World Journal of Engineering Research and Technology
WJERT
www.wjert.org
SJIF Impact Factor: 4.326

AN AUTOMATED RECOGNITION OF FAKE OR DESTROYED INDIAN CURRENCY NOTES (RESULT)

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Article Received on 11/03/2017 Article Revised on 01/04/2017 Article Accepted on 21/04/2017

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ABSTRACT

Automatic method for detection of fake currency note is very important in every country. In this project we have made fake currency note detection technique using MATLAB and feature extraction with HSV color space and other applications of image processing. In the project setup, note is placed in front of camera to check whether it is fake or genuine. The camera pictures of notes are analyzed by MATLAB program installed on computer. The project is meant to check Indian currency notes of 100, 500 and 1000 rupees. If the note is genuine, the respective message is appeared on the screen and vice-versa. The recognition system is composed of two parts. The captured image is first preprocessed by reducing data size and extracting its features by using image processing toolbox in MATLAB. The feature extraction is finished by considering HSV (Hue Saturation Value). The second step is recognition, in which the core is neural network classifier.

KEYWORDS: Indian Notes; Neural Network; MATLAB; Camera.

INTRODUCTION

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 increases.

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 has the ability to make counterfeit paper currency, but today it is possible for any person to print counterfeit bank notes simply by using a computer and a laser printer at house. Therefore to stop this 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 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. We have started developing an interactive system that solves this issues (i.e.,) paper currency identification system for Indian currency using MATLAB. The Indian currency notes have been identified and counterfeit notes has been found some features about how to detect a fake note by observing.

Latent Image: When the note is head horizontally, the Vertical band on the right shows an image of the number 500.

Security Thread: The note also has a three millimeter Wide security thread with the inscriptions: one thousand, the word 'Bharat' in Hindi and RBI.

Micro lettering: The 'RBI' and the numeral, "500" -which can be viewed with the help of a magnifying glass - are between the Mahatma Gandhi portrait and the vertical band.

Optical Variable Ink: The colour of the numeral 500 appears green when the banknote is held flat but would change to blue when the banknote is held at an angle. The font size is also reduced.

Watermark: When the note is held against the light, the picture of Gandhi and an electrolyte mark showing the number 500 appear in the white space. The best way to identify a note is the silver bromide thread that runs vertically through a currency note. Fake currency notes tend to have silver-coloured band painted in place of the silver thread. A real note has a prominent thread with raised 'RBI' markings made on it in English and Hindi. Also, in a real note, the colour of the thread shifts from green to blue when viewed from different angles.

***Intaglio printing*:** The portrait of Mahatma Gandhi, the Reserve Bank seal, guarantee and promise clause, Ashoka Pillar Emblem on the left, RBI Governor's signature are printed in intaglio i.e. in raised prints, which can be felt by touch, in Rs.20, Rs.50, Rs.100, Rs.500 and Rs.1000 notes.

Fluorescence: Number panels of the notes are printed in fluorescent ink. The notes also have optical fibers. Both can be seen when the notes are exposed to ultra-violet lamp.

Security thread: *The* Rs.500 and Rs.100 notes have a security thread with similar visible features and inscription "Bharat‟ (in Hindi), and RBI‟. When held against the light, the

security thread on Rs.1000, Rs.500 and Rs.100 can be seen as one continuous line. The Rs.5, Rs.10, Rs.20 and Rs.50 notes contain a readable, fully embedded windowed security thread with the inscription "Bharat" (in Hindi), and RBI". The security thread appears to the left of the Mahatma's portrait.

Identification mark: *Each* note has a unique mark of it. A special feature in intaglio has been introduced on the left of the watermark window. This feature is in different shapes for various denominations (100-Triangle, Rs.500-Circle, and Rs.1000- Diamond) and helps the visually impaired to identify the denomination.

LITERATURE SURVEY

Currently, there are a number of methods for paper currency recognition.[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 perception, 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]

System Architecture

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.

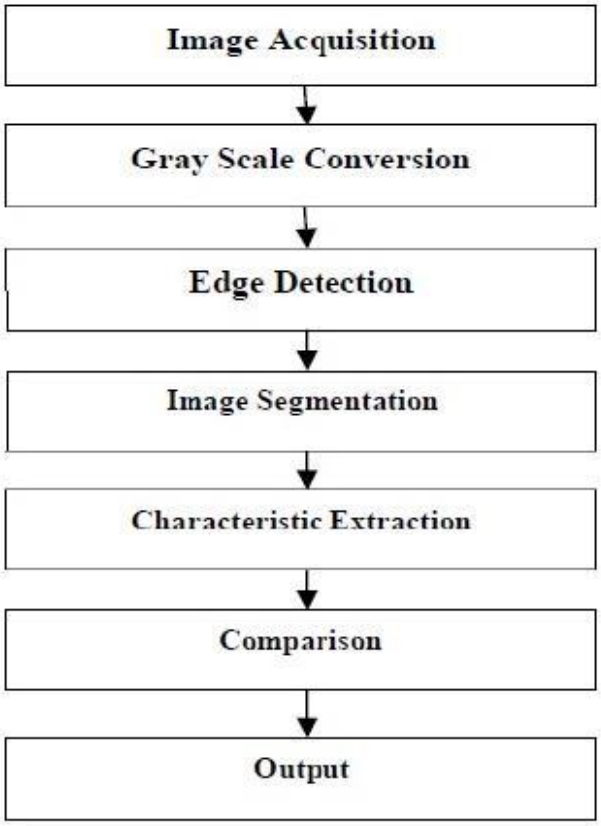

Fig 1: Indian Currency Recognition System.

Performance Analysis

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. A number of images of currency notes were taken from their front with the help of scanner and a mobile camera. The designed algorithm was then applied on these acquired images of Indian currency notes to find the denomination of the currency note. After we follow the above mentioned design steps of the proposed recognition scheme, the currency note in the image gets recognized successfully. The developed system is tested for various below mentioned conditions.

Images were taken from varied distances.

- Different orientations of currency notes were taken.
- Images were also taken which had only 60 – 80% of the visibility of the face of the currency note.
- Images of currency notes with little bit of dust were taken
- The approach consists of the following steps.

Image acquisition: Image is acquired by scanner by applying the white backlighting against the paper currency so that the hidden attributes are able to appear on the image of the currency. Here image acquisition of 500 denominations is shown below.

Figure 4.1: Original Indian Rs 500 Note.

Image pre-processing: Pre-processing of image are those operations that are normally required prior to the main data analysis and extraction of information.

Figure 4.2: Indian Rs 500 Note after resizing the original.

Gray-scale conversion: the image acquired 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).Input image are selected then system is process and converted it into gray scale conversion because we will see hidden feature of note like latent image are clear appear etc.is shown in below diagram.

Figure 4.3: Gray scale Conversion after Input Image of Indian Rs 500 Note.

Figure 4.4: Negative Image Obtained after Gray Image of Indian Rs 500 Note.

Image segmentation: segmentation is the process of partitioning a digital image into multiple segments.

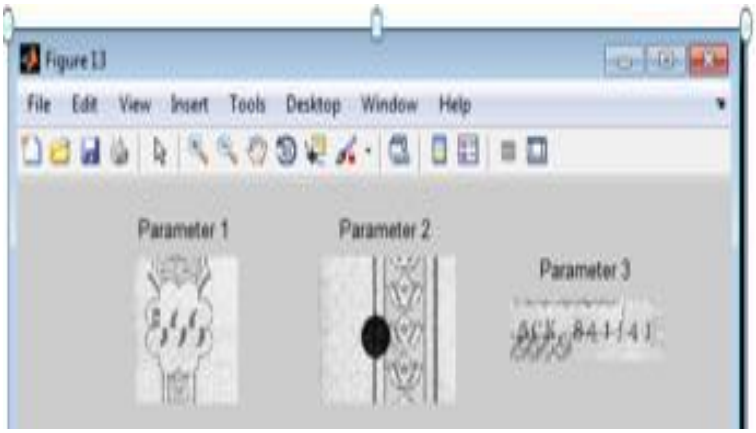

Figure 4.5: All Parameter Obtained after Cropping of Indian Rs.

Result Obtain: Lastly the extracted features are compared with the extracted features of original currency by calculating the number of black pixels of segmented image.

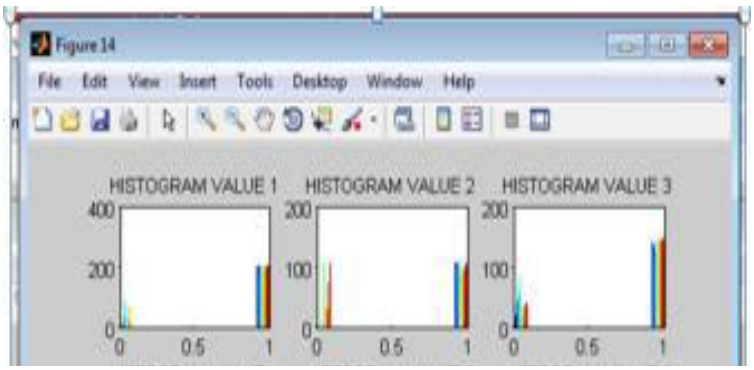

Figure 4.6: Histogram of All Parameter Obtained.

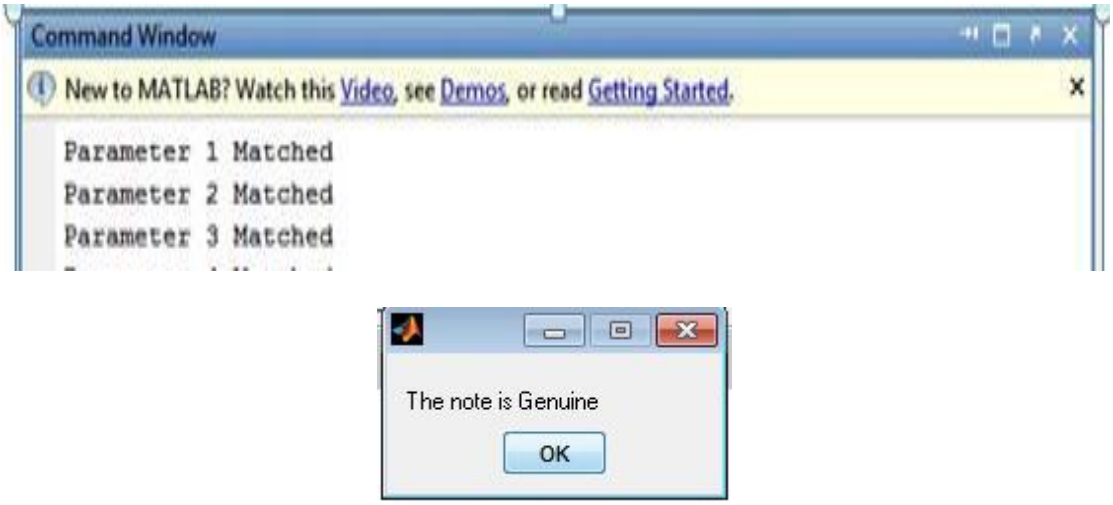

Figure 4.7: Final Result Obtained.

Table 4.3: Performance of All Currency Recognition Rate.

Types of Notes	No of Original Notes	No of Fake Notes	Recognition Rate	Other Author R R
RS 100	20	3	100%	100%
RS 500	20	2	100%	100%
RS 1000	10	1	90%	100%

CONCLUSION

In this paper, we have conducted a survey by going through different literature, which describes different techniques of fake note identification. I have concluded that if we apply some efficient pre-processing and feature extraction technique we. 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. At the point of conclusion, the research has been successful in implementing an automated recognition of fake or destroyed Indian currency notes and its positive results encourage others to improve further on its success.

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