

# Currency Authentication Using Image Processing

Prof. Manisha Singh<sup>1</sup>, Shubham Ambike<sup>2</sup>, Vishal Bhat<sup>3</sup>, Prince Sunny<sup>4</sup>, Nadeem Shaikh<sup>5</sup>,  
Deepak Vaishnav<sup>6</sup>

<sup>1</sup>(Asst. Professor, Dept. of Computer Engineering, DPCOE, Pune, Maharashtra)

<sup>2,3,4,5,6</sup>(Student, Dept. of Computer Engineering, DPCOE, Pune, Maharashtra)

\*\*\*

**Abstract** - The characteristics of paper notes vary from country to country. Currency authenticity or say identification is one among the important applications of pattern recognition. We have proposed a system for the automation of currency recognition using image processing techniques. The proposed system can be used for recognizing as well as authenticating given Indian banknotes. Only paper currency will be considered. This method works by identifying certain predefined areas of interest, and then extracting the denomination value using various characteristics such as color and text on the note. Our system identifies currency quickly and accurately. Initially, our system will be taking the frontside and backside of the currency(your note) as an input and then crop it into specific predefined areas of interest. Then each image is divided into three channels. Filtering is applied to each channel, the red, green, and blue channels are recombined to get back the RGB image. Different features such as HSV are extracted from the RGB image. The proposed model is based on a feature extraction and k-Nearest Neighbor (k-NN) classifier for recognizing test banknote. The recognition system indicates that the proposed approach is one among the foremost effective strategies for identifying currency patterns to read its face value and determine its authenticity for Indian currency notes.

**Key Words:** Indian Currency Recognition, Feature Extraction, HSV, k-Nearest Neighbour.

## 1.INTRODUCTION

The identification of currency depends on the characteristics of currency notes of a particular country. Due to use for a long time, currency notes may be contaminated by noises. To identify whether the currency is authentic or not there are many features. Although it may not be practically possible to accurately identify a counterfeit in a paper currency which can only be identified by an intelligent machine.

Modern automation systems in the real world requires a system that will recognize currency. It has various potential applications that includes banknote counting machines, money exchange machines,

assisting blind persons, electronic banking, currency monitoring systems etc. The recognition of currency is a very important need for visually impaired people. They are not being able to differentiate between currencies correctly, so it is very easy for them to be cheated by the others. Therefore, there is an urgent need to design a system that will recognize the currency authenticity and its value.

## 2. CURRENCY DETECTION

### 2.1 Identifying distinguishable region

Once the pre-processing steps have been done, we can identify which regions of the note are relatively distinguishable. This is done based on certain predefined areas. All the currencies have certain regions with fixed coordinates which we crop out for classification of notes. We have chosen 5 features from each currency note that are highlighted below within the images. Grouping is completed by checking out the values for pictorial features like hue and saturation for every feature then those values are compared with the original pictures of currency. The values chosen to classify the notes are found experimentally.



Fig. 2.A: Frontside of Rs 2000 banknote



Fig. 2.B: Backside of Rs 2000 banknote

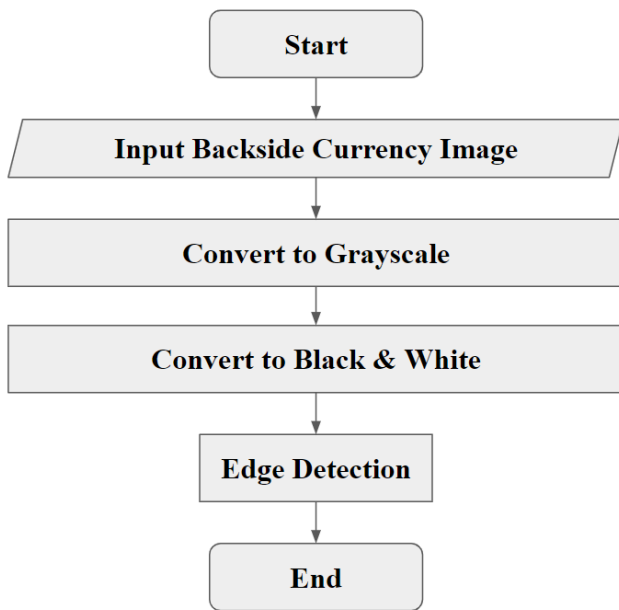


Fig. 2.C: Value Detection Flowchart

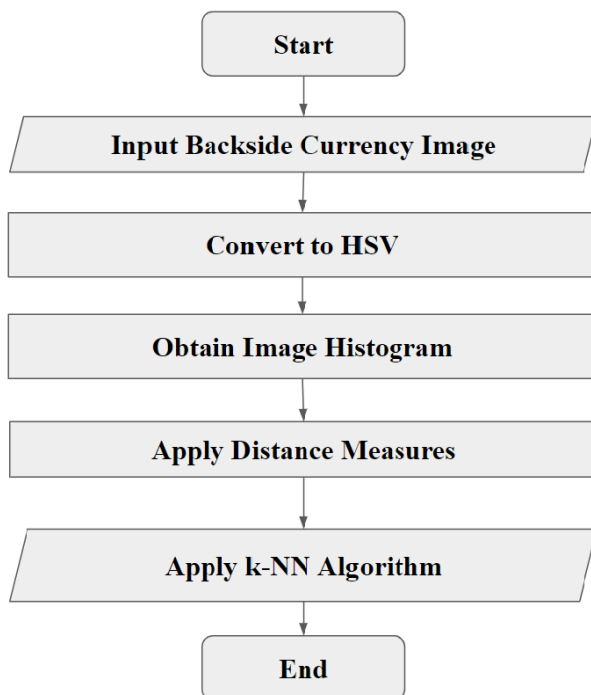


Fig. 2.D: Currency Authentication Flowchart

### 3. METHODOLOGY

#### 3.1 RGB Splitting

RGB Color Model: - Basic Color Model

The basic color model consists of rgb and alpha channels.

Which makes it a rgba model.

R-Red, G-Green, B-Blue, A-Alpha(Transparency of image).

The pixel is 32 bit.

R-G-B 8bits each and Alpha-8 bits.

#### 3.2 Color Blur

The blurring of image is applied to remove noise from the image.

It makes the images smooth for processing.

There are two types of Image Blurring one is grayscale blurring and other is color blurring.

We use windowing technique to blur an image.

Window can be of 3\*3, 5\*5 etc.

#### 3.3 RGB To HSV Conversion

HSV Color Model: It is most Stable Color Model and best for detecting natural colors.

h-Hue (Denotes the original color)

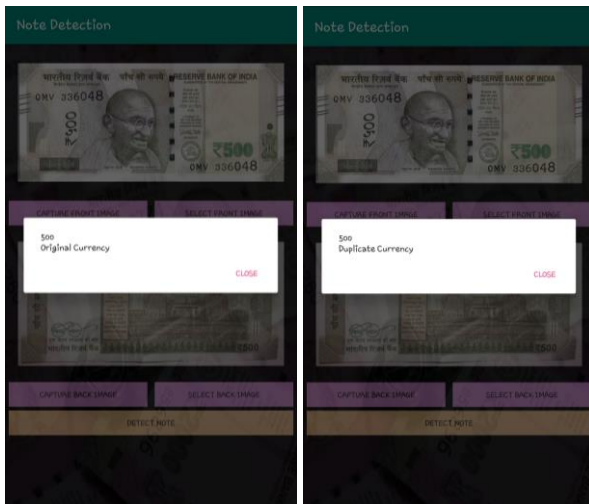
s-Saturation--(Concentration of color and mixture of white color)

v-Value/Luminous --Brightness

- Divide r, g, b by 255
- Compute cmax, cmin, difference
- Hue calculation :
  - if cmax and cmin equal 0, then h = 0
  - if cmax equal r, then compute  $h = (60 * ((g - b) / \text{diff}) + 360) \% 360$
  - if cmax equal g then compute  $h = (60 * ((b - r) / \text{diff}) + 120) \% 360$
  - if cmax equal b then compute  $h = (60 * ((r - g) / \text{diff}) + 240) \% 360$
- Saturation computation :
  - if cmax = 0, then s = 0
  - if cmax does not equal 0 then compute  $s = (\text{diff}/\text{cmax}) * 100$
- Value computation :

$$v = \text{cmax} * 100$$

#### 4. SAMPLE RESULTS



#### 5. ADVANTAGES AND DISADVANTAGES

##### 5.1 Advantages

1. User Friendly
2. Free of Cost
3. Fast Processing
4. Compatible to most of the Android Versions
5. Only mobile application for currency recognition as well as authentication on Android platform.

##### 5.2 Disadvantages

1. Recognition accuracy decreases in low light environment and blur images.
2. Does not work on another mobile operating system.

#### 6. LITERATURE SURVEY

There are also different methods of the currency recognition system using image processing techniques.

Vedasamhitha Abbaru *et.al* [1] proposed a method used for recognition of banknotes in which the system can identify the denomination as well as the country or origin of a given paper currency. The proposed method works by first identifying the country or origin using some certain predefined areas of interest and then extracting the value using characteristics like size, color, text on the note depending on differences of the notes within the same country.

Jesmin Akhter *et.al* [2] proposed a system which focuses on Bangladeshi Paper Currency based on supervised learning. First the system receives images of banknotes and then each image is divided into three channels. filtering is applied on each channel and recombined to get an RGB image respectively. Features like HSV, edge and grey-level co-occurrence matrix is calculated and stored. Euclidean distances are calculated from the reference values and the minimum distance gives required output.

Noura Semary *et.al* [3] proposed a system which uses basic image processing techniques on Egyptian banknotes with an accuracy around 89%. The techniques utilized include image segmentation, Region of Interest(ROI), histogram enhancement and finally template matching based on the cross-correlation between the image and training dataset.

Ahmed Yousry *et.al* [4] proposed a currency recognition system based on Oriented FAST and rotated Brief (ORB) algorithm. ORB is a FAST detector and the visual descriptor BRIEF (Binary Robust Independent Elementary Features) and aims to provide fast and effective alternatives to Local Scale Invariant Features(SIFT). After the preprocessing of images, ROI are extracted and then an ORB algorithm is applied.

#### 7. CONCLUSIONS

In this paper, the authentication and recognition of Indian paper currency is described by applying machine learning and image processing techniques. Basically five features are extracted including numeral value from frontside and backside, national emblem, left and right bleed lines from the image of currency. The currency denomination is extracted from the backside image using Optical Character Recognition(OCR) and pictorial features like Hue, Saturation, Value (HSV) are extracted for authentication of the currency, and then k-Nearest Neighbor Algorithm is applied for identification by considering a specific threshold value and determine its authenticity. This methodology works for Indian denominations 10, 20, 50, 100, 500 and 2000. The method is easy and simple for implementation. AS the actual computation is carried on the server, this application works well even on low end android smartphones. The decision making is done within a second. The system implemented is a low-cost system.

**REFERENCES**

1. Vedasamhitha Abburu, Saumya Gupta, S. R. Rimitha, Manjunath Mulimani, Shashidhar G. Koolagudi, "Currency Recognition System Using Image Processing", 2017 Tenth International Conference on Contemporary Computing (IC3), 10-12 August 2017, Noida, India
2. Jesmin Akter, Muhammad Kamal Hossen and Md. Shahnur Azad Chowdhury, "Bangladeshi Paper Currency Recognition system using Supervised Learning", Conference: 2018 International Conference on Computer, Communication, Chemical, Material and Electronic Engineering (IC4ME2), Rajshahi, Bangladesh.
3. Noura A. Semary, Sondos M. Fagl, Magda S.Essa, Ahmed F. Gad, "Currency Recognition System for Visually Impaired: Egyptian Banknote as a Study Case", Menoufia, Egypt, 2015.
4. Ahmed Yousry, Mohamed Taha and Mazen M.Selim, "Currency Recognition System for Blind People using ORB Algorithm", International Arab Journal of e-Technology, Vol. 5, No. 1, January 2018.
5. Muhammad Sarfraz, "An intelligent paper currency recognition system", International Conference on Communication, Management and Information Technology (ICCMIT 2015).
6. Rishabh Singh, Saurabh Singh, Deepak Sharma, Rashmita Mohapatra, Pranay Rao, "Counterfeit Currency Detection and Classification", International Journal of Innovative Research in Science, Engineering and Technology(IJIRSET), Vol. 6, Issue 11, November 2017.
7. Prof. Renuka Nagpure, Shreya Shetty, Trupti Ghotkar, Chirayu Yadav, Suraj Kanojiya, "Currency Recognition and Fake Note Detection", International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE), Vol. 4, Issue 3, March 2016
8. B.Sai Prasanthi, D. Rajesh Setty, "Indian Paper Currency Authentication System using Image processing", International Journal of Scientific Research Engineering & Technology (IJSRET), Volume 4, Issue 9, September 2015.
9. Swati Sagar, Shaheen Mondal, Apoorva Seth, Roopvati Shah, Akanksha Deshpande, "An Android Application for Indian Currency Recognition and Authentication for Blind", IJCSN International Journal of Computer Science and Network, Volume 5, Issue 2, April 2016.
10. Georgie V Rajan, Dincy M Panicker, Nisha Elizabeth Chacko, Jayalekshmi Mohan, "An Extensive Study on Currency Recognition System Using Image Processing", Proc. IEEE Conference on Emerging Devices and Smart Systems (ICEDSS 2018), 2-3 March 2018, Mahendra Engineering College, Tamilnadu, India.
11. Wani Chhaya V., Gundal Sheetal S., "Android Application on Fake Indian Currency Recognition", International Journal & Magazine of Engineering, Technology, Management and Research (IJMETMR), Vol. 3, No. 7, July 2016.