RBI (Reserve bank of India) face the problem on counterfeit currency notes.The bank staffs are specially trained to detect counterfeit notes but problem begins once such notes are mixed into the market and circulated through common people. Even receiving fake notes from ATM counters have also been reported at some places. Over the past few years, as a result of the great technology come advances in color printing, duplicating and scanning counterfeiting problems become increses. Counterfeit notes are one of the biggest problem occurring in cash transactions. For country like India, it is becoming big hurdle,Because of the advances in printing, scanning technologies it is easily possible for a person to print fake notes with use of latest hardware tools. Detecting fake notes manually becomes time-consuming and untidy process hence there is need of automation techniques with which currency recognition process can be efficiently done. Many techniques have been proposed with the use of MATLAB, feature extraction with HSV color space and other applications of image processing. We have implemented a fake note detection unit with MATLAB algorithm. This paper is a based on the same project to give solution for fake currency problem. In the previous, only the printing house hasthe ability to make counterfeit paper currency, but today it is possiblefor any person to print counterfeit bank notes simply by using a computer and a laser printer at house. Therefore to stop these issue The Indian currency notes recognition system is very useful .In order to deal with such type of problems, an automated Recognition of currency notes is introduced with the help of feature Extraction, classification based in SVM, Neural Network .To implement this design we are dealing with MATLAB Tool.

Keywords:- *Counterfeit, feature extraction, image processing, MATLAB algorithm.*

I INTRODUCTION

The needs for automatic banknote recognition systems encouraged many researchers to develop corresponding robust and reliable techniques. Processing speed and recognition accuracy are generally two important targets in such systems manual testing of all notes in transactions is very time consuming and untidy process and also there is a chance of tearing while handing notes. Therefore Automatic methods for bank note recognition are required in many applications such as automatic selling-goods and vending machines. Extracting sufficient monetary characteristics from the currency image is essential for accuracy and robustness of the automated system. This is a challenging issue to system designers. Every year RBI (Reserve bank of India) face the counterfeit currency notes or destroyed notes. Handling of large volume of counterfeit notes imposes additional problems. Therefore, involving machines (independently or as assistance to the human experts) makes notes recognition process simpler and efficient.

Feature Of Indian currency Notes.

1. Watermark: The Mahatma Gandhi Series of banknotes contains the Mahatma Gandhi watermark with a light and shade effect and multidirectional lines in the watermark window.
2. Latent Image**:** On the obverse side of Rs.1000, Rs.500,Rs.100, Rs.50 and Rs.20 notes, a vertical band on the right side of the Mahatma Gandhi's portrait contains a latent image showing the respective denominational value in numeral. The latent image is visible only when the note is held horizontally at eye level.
3. Fluorescence Number panels of the notes are printed in fluorescent ink. The notes also have optical fibres. Both can be seen when the notes are exposed to ultra-violet lamp.
4. Micro lettering- This feature appears between the vertical band and Mahatma Gandhi portrait. It contains the word 'RBI' in Rs.5 and Rs.10. The notes of Rs.20 and above also contain the denominational value of the notes in micro letters. This feature can be seen better under a magnifying glass.
5. Optically Variable Ink This is a new security feature incorporated in the Rs.1000 and Rs.500 notes with revised colour scheme introduced in November 2000. The numeral 1000 and 500 on the obverse of Rs.1000 and Rs.500 notes respectively is printed in optically variable ink viz., a colour-shifting ink. The colour of the numeral 1000/500 appears green when the note is held flat but would change to blue when the note is held at an angle .
6. See through Register- The small floral design printed both on the front (hollow) and back (filled up) of the note in the middle of the vertical and next to the Watermark has an accurate back to back registration. The design will appear as one floral design when seen against the light.

7. Serial Numbers Every banknote has its own serial number, so it is more important to check whether the number is wrong or repeated. There were the selected units that will help us to recognize the banknote. The counterfeit currency note first segmented into different parts containing these units and with the NNTOOL and appropriate algorithm processing and feature.

II LETURATURE SURVAY

Currently, there are a number of methods for paper currency rrecognition [1][2][3]. Using the properties of the HSV (Hue, Saturation and Value) color space with emphasis on the visual perception of the variation in Hue, Saturation and Intensity values of an image pixel [1].

The printing house has the ability to make counterfeit paper currency, but it is possible for any person to print counterfeit bank notes simply by using a computer and a laser printer at house. Therefore the issue of efficiently distinguishing counterfeit banknotes from genuine ones via automatic machines has become more and more important.

The paper [3], presented by Trupti Pathrabe and Swapnili Karmore introduced a new technique to improve the recognition ability and the transaction speed to classify the Japanese and U.S. paper currency. This compares two types of data sets, time series data and Fourier power spectra are used. In both cases, they are directly used as inputs to the neural network. They also refer a new evaluation method of recognition ability. The paper [4], presented by Mirza and Nanda has a technique to extract paper currency denomination. The extracted region of interest (ROI) can be used with Pattern Recognition and Neural Networks matching technique. First they acquire the image by simple flat scanner on fix dpi with a particular size, the pixels level is set to obtain image. Few filters are applied to extract denomination value of note. They use different pixel levels in different denomination notes. The Pattern Recognition and Neural Networks matcher technique is used to match or find currency value/denomination of paper currency. The paper [6], presented by Sai Prasanthi and Rajesh Setty describes an approach for verification of Indian currency banknotes. The currency will be verified by image processing techniques.

In this article, six characteristic features are extracted. The approach consists of a number of components including image processing, edge detection, image segmentation, characteristic extraction, comparing images. The characteristics extraction is performed on the image of the currency and it is compared with the characteristics of the genuine currency. The Sobel operator with gradient magnitude is used for characteristic extraction. Paper currency recognition with good accuracy and high processing speed has great importance for banking system. [Sobel operator or Sobel filter is used in image processing and computer vision, particularly within edge detection algorithms where it creates an image emphasizing edges. three characteristics of paper currencies including size, color and texture are used in the recognition. By using image histogram, plenitude of different colors in a paper currency is computed and compared with the one in the reference paper currency. Based on the traditional local binary pattern (LBP) method, an improved LBP algorithm, called block-LBP algorithm, is used for characteristic extraction [5].The scheme can efficiently be implemented in cheap hardware which may be very useful in many places. The recognition system takes scanned images of banknotes which are scanned by low cost optoelectronic sensors and then fed into a multilayer perceptron, trained by back propagation algorithm, for recognition. In another study, three characteristics of paper currency are considered including size, color and texture [7]. The Marcov chain concept is used to model the texture of paper currencies as random process. Ensemble neural network (ENN) is used for the recognition system. The individual neural Asian Journal of Engineering and Technology Innovation 02 (02) 2014 (17-21) (Rev)20 networks in an ENN are skilled via negative correlation learning. The purpose of using negative correlation learning is to skill the individuals in an ensemble on different parts or portion of input patterns. A new technique is proposed to improve the recognition ability and the transaction speed to classify the Japanese and U.S. paper currency [8].

III STEPS IN FAKE NOTE RECOGNITION SYSTEM

Processing speed and recognition accuracy are generally two important targets in such systems. A Digital Image processing is an area characterized by the need for extensive experimental work to establish the validity of proposed solutions to a given problem. It encompasses processes whose inputs and outputs are images encompasses processes that extract attributes from images up to and including the recognition of individual objects. MATLAB is the computational tool of choice for research, development and analysis. The image formats supported by MATLAB are BMP, HDF, JPEG, PCX, TIFF, XWB, PNG etc. Characteristic extraction of images is challenging work in digital image processing. It involves extraction of visible and some invisible features of Indian currency notes. A good characteristic extraction scheme should maintain and enhance those characteristics of the input data which make distinct pattern classes separate from each other.

The approach consists of a number of steps including image acquisition, gray scale conversion, edge detection, feature extraction, image segmentation and comparison of images. Image acquisition is the creation of digital images, typically from a physical scene. In the proposed work, the image will be acquired by using simple digital camera by providing some backlighting so that all the features of the currency can appear on the image properly. The image is then stored in the computer

for further processing. Edge detection and image segmentation are the most important tasks performed on the images.

A. Edge detection Edge detection is a fundamental tool in image processing and computer vision, particularly in the areas of feature detection and feature extraction, which aim at identifying points in a digital image at which the image brightness changes sharply or, more formally, has discontinuities. Edge detection is one of the fundamental steps in image processing, image analysis, image pattern recognition, and computer vision techniques.

B. Image segmentation Image segmentation sub divides the image into its constituent regions or objects. The level to which sub division is carried depends on the problem being solved. Segmentation algorithm for monochrome images generally are based on one of the two basic properties of image intensity values- 1.) Discontinuity 2.) Similarity In the first category, the approach is to partition an image based on abrupt changes in intensity such as edges in an image. The approach in the second category is based on partitioning an image into regions that are similar according to a set of predefined criteria.

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The proposed system will work on two images, one is original image of the paper currency and other is the test image on which verification is to be performed. The proposed algorithm for the discussed paper currency verification system is presented as follows-

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. The below diagram shows the step-by step process of this paper currency verification system-

The technique uses four characteristics of paper currency including identification mark, security thread, latent image and watermark. The system may extract the hidden features i.e. latent image and watermark of the paper currency.

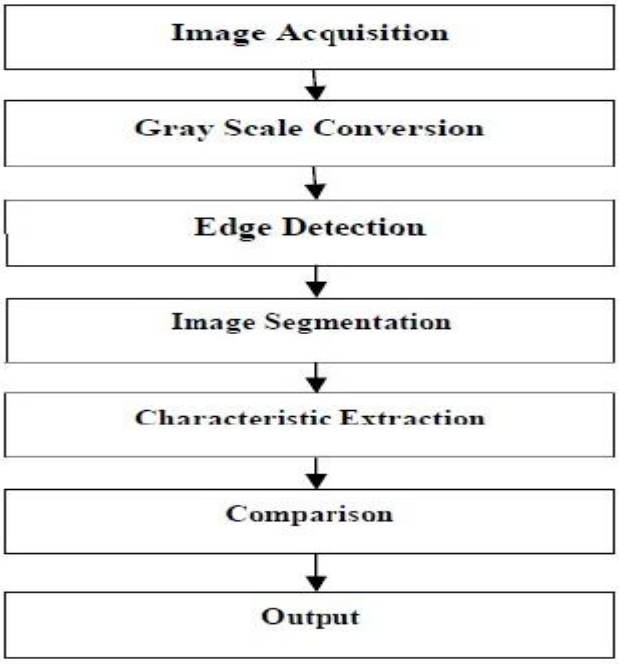

Figure 1 Indian Currency Recognition System

In the proposed method characteristics of paper currencies are employed that are used by people for differentiating different banknote denominations. Basically, at first instance, people may not pay attention to the details and exact characteristics of banknotes for their recognition, rather they consider the common characteristics of banknotes such as the size, the background color (the basic color), and texture present on the banknotes. In this method, these characteristics will be used to differentiate between different banknote denominations.

Identification of fake note paper currency identification system is useful in banking systems and in other fields of financial applications. Automatic currency note identification invariably depends on the currency note characteristics of a

particular country and the extraction of features directly affects the recognition ability. In section II, we have gone through various literatures, seen brief comparison among existing techniques. Problem in existing system can be easily understandable if we divide identification process as follows, Ying Li Tian et. Al [9] said that motion blur affects the system performance, thereby true note recognition rate get decreases. Problems can be summarized as follows, i) Motion Blur Problem. ii) Noise imposed by image capture instrument. iii) Different type of note. iv) Less efficient feature extraction technique.

IV EXPECTED AND OTHER PREVIOUS RESEARCH RESULTS

In order to implement the proposed solution of finding Counterfeit notes, we simulate the operations of image processing with the help of MATLAB. The given image involves two types of services - Real and Fake. The segmentation of the image is as follows. After the image has been acquired and segmented, it will be transformed to the gray scale format. The gray scale conversion diagram is as follows

Below figure shows the front view of software application

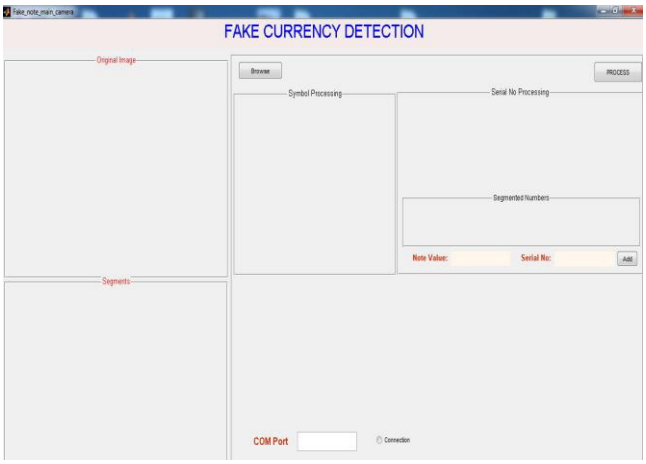

Figure 2 Front panel of software application

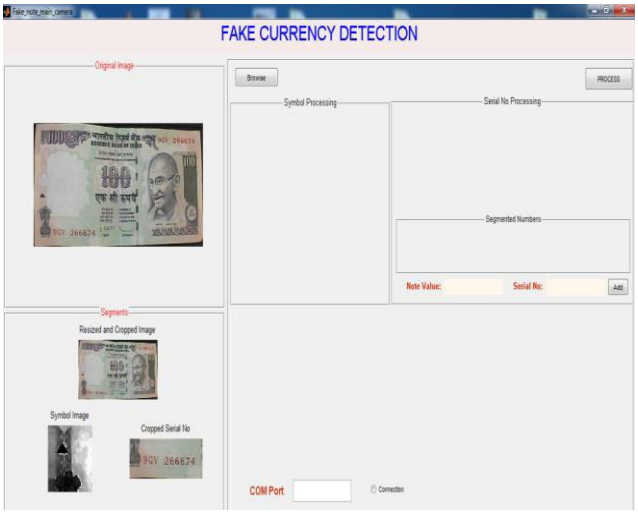

Figure 3 Front panel of software after image is selected

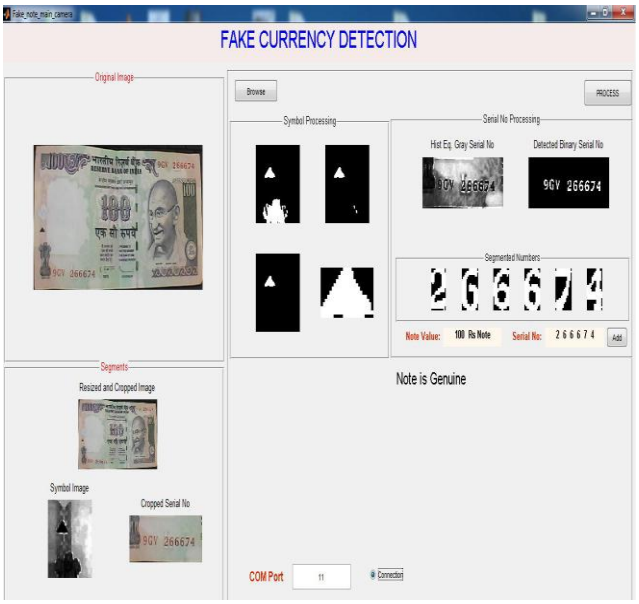

Figure 4 Front panel of software after image is processed and result is "Note is Genuine

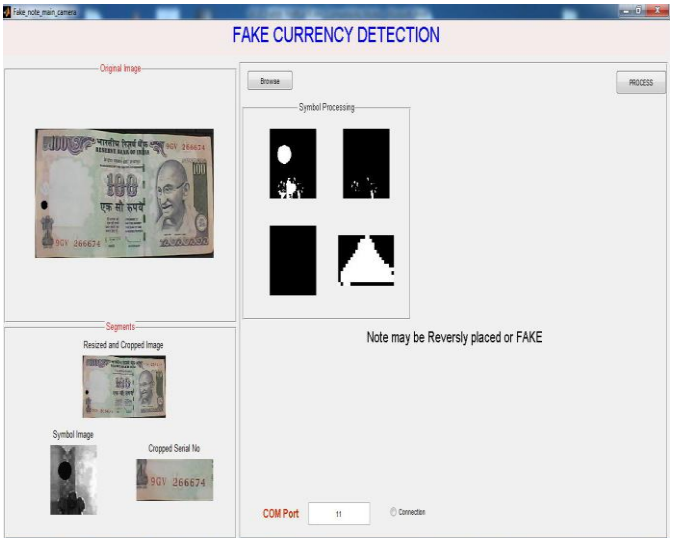

Figure 5 Front panel of software after image is processed and result is "Note may be reversal placed or fake"

The original input image is in RGB color. 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), B (Blue). In this, the image of the currency notes gets converted into gray scale from file format to pixel values. Converting to gray scale does not reduce the required level of information of currency notes. Then a new set of values has been generated from original gray scale pixel values by having a linear combination of the former values. After the transformation, edge detection is performed to extract the image's identity as what is used to recognize by the system. Edge detection reflects sharp intensity changes in the colors of the image. Then this detected edge information is extracted and arranged in a format required by the network. The following figure shows the detection of edges to extract features. Pattern matching is a family of tools for finding similar objects in

different sources. In image processing, the pattern matching is Pattern matching is a family of tools for finding similar objects in different sources. In image processing, the pattern matching is used for locating a small image (called model) from a bigger one (called target image). The following figure shows the matched images of the comparison between fake and real notes.

V CONCLUSION

In this paper, we have conducted a survey by going through different literature, which describes different techniques of fake note identification. This is a MATLAB based system for automatic recognition of security features of Indian currency. The low cost system, using effective and efficient image processing techniques and algorithms, provide accurate and reliable results at good throughput as shown by experimental results. The developed algorithm works for Indian denomination 100, 500, 1000.

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