Detection of Counterfeit Indian Currency Note using Image Processing

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Abstract:
Fake Currency has always been an issue which has created a lot of problem in the market. The increasing technological advancements have made the possibility for creating more counterfeit currency which is circulated in the market which reduces the overall economy of the country. There are machines present at banks and other commercial areas to check the authenticity of the currencies. But a common man does not have access to such systems and hence a need for software to detect fake currency arises, which can be used by common people. This proposed system uses Digital Image Processing Techniques to detect whether the currency is genuine or counterfeit. The system is designed using OpenCV Python programming language. It consists of the steps such as grayscale conversion, edge detection, features extraction, etc. which are performed using suitable methods.

Keywords: Counterfeit currency, Digital Image Processing, Edge Detection, Feature extraction.

I. INTRODUCTION

Different countries around the world use different types of currencies for the monetary exchange of some kinds of goods. One common problem faced by many countries related to currency, is the inclusion of fake currency in the system. India is one of the countries that face a lot of problems and huge losses due to the fake currencies. Due to this there are losses in the overall economy of the country’s currency value. The technological advancements have made a pathway for currencies to be duplicated such that it cannot be normally recognized. Advanced printers and new editing computer software are used to create counterfeit currencies. Fake currencies can just be slipped into bundles of genuine currency which is how they are usually circulated in the market. Commercial areas like the banks, malls, jewelry stores, etc. have huge amount of transactions on a daily basis. Such places may be able to afford and find it feasible to buy machines that use UV light and other techniques to detect the authenticity of the currency. But for common people it is very difficult to just detect whether the currency is fake or genuine and they may face losses especially during bank deposits or transactions. This system is designed such that any person can use it easily and detect the authenticity of the currency he/she has by using the visual features of the currency. The system is based on Image processing where a number of steps are used to process the image of a currency and give the result to the user that the currency is genuine or not.

II. LITERATURE SURVEY

Ms. Reshu Gupta proposes a novel method for recognition and authentication of Indian paper currency note using Image processing with MATLAB. The study of detailed information about the various distinct security features that are embedded in the original Indian currency note of the Denominational value 2000 using multispectral imaging. This study also exposes the features that do not appear in the photocopy and scanned currency notes so as to offer a better knowledge and idea about variance in the genuine and fake currency [1].

Saiyed Mohammed Arshad1 et.al made an effort to explore the various security features of the highest denomination of 200. Counterfeit of currency of denomination 2000 will be a very difficult task because as many security features are embedded in the newly introduced currency notes which makes the currency of highest features. Analysis of Indian Currency that can be used for Recognition and Authentication of genuine currency note using Image processing in MATLAB [2]. S. Atchaya et.al basically had found the currency through the currency barcode and serial number by using MATLAB image pre-processing technique. Here input is in the form of image and will be converted using soble operator. Then the features is extracted from the segmentation. Finally, compared Real and Fake images and find weather the currency is original or duplicate [3]. Tushar Agasti et.al used a features of currency note like serial number, security thread, Identification mark, Mahatma Gandhi portrait for identifying counterfeit of the currency note. 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 scrabbles on it. system can also be done using suitable processor so that to increase the speed of detection [4]. Yepuri S poorthi et.al proposed work for currency recognizing system to identify fake notes. In MATLAB the features of the currency notes are extracted with the help of digital image processing. Then pre-processing by filtering and segmentation is completed. patterns are extracted by Grayscale method. They extracted features like Security Optically Variable link, Security Thread etc. to compare the scanned image with the original notes [5].

III. METHODOLOGY

The system proposed here work on the image of Indian currency note acquired by a digital camera. The method which is applied here is as follows:

- The proposed method is based on the digital image processing technique for the detection of counterfeit Indian currency note.

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As the high denomination value, 500 Rupee Note is considered here.
There are various different features that are present in the currency of 500 Rupee Note, which are used by common people for differentiating currency denomination.
In this proposed model features like denomination value 500 written in Devanagari, RBI logo, denomination written in numerals with rupee symbol, circle with 500 in raised print, security thread and Ashoka Pillar Emblem are used for detection of real or fake note.

IV. SECURITY FEATURES OF RS.500 NOTE

Figure 1. Salient features on the Front of the Rs.500 Note

Obverse
1. See-through register in denominational numeral.
2. Latent image of the denomination numeral.
3. Denomination numeral in Devanagari.
4. Mahatma Gandhi’s portrait in Centre facing to right.
5. Windowed security thread that changes colors from green to blue when the note is tilted.
6. Guarantee clause, Governor's signature with promise clause and RBI emblem tilted towards the right.
7. Portrait and electrotype watermarks.
8. Number panel with numerals growing from small to big on the top left side and bottom right side.
9. Denomination in numerals with rupee symbol in color changing ink (green to blue) on the bottom right.
10. Ashoka pillar emblem on the right.

For visually impaired:
Intaglio or Raised printing of Mahatma Gandhi’s portrait, Ashoka pillar emblem and an identification mark.
1. Circle with Rs 500 in raised print on the right.
2. Five bleed lines on left and right in raised print.

Reverse
1. Year of printing of the note on left
2. Swachh Bharat logo with the slogan.
3. Language panel towards the Centre.
4. Red Fort with Indian flag.
5. Denomination numeral in Devanagari on right.

V. PROPOSED MODEL

The design flow of fake Indian currency detection system includes following stages:
1. Image acquisition
2. Image pre-processing
3. Gray scale conversion
4. Edge detection
5. Feature extraction
6. Comparison
7. Result

The proposed system is works on two modules, one is the extract the Indian currency security feature and creates a dataset and other is the test currency dataset image on which authentication is too performed. The figure 5 shows the design of the proposed system.

Figure 2. Salient features on the back of Rs.500 Note

Figure 3. Methodology for detection of counterfeit note of denomination 500

1. Image acquisition
Figure 4 shows the acquisition image. In this process, first image by using various ways to acquire image such as with the help of camera or scanner.

Figure 4. Input image
2. Image Pre-processing
Image pre-processing is required prior to the main dataset and extraction of information and performs different operation for any currency verification. It includes Image Adjusting: when we get the image from a camera, Figure 4 is captured in small size. Figure 6 shows the resized image. This helps in removing the background form the image also helps in converting the size of the image.

3. Gray scale conversion
The capture image acquired is in RGB color. This image is heavy and has more noise. Figure 7 shows converting the RGB image into gray scale, it reduces the size of the image and also the intensity information which is easy to process instead of processing three components R(Red), G(Green), B(Blue).

4. Edge detection
Edge detection is a tool in computer vision, particularly in the process of feature extraction and detection, which aim at identifying key points in a digital image. To segment an object from capture image, one needs closed region boundaries. Edge detection is one of the processes in image processing, image analysis, image pattern recognition, and computer vision techniques.

5. Feature extraction
Extracting feature is a challenging technique image processing where the dimension of the data is reduced. When the input data is too large to be processed and contain less information then input data will be transformed into reduced representation set of features. If the attribute features are chosen carefully then it is expected to extract relevant information instead of processing whole input data which are very important for recognition of currency as real or fake.

6. Comparison
In comparison the features extracted from the images of the currency notes plays a very important role. Basically, it is the comparison of the features that enables to differentiate counterfeit notes from the genuine ones.

7. Result
The final decision depends upon the intensities of all extracted features and extracted features of currency note are compared to conclude that the currency is real or fake.

On comparing the extracted features of test image do not match with features of train image, so the result obtained is fake which is shown in the below figure.
VI. RESULT AND DISCUSSION

The system is trained with 30 trained Indian currency note security features and the system is tested 20 testing images of denomination 500 Indian banknote. The security feature extracted are compare with trained security feature. The accuracy calculated based on the testing image. The Table below represent the accuracy in %. In denomination 500 testing images pass 18 banknotes out of 20. The average accuracy is obtaining 90%. The table 1 below illustrate the experimental results.

| Denomination     | Image Datasets | Test Pass | Test Fail | Accuracy |
|------------------|----------------|-----------|-----------|----------|
| 500 Rupee Notes  | 30 Training and 20 Test Banknote Image | 18        | 02        | 90%      |

For the purpose of testing this system as mentioned we have experimented with 50 images and the result analysis is as follows. The table 2 represents the classification of result.

| Currency images trained | 30                 |
|-------------------------|--------------------|
| Currency images tested  | 20                 |
| Real notes              | 15                 |
| Fake notes              | 5                  |

| True Positive           | 13                 |
| True Negative           | 5                  |
| False Positive          | 2                  |
| False Negative          | 0                  |

Precision = True Positive / (True Positive +False Positive)
Recall = True Positive / (True Positive + False Negative)
F- Measure = (2 * Precision * Recall) / (Precision + Recall)
Accuracy = (TN+TP) / (TN + FP + TP + FN)

From the above equation we have calculated the result, and obtained precision as 0.86, recall as 1, F-Measure as 0.93 and accuracy as 0.9.

VII. CONCLUSION

In this currency detection system, the validation of Indian paper currency note is outlined by applying digital image processing techniques using OpenCV. By using the above mentioned technique we have find that extraordinary results can be completed in less time. The paper also includes the study of detailed information about various Indian currency notes. This is an OpenCV based using effective computer vision methods and algorithm which provide accurate and reliable result. Our experiment shows that this is the low cost system to detection the Indian banknote. We have checked on different notes on this system and the result is 90% which shows that the system is working efficiently.

VIII. REFERENCES

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