Novateur Publication's
International Journal of Innovation in Engineering, Research and Technology [IJIERT]
ICITDCEME'15 Conference Proceedings
ISSN No - 2394-3696

REVIEW ON FAKE INDIAN CURRENCY RECOGNITION TECHNIQUES

Chhaya Wani
Department of Electronics, A.V.C.O.E College, Sangamner,
Savitribai Phule Pune University, India

Sheetal Gundal
H.O. D, Department of Electronics, A.V.C.O.E College, Sangamner,
Savitribai Phule Pune University, India

ABSTRACT
The paper proposes a review on Fake Indian Currency Recognition techniques to detect mal practicing. In the country, the problem is in acute situation because of counter less activities of people involved in the rackets. Counterfeiting problems occurs over a time due to technological advances in color printing, duplicating and scanning. Fake currency notes of Rs.100, Rs.500 and Rs.1000 are highly detected.

GENERAL TERMS
Image Processing, Image Acquisition, Image Pre-processing, Pattern Matching, Counterfeit Detection, Digital Image Processing, Classification, Edge Detection etc.

KEYWORDS
Watermark, Register, Micro Letters, ROI, DWT, Intaglio, sub-bands, Portrait etc.

INTRODUCTION

The Indian Currency Recognition based on First Line Inspection method & Second Line Inspection Method.

1 FIRST LINE INSPECTION METHOD

It contains security features:

Water mark, Latent Image, Micro Letters, Register, I. D. Mark, Security Thread, Intaglio Printing and Number Panel.

2 SECOND LINE INSPECTION METHOD

It contains: Discrete Wavelet Transform, Digital Image Processing and Counterfeit Detection using Pen.

FAKE CURRENCY DETECTION TECHNIQUES

1. FIRST LINE INSPECTION TECHNIQUES

1.1 WATERMARK:

A banknote paper has a quality of varying density so that Mahatma Gandhi watermark visible on the other side of note when light is focused on rear side of the note

1.2 LATENT IMAGE:

On the right side of Mahatma Gandhi's portrait, a vertical band is present containing the respective denominational value in numeral. We can check the latent image only when we hold it horizontally at eye level.

1.3 MICRO LETTERS:

IJIERT-ICITDCEME'15

It is situated between Mahatma Gandhi's portrait and the vertical band. Micro letter section contains denomination value on the notes of Rs.20 and above while other contains the only word 'RBI'. A magnifying glass is required to verify it.

1.4 REGISTER:

It is a floral design section printed on both sides. The front side is hollow whereas and back side is filled up. It can be seen when held against light.

Figure 1. Security Features of Indian Currency

1.5 IDENTIFICATION MARK:

It helps the visually impaired people to identify the denomination by touch. Various geometrical shapes for different denominations are-

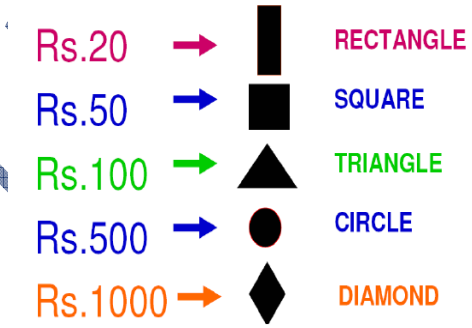

Fig.2. Identification Mark for various denominations

1.6 SECURITY THREAD:

It is a 3.00 mm wide strip with inscriptions 'Bharat' (In Hindi) and 'RBI' and it shows color change from green to blue when seen from differed angles.

1.7 INTAGLIO PRINTING:

It involves high impact printing process to raise the paper surface. On a banknote, Intaglio printing is applied on Guarantee and promise clause, Reserve Bank Seal, The Ashoka Pillar emblem, RBI Governor Signature and portrait of Mahatma Gandhi.

1.8 NUMBER PANEL:

IJIERT ICITDCEME'15

The panel contains serial number printed in a red color ink with a specific font to identify the currency note.

2.SECOND LINE INSPECTION TECHNIQUES

2.1 DWT (DISCRETE WAVELET TRANSFORM)

Algorithm used in DWT:

1. Image Acquisition
2. Image Preprocessing
3. Edge Detection
4. Apply DWT
5. Classification
6. Result

It involves Image Acquisition for training and testing purpose using scanner. Here, we scan image of different currency notes of both good and bad quality with high clarity.

After that, Image Pre-processing task is carried out for enhancing the image and to remove noise. It includes Image Resizing, Image Rotating, Gray Scale Image and Edge Detection. Canny Edge Detector is used in the method. Now, by applying DWT, the images are decomposed into four sub-bands. These sub-bands are LL1, LH1, HL1 and HH1. LH1, HL1 and HH1 sub-bands represent the finest scale wavelet coefficients, i.e. image details and the sub-band LL1 corresponds to the coarse level coefficients i.e., image approximation. To obtain the next coarse level of wavelet coefficients, the sub-band LL1 can be decomposed and sampled. Similarly, LL2 can be used for further decomposition. This process continues until the final scale. The results obtained through DWT are used for texture analysis, discrimination and statistical feature extraction.

At Classification stage, extracted features are used to train the neural network using probabilistic neural network. After the training, section testing includes extracted features of currency comparison with all the currency in the database.
If the features are matched, it displays the proper result to the user else it displays it as unknown currency.

2.2 DIGITAL IMAGE PROCESSING

The steps used in the techniques are as follows:

1. Scanning
2. ROI
3. Gray scale imaging
4. Applying Edge Filters
5. Pattern matching

RESULT

Firstly, different notes are scanned at 150dpi with 128X128 pixels using simple scanners. Now-a-days, scanning quality is much improvised so that the further results becomes high resolution samples for fraud detection.

ROI (Region of Interest) extraction is later on process. Image is converted to gray scale and the level is to be set up for next stage.

Various filters like Sobel edge filter, Laplacian edge filer, average edge filer is used in complimenting to get denomination value. To match with image pixel, neural network and pattern recognition techniques are used. Mostly, MATLAB is used as a tool of pattern recognition.

In Indian Currency, the numerals in denomination are easily extracted hence it is a very efficient process to detect fraud.

IJIERT-ICITDCEME'15

2.3 COUNTERFEIT DETECTION USING PEN

Actually, this is a technique which is imposed in the form of a device like a pen. Pen contains 'iodine' as ink which is brown in color.

Commercial paper is brown, to make it brighter it is bleached and starched. Ink turns into black if the note is fake as iodine reacts with starch otherwise it remains brown.

If in a case where paper is not bleached or starched, the pen will give the result as a genuine note.

SUMMARY OF CURRENCY RECOGNITION TECHNIQUES

Techniques discussed are summarized and compared:

Table 1. Table captions should be placed above the table

Techniques	It contains	Efficiency & Limitations
First Line Inspection Method	Water mark, Latent Image, Micro Letters, Register, I. D. Mark, Security Thread, Intaglio Printing, Number Panel	It can be easily carried out. No special tools are required. Sometimes it is difficult to detect fault using these techniques. In case of old notes, feature recognition is not proper.
Second Line Inspection Method- DWT	Image Acquisition, Image Pre-processing, Edge Detection, Apply DWT, Classification	Proper matching of sub-bands gives appropriate result. Process is lengthy and in some cases result is ambiguous.
Second Line Inspection Method- Digital Image Processing	Scanning, ROI, Gray scale imaging, Applying Edge Filters, Pattern matching	Numeral denominations can be perfectly detected. It is an advanced and superior technique than others.
Second Line Inspection Method- Counterfeit Detection using Pen	Pen contains 'iodine' as ink which reacts with starch on fake note.	It is not suitable in the case when paper is not starched of a fake note. This technique is not much efficient.

IJIERT-ICITDCEME'15

RELATED WORK

1.2 COLOR BASED RECOGNITION TECHNIQUE

Wei-Ying Ma describes Color histogram (CH) method for an image. It uses technique of counting the pixels of each color. The global color distribution in an image is described by histogram. It is easy to compute. Segregation is used to find between a range of colors and a prominent color in note.

1.2 CURRENCY LOCALIZATION TECHNIQUES

Currency localization technique is a mixed approach. First, image of currency note is localized and then various threshold based algorithm are applied.
Parminder Sigh Reel, Gopal Krisnan and Smarti Kotwal has done work on currency note recognition based on heuristic analysis of character and digits of serial number. Heuristic analysis filters non-character elements which are not separated by traditional OCR method reliably.

CONCLUSION

In this paper we have make review on various methods that can be used to recognize different feature of note. Each method has its own objectives and significance, also certain limitation.

First line inspection method is simplest and carried out in day to day life. Second line infection method techniques like DWT, Digital image processing. We have surveyed and classified significant fraction of the proposed techniques.

REFERENCES

[1] Vipin Kumar Jain. Lecturer, Department of Computer Science, S.S.Jain Subodh P.G.College, Jaipur. Research Scholar of Banasthali University. Dr. Ritu Vijay Head, Department of Electronics. Banasthali University."Indian Currency Denomination Identification Using Image Processing Technique". International Journal of Computer Science and Information Technologies, vol.4, 2013.

[2] S. S. Sannakki, Pallavi J. Gunjale.
Department of Computer Science and Engineering, Gogte Institute of Technology, Belgaum, Karnataka, India. "Recognition and Classification of Currency Notes using Discrete Wavelet Transform". International Journal of Emerging Technology and Advanced Engineering vol. 4, July 2014.

[3] Hanish Aggarwal, Padam Kumar.
Department of Electronics and Computer Engineering Indian Institute of Technology Roorkee, Roorkee, India.
"Indian Currency Note Denomination Recognition in Color Images"

[4]Ms. Trupti Pathrabe1, 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.

[5]Rubeena Mirza, Vinti Nanda, "Paper Currency Verification System Based on Characteristic Extraction Using Image Processing", International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249. 8958, Volume-1, Issue-3, February 2012.

IJERT-ICITDCEME'15