Volume 6, Issue 7, July 2016 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

A Survey on Fake Indian Paper Currency Identification System

P. Julia Grace, Ph.D.
Assistant Professor and Research Supervisor
Department of Computer Science
JBAS College for Women, Chennai, India

A. Sheema
M. Phil. Computer Science Scholar
Mother Teresa Women's University Extn. Center,
Saidapet, Chennai, India

Abstract: ***Fake notes in India are being flooded into the system. At present fake note recognition becomes the vital topic for the researchers. The main focus of the standard paper currency identification system is on recognizing forged currencies. The currency identification system is a must and it is essential that it should be very accurate. A thriving approach to paper currency identification depends upon a number of steps, including edge detection, feature extraction, image segmentation, image acquisition, grayscale conversion, and comparison of images. In this paper, we have gone through a different type of literature survey which describes different techniques of counterfeit currency identification. The paper also proposes a review on Fake Indian Currency identification techniques to detect mal practicing. We conclude, when we apply some efficient pre-processing and feature extraction techniques, we can still improve the accuracy of currency identification system.***

Key words: Characteristic Feature Extraction, Image Processing, Edge detection, Segmentation, Image acquisition

I. INTRODUCTION

Manual testing of all notes in transactions is very time consuming, untidy process and also there is a chance of tearing while handing notes. No one can ever be 100 percent confident about the manual recognition. Fake or 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 the help of latest hardware tools. Detecting fake notes manually becomes time-consuming and untidy process hence there is need of automation techniques with which currency identification process can be efficiently done.

Every year 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 with the assistance to the human experts, makes notes identification process simpler and efficient. For the detection of forged notes (take a bank as example) it needs to identify the denomination every time they use the device which consist of ultraviolet light. The bank employee keeps the paper currency note on the device and try to find whether the watermark identification, serial number and other characteristics of the notes are proper to get the denomination and check its authentication. This increases the work of the employee. Instead, if the banker uses this system, the result could be more accurate [1]. Same is the case with areas such as shopping malls, investment firms where such systems can be used. Immediate need is to make an easier way to identify the currency notes.

The best means is to use of the visible options of the paper money - both the dimensions and color of the paper money [2]. Various researchers have worked for fake note identification. Until now, there are several ways for fake note recognition. The remaining sections are further arranged as follows: II section describes the literature survey of the fake note recognition system. III section describes few major steps in the fake note recognition system. The problem identification of the fake note currency recognition system is in section IV. Section V describes the comparison of the previous papers which deals with various fake note currency identifications. VI section gives the conclusion of the study.

II. LITERATURE SURVEY

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.

© 2016, IJARCSSE All Rights Reserved

The paper [5], proposed by Pathrabe and Bawane gives the algorithm with low computational complexity, which can meet the high speed requirement in practical applications. It needs to be noted that the proposed technique may not be able to distinguish counterfeit notes from genuine notes. Indeed, techniques use infrared or ultraviolet spectra may be used for discriminating between genuine and counterfeits notes.

The review [1] presented by Komal vora et al. [1] suggests a widespread review of study on paper currency recognition system. A number of techniques applied by a diversity of researchers are proposed briefly in organize to evaluate the condition of art. Here, the author focuses primarily on currency detection system including different steps like image acquisition, feature extraction and categorization system uses different algorithm. The classification result facilitates the recognition of fake currency mainly using serial number extraction by implementing optical character recognition (OCR). It is found that the proposed method gives superior results.

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 emphasising edges]

III. STEPS IN FAKE NOTE IDENTIFICATION SYSTEM

Few significant steps in the fake note identification system as shown in the figure1.

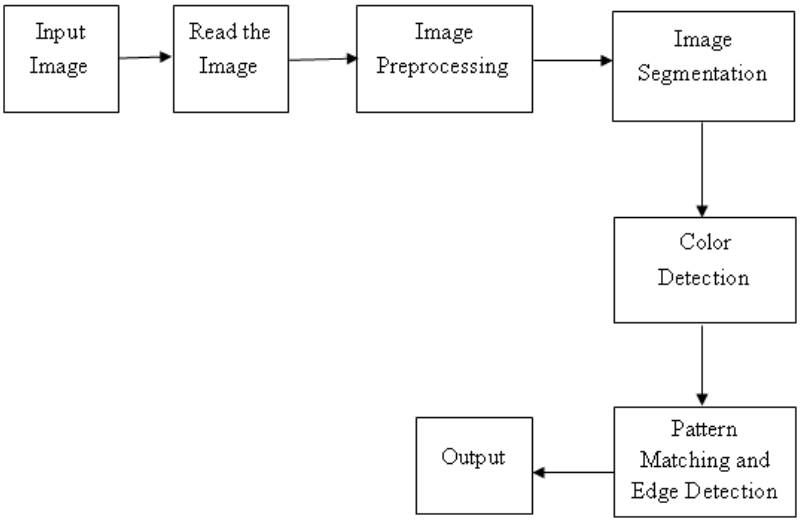


Figure 1

Image Acquisition: The image acquisition is to acquire a digital image. It requires an image sensor and the capability to digitize the signal produced by the sensor.

Preprocessing: The aim of image pre-processing is to suppress undesired distortions or enhance some image features that are important for further processing or analysis. Image pre-processing includes Image adjusting, Image smoothening (removing noise). Preprocessing functions involve operations that are normally required prior to the main data analysis and extraction of information, and are generally grouped as radiometric or geometric corrections. Some standard correction procedures may be carried out in the ground station before the data is delivered to the user. These procedures include radiometric correction to correct for uneven sensor response over the whole image and geometric correction to correct for geometric distortion due to Earth's rotation and other imaging conditions (such as oblique viewing).

a) Radiometric corrections: Radiometric correction is a preprocessing method to reconstruct physically calibrated values by correcting the spectral errors and distortions caused by sensors, sun angle, topography and the atmosphere. b) **Geometric corrections :** Geometric corrections include correcting for geometric distortions due to sensor-Earth geometry variations, and conversion of the data to real world coordinates (e.g. latitude and longitude) on the Earth's surface. The systematic or predictable distortions can be corrected by accurate modeling of the sensor and platform motion and the geometric relationship of the platform with the Earth. Therefore, to correct other unsystematic or random errors we have to perform geometric registration of the imagery to a known ground coordinate system.

Segmentation: Segmentation is the process of partitioning a digital image into multiple segments. It is typically used to distinguish objects from backgrounds. Here edge based segmentation is performed on the image. Based on the binary images processed by the morphological transformations, we need to segment the small objects, the digits on the serial numbers, from the large banknote images. To implement this, first used the Sobel operator to the large binary banknote images in order to distinguish the regions of interest (ROIs) from the background, then extract the ROIs in order to obtain the small digits (objects for forming the templates of the digits and for recognition.

© 2016, IJARCSSE All Rights Reserved

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- Discontinuity, 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.

Color Detection: This is to describe how to detect the primary color of the images. There are too many types of color model we can use, like RGB, HSV, and GREY. Use RGB model because we need to calculate the mean of the color. The image is presented as *x* by *y* by 3 matrix (here *x* is the width of the image, *y* is the height of the image), iteration each pixel and store the value of R, G, and B. After that, the mean of each channel will be calculated. Do not calculate the whole primary color of the currency. We cut half of the currency, because most of the currencies are dividing into two parts. And the left part is mostly white area, while the right part has some patterns or portrait. The primary color of the image is used to check what this currency is and this is one of the important characters for recognizing the currency.

Edge Detection: For boundary detection, we require a binary image, which has only 2 colors, black and white. All we do in this process is simply, separate the background and the foreground, and separate the ROI, to extract required information from the cropped ROI image. So from the binary image we find out the dimensions of the currency and find out the aspect ratio, aspect ratio remains same in all light conditions, so it becomes an important feature for recognizing image. Then we compare the aspect ratio of the target image with the ideal aspect ratios of all the denominations of that particular currency. The other features we extract are H, S and V of particular blocks of the currency. We use Euclidian distance equation for finding out the average values of the differences between the target and Ideal HSV features.

IV. PROBLEM IDENTIFICATION

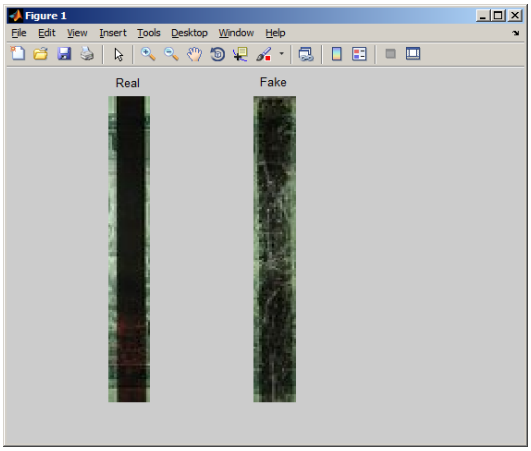
Identification of fake note paper currency identification system is useful in banking systems and in other fields of financial applications. Automatic currency note identification invariably depends on the currency note characteristics of a particular country and the extraction of features directly affects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

V. COMPARISON OF EXISTING PAPERS

References	Methods	Currency Used	Remarks	Accuracy rate
YingLi Tian et. Al [9]	Component based framework	US	Motion Blur Problem	96%
Chinmay Bhurke et.al. [10]	Canny Edge Detector	AUD, INR, SAR, USD, EUR	Failed detection of color	98%
S. Surya et.al. [8]	Sobel operator	INR	Sobel operator is not as sensitive to noise and it amplifies high frequency.	100%
Allah Bux Sargano et. al. [11]	Feed-forward Backpropagation Neural Network (BPN)	Pakistani	Author concluded that efficient feature extraction technique will improve accuracy of identification against forged currency	99%

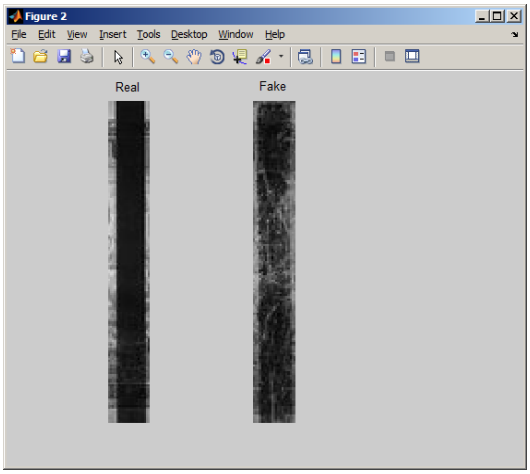
VI. EXPERIMENTAL IMPLEMENTATION AND SAMPLE SCREENS



© 2016, IJARCSSE All Rights Reserved

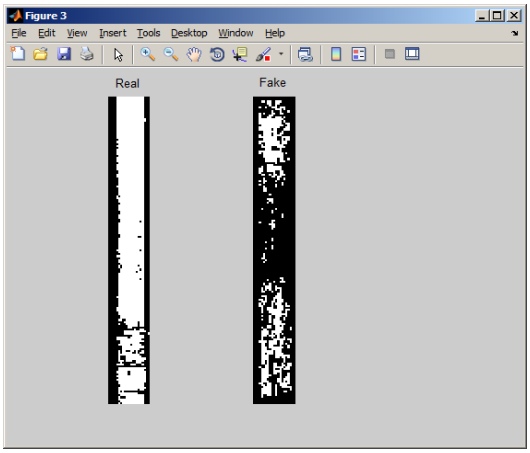
In order to implement the proposed solution of finding Counterfeit notes, we simulate the operations of image processing with the help of MATLAB. The given image involves two types of services - Real and Fake. The segmentation of the image is as follows.

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

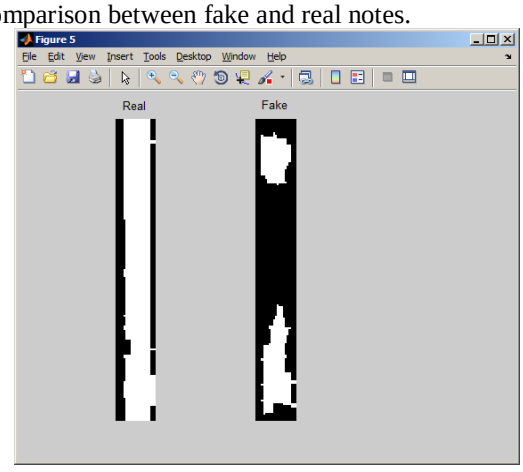


The original input image is in RGB color. It is converted into gray scale because it carries only the intensity information which is easy to process instead of processing three components - R (Red), G (Green), B (Blue).

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.

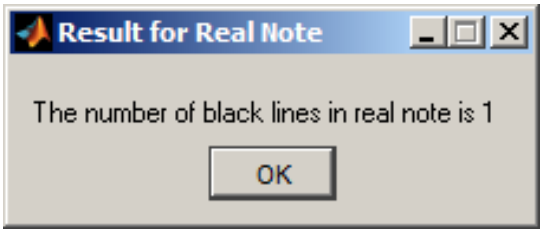


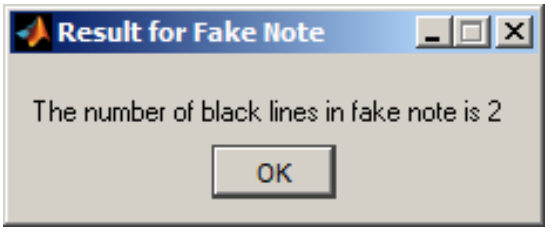
Pattern matching is a family of tools for finding similar objects in different sources. In image processing, the pattern matching is used for locating a small image (called model) from a bigger one (called target image). The following figure shows the matched images of the comparison between fake and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



© 2016, IJARCSSE All Rights Reserved

Using the pattern matching technique the resultant images which can recognize the number of lines in real and fake notes are as follows.





VII. CONCLUSION AND FUTURE ENHANCEMENTS

The authentication of Indian paper currency is described by applying image processing. Fake note or Counterfeiting of bank notes affects the survival of the financial symmetry as its value, rapidity, output and wellbeing may be affected. Majority of countries uses paper money for transactions, overwhelmed by this difficulty. In this paper, we have conducted a survey by going through different literature, which describes different techniques of fake note identification. We have concluded that if we apply some efficient pre-processing and feature extraction technique we can still improve the accuracy of identification system.

We have started developing an interactive system that solves this issues (ie.,) paper currency identification system for Indian currency using MATLAB. The Indian currency notes have been identified and counterfeit notes has been found. This work is done by applying different filters. So far in all the previous research papers the images were scanned horizontally. We are trying to scan the images with different angles and different methods could be used for recognizing foreign currencies like dinar, US dollar, EURO etc., in order to produce better accuracy rate in finding counterfeiting notes. This technique is very adaptive to implement in real time world. Not only in banks, can also be used in shops or some other places

REFERENCES

[1] Komal Vora, Ami Shah, Jay Mehta, A Review Paper on Currency Recognition System, International Journal of Computer Applications (0975 – 8887) Volume 115 – No. 20, April 2015.

[2] Snehlata Sahu Toran Verma, Identification of Paper Currency Techniques: A Survey, International Journal of Science Technology & Engineering | Volume 2 | Issue 12 | June 2016 ISSN (online): 2349-784X.

[3] G. Trupti Pathrabe, Mrs.Swapnili Karmore, A Novel Approach of Embedded System for Indian Paper Currency Recognition, International Journal of Computer Trends and Technology, May to June Issue 2011, ISSN: 2231-2803.

[4] Rubeena Mirza, Vinti Nanda, Characteristic Extraction Parameters for Genuine Paper Currency Verification Based on Image Processing, IFRSA International Journal of Computing, Volume 2, Issue 2, April 2012.

[5] Pathrabe T, Bawane N.G, Feature Extraction Parameters for Genuine Paper Currency Recognition & Verification, International Journal of Advanced Engineering Sciences and Technologies, Volume 2, 85-89, 2011.

[6] B.Sai Prasanthi, D. Rajesh Setty , Indian Paper Currency Authentication System using Image processing International Journal of Scientific Research Engineering & Technology (IJSRET), ISSN 2278 – 0882.

[7] Aruna d h, Manpreet bagga , Dr.baljit singh , A survey on indian currency note denomination recognition system, International Journal of Advance Research In Science And Engineering , March 2015 ISSN-2319-8354(E) .

[8] S. Surya, G. Thailambal , Comparative Study on Currency Recognition System Using Image Processing , International Journal Of Engineering And Computer Science ISSN:2319-7242.

[9] Faiz M. Hasanuzzaman, Xiaodong Yang, and YingLi Tian, Senior Member, IEEE Robust and Effective Component-based Banknote Recognition for the Blind IEEE Trans Syst Man Cybern C Appl Rev. 2012 Nov; 42(6): 1021–1030.

[10] Chinmay Bhurke, Meghana Sirdeshmukh , M.S.Kanitkar, Currency Recognition Using Image Processing , International Journal of Innovative Research in Computer and Communication Engineering (An ISO 3297: 2007 Certified Organization) Vol. 3, Issue 5, May 2015.

© 2016, IJARCSSE All Rights Reserved

AUTHOR'S PROFILE

Julia Grace P. received her B.Sc., Computer Science in 2000 and MCA in 2003, both from Manonmaniam Sundaranar University. She got the University FIRST Rank in MCA. She obtained her B.Ed., in 2004 from University of Madras, M.Phil., from Madurai Kamaraj University in 2005 and Ph.D. from Mother Teresa Women's University in 2013 . Right now, she is Assistant Professor in Computer Science in JBAS College for Women (Autonomous), Chennai. Until now, she has guided 11 M.Phil scholars, presented 15 papers in National, International Conferences and published 12 research articles in International Journals. Her areas of interest are Artificial Intelligence, System Biology, Machine Learning and Theoretical Computer Science. She is a life member of International Association of Professional Academicians, member of International Association of Engineers, executive board member and review member for few reputed journals.

A. Sheema is currently doing M.Phil Computer Science in Mother Teresa Women's University, Kodaikanal [Chennai Centre], after completing her MCA in April 2012.

© 2016, IJARCSSE All Rights Reserved