

# Fake Paper Currency Recognition

Prof. Anita Lahane<sup>1</sup>, Ashwin Pandey<sup>2</sup>, Mihir Palyekar<sup>3</sup>, Ishwar Bhangare<sup>4</sup>

<sup>1</sup>Professor, Department of Computer Engineering, Rajiv Gandhi Inst. Of Technology, Mumbai, Maharashtra

<sup>2,3,4</sup>Student, Department of Computer Engineering, Rajiv Gandhi Inst. Of Technology, Mumbai, Maharashtra

\*\*\*

**Abstract** - The advancement of color printing technology has magnified the speed of pretend currency note printing and duplicating the notes on an awfully giant scale. A few years back, the printing could be done in a print house, but now anyone can print a currency note with maximum accuracy using a simple laser printer. As a result, the difficulty of pretending notes rather than the real ones has been magnified terribly for the most part. And counterfeit of currency notes is additionally a giant drawback to that. This results in the style of a system that detects the faux currency note in very less time. The planned system offers an associate approach to verify the Indian currency notes. Verification of currency note is finished by the ideas of the image processing. This project includes extraction of various features of Indian currency notes which are "security thread, serial number, latent image, watermark, identification mark". The planned system has blessings like simplicity and high-performance speed. The result can predict whether or not the currency note is faux or not. The basic logic is developed using Image acquisition, grayscale conversion, edge detection, image segmentation, feature extraction, and comparison. The features of the note to be tested are compared with the dataset formed from the original magnified image and finds out whether it is fake or original. The most vital challenge is consistently and methodologically repetition the analysis method to scale back human error and time.

**Key Words:** Pre-processing, Recognition, Human Error, Currency, Random Forest Algorithm, Neural Net Algorithm, Application

## 1. INTRODUCTION

Technology is growing very fast these days. Consequently, the banking sector is additionally obtaining modern-day by day. This brings a deep need for automatic fake currency detection in an automatic teller machine and automatic goods seller machine. Many researchers are inspired to develop strong and economical automatic currency detection machine. An automatic machine which might sight banknotes is currently wide utilized in dispensers of contemporary product like candies, soft drinks bottle to bus or railway tickets. The technology of currency recognition essentially aims for characteristic and extracting visible and invisible options of currency notes. Until now, several techniques are projected to spot the currency note. But the simplest approach is to use the

visible options of the note [1]. For example, color and size. But this manner isn't useful if the note is dirty or torn. If a note is dirty, its color characteristic is changed widely. So it is important how we extract the features of the image of the currency note and apply the proper algorithm to improve accuracy to recognize the note.

## 2. LITERATURE REVIEW

Presently, there square measure variety of strategies for folding money recognition [1][2][3]. Using symmetrical masks has been employed in [2] for recognizing folding money in any direction. In this technique, the summation of non-masked pixel values in each banknote is evaluated and fed to a neural network for recognizing paper currency. In this technique, two sensors are used for recognition of the front and back of the paper currency, but the image of the front is the only criterion for decision. In another study for folding money recognition [1], initially, the edges of patterns on a paper currency are spotted. In the next step, paper currency is divided into  $N$  equal parts along the vertical vector. Then, for every come near these components, the number of pixels is added and fed to a three-layer, back propagation neural network. In this method, to conquer the problem of recognizing dirty worn banknotes, the following linear function is used as a pre-processor:

$$f(x) = Fax + Fb \quad (1)$$

where  $x$  is the given (input) image in grayscale,  $f(x)$  is the resultant image; and  $Fa$ ,  $Fb$  and  $N$  are selected 3, -128 and 50 respectively [1]. In this technique, the algorithm depends on the number of paper currency denominations. Here, the complexity of the system increases by increasing the number of classes. Therefore, this technique can be used only for the recognition of a small number of banknote denominations. The technique discussed in this paper is not dependent on the number of paper currency classes. The features presented in this paper are independent of the way that a paper currency is placed in front of the sensor.

It must be famous that the mentioned technique might not be ready to differentiate real notes from counterfeits. Indeed, strategies like [8] that use infrared or ultraviolet spectra is also used for discriminating between real and counterfeits notes.

### 3. METHODOLOGY

The proposed methodology consists of three parts. In the initial half, the banknotes square measure scanned and also the info is developed. After scanning, the banknotes square measure pre-processed for noise as second a part of the system. In the third half, vital currency options square measure elects and extracted. The selected options square measure simply extractable and have sensible discrimination power. These features are passed to the neural network for classification in the fourth part. The fifth part shows the experimentation results. All these elements are delineated within the resultant sections. The procedures are as follows,

#### 3.1 Image Acquisition

Performing image acquisition in image processing is always the first step in the work-flow sequence because, without an image, no processing is possible. After the image has been obtained, varied ways of the process are often applied to the image to perform the numerous totally different vision tasks. There are various ways to acquire images such as with the help of a camera or scanner. The acquired image should retain all the features.

#### 3.2 Pre-processing

The main goal of the pre-processing to reinforce the visual look of pictures and improve the manipulation of knowledge sets. Image pre-processing, conjointly known as image restoration, involves the correction of distortion, degradation, and noise introduced during the imaging process. Interpolation is the technique mostly used for tasks such as zooming, rotating, shrinking, and geometric corrections. Removing the noise is a very important step once the process is being performed. However, noise affects segmentation and pattern matching.

#### 3.3 Gray Image

In photography and computing, a grayscale or grayscale digital image is an image in which the value of each pixel is a single sample, that is, it carries only intensity information. Images of this type, also known as black-and-white, are composed exclusively of shades of gray, varying from black at the weakest intensity to white at the strongest.

Grayscale pictures square measure distinct from one-bit bitonal black-and-white pictures, which in the context of computer imaging are images with only the two colors, black, and white (also called bi-level). grayscale pictures have several reminder grays in between.

Grayscale pictures square measure usually the results of measure the intensity of sunshine at every element during a single band of the spectrum (e.g. Infrared, visible radiation, ultraviolet, etc.), and in such cases, they are monochromatic proper when only a given frequency is captured. But conjointly they will be synthesized from a full-color image; see the section regarding changing to grayscale.

#### 3.4 Binarization

The image acquired is in RGB color. It is converted into grayscale because it carries only the intensity information which is easy to process instead of processing three components R (Red), G (Green), B (Blue). To take the RGB worth's for every element and build as output one value reflective the brightness of that element. One such approach is to require the type of contribution from every channel:  $(R+B+C)/3$ . However, since the perceived brightness is commonly dominated by the inexperienced part, a different, more "human-oriented", a method is to take a weighted average,

e.g.:  $0.3R + 0.59G + 0.11B$ .

#### 3.5 Edge Detection

Edge detection is that the name for a group of mathematical ways that aim at distinguishing points during a digital image at that the image brightness changes sharply or, additional formally, has these continuities. The points at that image brightness changes sharply square measure usually organized into a group of flexuous line segments termed edges. Edge detection is a picture process technique for locating the boundaries of objects at intervals pictures. It works by detecting discontinuities in brightness. Edge detection is employed for image segmentation and knowledge extraction in areas like image process, computer vision, and machine vision.

#### 3.6 Image Segmentation

Image segmentation is the method of partitioning a digital image into multiple segments (sets of pixels, also known as super-pixels). The goal of segmentation is to modify and/or modification the illustration of a picture into one thing that's additional important and easier to research. Image segmentation is often wont to find objects and limits (lines, curves, etc.) in pictures [7].

### 4. FEATURES EXTRACTED

The features that are extracted to check the credibility of the note are as follows,

1. Variance of wavelet transformed image.
2. Skewness of wavelet transformed image.
3. Curtosis of wavelet transformed image.
4. Entropy of the image.

### 5. SYSTEM ARCHITECTURE

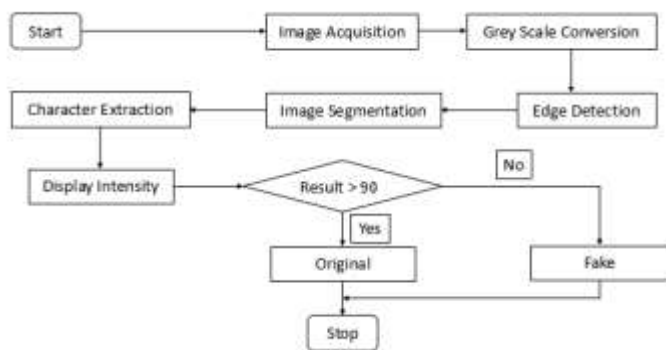


Fig -1: System Architecture

### 6. ACCURACY COMPARISON

We have used two algorithms those are Random Forest Classifier Algorithm and Neural Net and the after comparing the results provided by both the algorithms following is the accuracy provided by them,

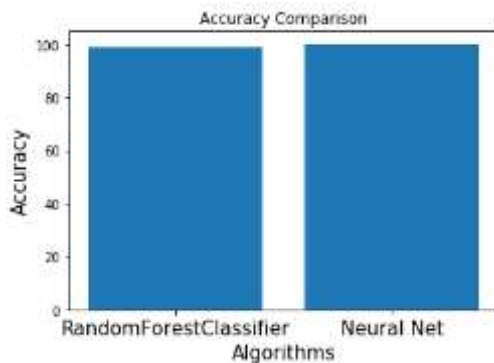


Fig -2: Accuracy Comparison

The accuracy provided by Random Forest Classifier Algorithm is

Accuracy - 99.12536443148689 %

And the confusion matrix generated is,

	Predicted Real	Predicted Fake
Actual Real	190	1
Actual Fake	2	150

Fig -3: Confusion Matrix

### 7. CONCLUSION

In this paper, an efficient approach is proposed to extract the features of Indian currency notes and recognize it. The project also contains the fake currency detection and authentication of Indian Rupee. Our future work will be concentrated on the extraction of features from various currency notes belonging to different countries as well as recognition and classification. Currently, the system is

designed only for the computer. Also, the system is restricted to Indian paper currency only. In the near future, we will be developing a mobile based application which will run on any platform. Also, we will be adding currency detection for various well-known countries.

### ACKNOWLEDGEMENT

We would like to specific our sincere feeling to Dr. Sanjay U. Bukade, Principal, and Dr. Satish Y. Ket, H.O.D of Computer Department of Rajiv Gandhi Institute of Technology for providing us an opportunity to do our project work on "Fake paper currency recognition using image processing".

This project bears on the imprint of many peoples. We sincerely thank our project guide Prof. Anita A. Lahane for her guidance and encouragement in carrying out this synopsis work.

Finally, we might prefer to impart our colleagues and friends United Nations agency helped North American nation in finishing the Project precis work with success.

### REFERENCES

- [1] Yu-Ichi Ohta, Takeo Kanade, and Toshiyuki Sakai, "Color information for region segmentation," Computer Graphics and Image Processing, vol. 13, pp. 222 - 241, 1980.
- [2] J. Geronimo D, Phardin PM Assopost, "Fractal functions and Wavelet expansions based on several Scaling Function" Approx. Theory, pp.373-401, 1994.
- [3] M. Gori, A. Frosini and P. Priami. "A neural network-based model for paper currency recognition and verification", IEEE Trans. Neural Networks, pp1482-1490,Nov.1996.
- [4] A Frosini, M Gori, and P Priami, "A neural network-based model for paper currency recognition and verification," IEEE Transactions on Neural Networks, vol. 7, pp. 1482 - 1490, 1996.
- [5] Sun Baiqing and Fumiaki Takeda, "Proposal of Neural Recognition with Gaussian Function and Discussion for Rejection Capabilities to Unknown Currencies," Knowledge-Based Intelligent Information and Engineering Systems, vol. 3213, pp. 859-865, 2004.
- [6] JiQian, DongpingQian, Mengjie Zhang, A Digit Recognition System for Paper Currency Identification Based on Virtual Instruments" 1- 4244-0555-6/06, 2006.
- [7] Feature Extraction for paper currency recognition, Department of Computer and Electrical Engineering Noushirvani Institute of Technology, University of Mazandaran P.O.BOX 47144,babol,Iran ,IEEE 2007.
- [8] Hamid Hassanpour and Payam M Farahabadi, "Using Hidden Markov Models for paper currency recognition," Expert Systems with Applications, vol. 36, no. 6, pp. 10105-10111, 2009.
- [9] Rafael C. Gonzalez, Richard E. Woods and Steven L. Eddins, Digital Image Processing using MATLAB. Pearson Education, 2009.

- [10] Junfang G, Yanyun Z, Anni C. A reliable method for paper currency recognition based on LBP, Proceedings of the 2nd IEEE International Conference on Network Infrastructure and Digital Content, p. 359-363; 2010.
- [11] Bu-Qing Cao and Jian-Xun Liu, "Currency Recognition Modeling Research Based on BP Neural Network Improved by Gene Algorithm," 10. Second International Conference on Computer Modeling and Simulation, vol. 2, pp. 246 -250, 2010.
- [12] Indian currency recognition based on texture analysis, INSTITUTE OF TECHNOLOGY, NIRMA UNIVERSITY, AHMEDABAD - 382 481, 08-10, IEEE DECEMBER, 2011, AHMEDABAD - 382 481, 08-10, IEEE, DECEMBER, 2011.
- [13] Feature extraction of currency notes: An approach based on wavelet transform. Amir Rajaei, Elham Dallalzadeh, Mohammad Imran Department of Studies in Computer Science, University of Mysore, Manasagangothri, Mysore - 570 006, Mysore, Karnataka, India IEEE 2012.
- [14] Ying-Ho Liu, Anthony J.T. Lee, Fu Chang, "Object recognition using discriminative parts," Computer Vision and Image Understanding, Vol. 116, no. 7, pp. 854-867, 2012.