Fake Currency Detection using Image Processing

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Abstract— The advancement of color printing technology has increased the rate of fake currency note printing and duplicating the notes on a very large scale. 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 issue of fake notes instead of the genuine ones has been increased very largely. India has been unfortunately cursed with the problems like corruption and black money .And counterfeit of currency notes is also a big problem to it. This leads to design of a system that detects the fake currency note in a less time and in a more efficient manner. The proposed system gives an approach to verify the Indian currency notes.

Index Terms— Characteristics extraction, Edge detection, identification mark, image acquisition, image segmentation, latent image, gray scale conversion.

1 Introduction

Technology is growing very fast these days. Consequently the banking sector is also getting modern day by day. Many researchers have been encouraged to develop robust and efficient automatic currency detection machine. The technology of currency recognition basically aims for identifying and extracting visible and invisible features of currency notes. Until now, many techniques have been proposed to identify the currency note. For example, color and size. But this way is not helpful if the note is dirty or torn. If a note is dirty, its color characteristics are changed widely. So it is important that how we extract the features of the image of the currency note and apply proper algorithm to improve accuracy to recognize the note.

The image of the currency note is captured through a digital camera. The hidden features of the note are highlighted in the ultraviolet light. Now processing on the image is done on that acquired image using concepts like image segmentation, edge information of image and characteristics feature extraction. It involves extraction of invisible and visible features of Indian currency notes. This approach consists of different steps like image acquisition, edge detection, gray scale conversion, feature extraction, image segmentation and decision making.

1.1. Process of Edge detection:
It is a basic tool in image processing. It is widely used in area of feature detection and extraction. This process aim at identifying point in digital image at which image brightness sharply changes.

1.2. Process of Image segmentation:
This process sub divides image into it sub regions. The level of division depends on the problem. Segmentation algorithm for images which are monochromatic is based on properties of images like discontinuity and similarity.

2 Methodology

2.1 Review Stage

The system proposed here work here on the image of currency note under ultraviolet light acquired by a digital camera. The algorithm which is applied here is as follows:

1. Acquisition of image of currency note under ultraviolet light by simple digital camera or scanner.

2. Image acquired is RGB image and now is converted to gray-scale image.

3. Edge detection of whole gray scale image.

4. Now characteristics features of the paper currency will be cropped and segmented.

5. After segmentation, characteristics of currency note are extracted.

6. Intensity of each feature is calculated.

7. If the condition is satisfied, then the currency note is said as original otherwise fake.

The characteristics that can be used to check the authentication of currency note are:

A. Security Thread:
It is a 3mm windowed security thread with inscriptions of India in Hindi, RBI and 2000/500 on banknotes with color shift. Color of the thread changes from green to blue when the note is tilted.

B. Serial Number:
Serial number panel with banknote number growing from small to big on the top left side and bottom right side.

C. Latent image:
A vertical band on front side of denomination at right hand size. It contains latent image showing numeral of denomination when banknote is held horizontally at eye level.

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D. Watermark:

The portrait of Mahatma Gandhi, and multidirectional lines and a mark showing the denominational numeral appear which can be viewed when held against light.

E. Identification Mark:

A mark with intaglio print which can be felt by touch, helps blind person to identify the denominate.

3 PROPOSED SYSTEM

The flow diagram of the process to be followed in the proposed system is as follows:-

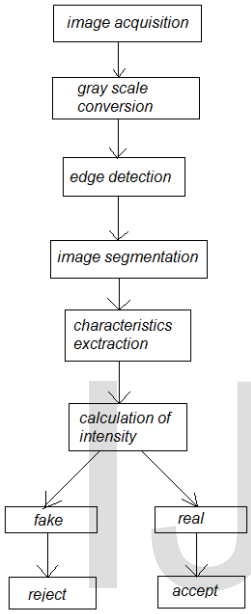

Fig1. Flow diagram of process

1) Image acquisition:

The image is kept under ultraviolet light and the image is captured through a simple digital camera.

2) Image preprocessing:

It involves the operations required prior to data analysis and information extraction. Here image resizing is done.

3) Gray scale conversion and edge detection:

The acquired image is obtained as RGB image which is now converted into gray scale image since it carries intensity information. This image is further processed and edges of gray scale images are detected.

4) Image segmentation:

It's the process of dividing image into multiple parts by cropping it.

5) Feature extraction:

Now the features are extracted using edge based segmentation.

6) Now the process of calculation of intensity of each extracted feature is done. If the calculated intensity is greater than the threshold of 70%, then it is classified as original note otherwise it is considered as fake one.

7) The final decision depends upon the intensities of all extracted features.

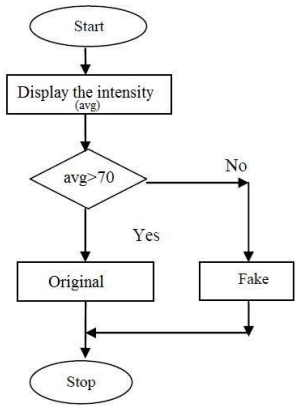

Fig2. Flow diagram of process

4 EXPERIMENTAL RESULTS

Intensities of all remaining features were also calculated for different notes of 500 and 2000.

Table 1. Results for 500-1 note

Features	Intensity
Serial number	93%
Security thread	82%
Mahatma Gandhi portrait	83%
Identification mark	80%

Table 2. Results for 500-2 note

Features	Intensity
Serial number	76%
Security thread	73%
Mahatma Gandhi portrait	60%
Identification mark	68%

Table 3. Results for 2000 note

Features	Intensity
Serial number	75%
Security thread	82%
Mahatma Gandhi portrait	86%
Identification mark	73%

From the above results it was observed clearly that an original currency note's extracted features displays minimum intensity of 70%, it is seen that the 500-2 note displays intensity less than 75% for some features hence it is considered as fake note.

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5 CONCLUSION

The fake currency detection using image processing was implemented. Features of currency note like serial number, security thread, Identification mark, Mahatma Gandhi portrait were extracted. The process starts from image acquisition to calculation of intensity of each extracted feature. The system is capable of extracting features even if the note has scribbles on it. The algorithm processed here works suitably for the newly introduced 500 and 2000 denomination.. Hardware implementation of the proposed system can also be done using suitable processor so that to increase the speed of detection. An automatic railway ticket booking system can also be proposed which includes currency detection as one of its part.

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