

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

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Vol. 6, Issue 11, November 2017

Counterfeit Currency Detection and Classification

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ABSTRACT: This paper purposes the study of method through which Fake currency can be detected. Fake notes are a problem of almost every country but India has been hit really hard and has become a very acute problem. Therefore the issue of efficiently distinguishing counterfeit banknotes from genuine ones via automatic machines has become more and more important. Automated paper currency recognition system can be a very good utility in banking systems and other field of commerce. Paper currency recognition with good accuracy and high processing speed has great importance for banking system. This proposed system describes an approach for verification of Indian currency banknotes. The currency will be verified by using Image Processing techniques. Thus, this project will be very useful in identifying fake currency.

KEYWORDS: Counterfeit notes, Image Processing, Image Segmentation, Binarization.

I. INTRODUCTION

Modernization of the financial system is a milestone in protecting the economic prosperity, and maintaining social harmony. The Reserve Bank of India is only one which has the full authority to issue bank notes in India. But some unsocial groups of people are prone to make these fake currencies. Fake Indian Currency of 100, 500 and seems to have flooded the system and there is no proper way to deal with them for a common person. Common Person fall prey to this currencies and this acts as a cheat and disadvantage for them. The value of money is increasing and Rs. 500 is one of the highest value currency existing till date and maximum fake is done in these notes. From few years, along with the original currency, Fake Currency is also circulating in the society and unbalancing the social harmony of the society. Many of the transaction are also carried out with it. Counterfeit Currency Detection and Classification means finding fake currency from the entire currencies. With the advancement of the modern banking services, automatic methods for paper currency detection has become important in most of the applications such as in automated teller machines and automatic goods seller machines. Images are processed by using various techniques of image processing and further various features are extracted from the images. Automatic methods of banknotes recognition are required in many applications, such as automatic selling goods and vending machines, among others. The approach consists of a number

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of components including image processing, image segmentation, characteristic extraction, comparing images. The basic thing of approach is that we extract the features on the basis of which we are going to classify the fake note. [4]

II. LITERATURE SURVEY

1. "Design and Implementation of Indian Paper Currency Authentication System Based on Feature Extraction by Edge Based Segmentation Using Sobel Operator" The method in this paper is inspired by the analysis of hidden marks on the image of the paper currency. The algorithm applied here is very simple and works properly. The image of the paper currency is acquired through camera by applying white backlighting to the paper currency so that the hidden marks of currency is appeared on the image. Now the image is further processed by applying the image processing techniques like image preprocessing, edge detection, image segmentation, characteristics extraction.
2. Authentication of currencies using image processing by B.Sai Prasanthi, Rajesh Setty In this approach we extract the general attributes of the paper currency that is shape including identification mark, security thread and watermark etc.. These features are extracted by detecting the edges and estimating the gradient of the image at every point to generate a gradient image and thresholding the gradient image to accomplish image segmentation.
3. "An automatic recognition of fake indian paper currency note using MATLAB In this project they have made fake currency note detection technique using MATLAB and feature extraction with HSV color space and other applications of image processing. The system is also interfaced with input device CCD camera and output device LCD display [1]

III. PROPOSED METHODOLOGY AND DISCUSSION

3.1 PROPOSED SYSTEM

The system will work on two images, one is original image of the paper currency and other is the test image on which verification is to be performed. The proposed algorithm for the discussed paper currency verification system is presented as follows

1. Image of paper currency will be acquired by simple scanner in .jpg extension.
2. The image processing will be implemented on this image.
3. The various characteristics of the paper currency will be cropped and segmented.
4. After segmentation, the characteristics of the paper currency will be extracted.
5. The extracted characteristic of test image then undergoes classification.
6. On the basis of classification the result is generated.

In the proposed method characteristics of paper currencies are employed that are used by people for differentiating different banknote denominations. Basically, at first instance, people may not pay attention to the details and exact characteristics of banknotes for their recognition, rather they consider the common characteristics of banknotes such as the size, the background color (the basic color), and texture present on the banknotes. So we are implementing some different way or typical features of currency detection. [5]

3.2 METHODOLOGY

Image processing based currency recognition technique consists of few basic steps like image acquisition, its preprocessing and finally recognition of the currency. Image processing generally involves three steps.

1. Import an image with an optical scanner or directly through digital photography.
2. Manipulate or analyse the image in some way.
3. Output the result. The result might be the image altered in some way or it might be a report based on analysis of the image.

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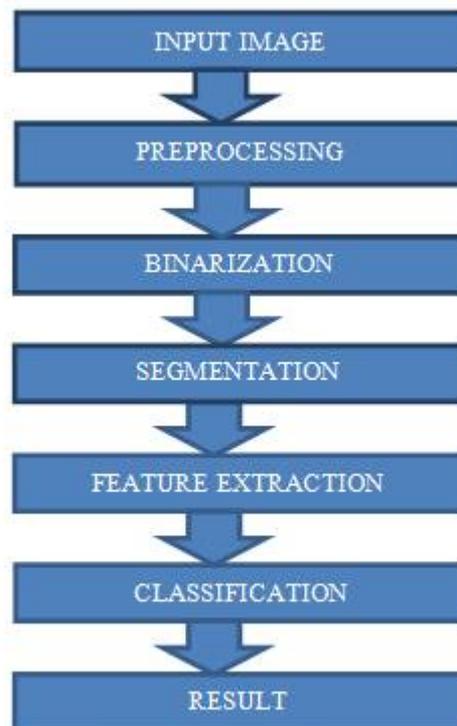


Fig.1: Flowchart [2]

1. Image Acquisition (Input Image) Image acquisition in image processing can be broadly defined as the action of retrieving an image from some source, usually it is a hardware-based source, so it can be passed through whatever processes need to occur afterward. Performing image acquisition in the process of image processing is always the first step in the workflow sequence because, without an image, no processing is possible. The image that is acquired is completely unprocessed and is the result of scanner which was used to generate it, which can be very important in some fields to have a consistent baseline from which to work. One of the ultimate goals of this process is to have a source of input that operates within such controlled and measured guidelines that the same image can, if necessary, be nearly perfectly reproduced under the same conditions so anomalous factors are easier to locate and eliminate.

2. Image pre-processing: The aim of image pre-processing is to suppress undesired distortions or enhance some image features that are important for further processing or analysis. It includes Image adjusting, Image smoothing, Median filter. In Image adjusting the image we got from scanner or digital camera is too big. So calculations are going to be a bigger one. In order to reduce this calculation we are reducing the size of image. Image Adjusting is done with the help of image interpolation technique which is used for tasks such as zooming, rotating, shrinking, and for geometric corrections. Bilinear and bicubic are the two different types of image interpolation. In the first one concept of four nearest is used to estimate the intensity at a given location. Let (x, y) denotes coordinates of the location where we want to assign an intensity value and $Z(x, y)$ denote that intensity value so to evaluate assigned value we use equation $Z(x,y)=ax+by+cx+y+d$ Where four coefficients can be obtained from the four equations from the four unknown can be written using four nearest neighboring of point. In Image smoothing when we capture image through digital camera or scan image through scanner, some noise will appear on the image. The removal of this noise is an important step in the image processing. In an image processing, to smooth a data set is to create an approximating function that attempts to capture important patterns in the data, while removing noise or other fine-scale structures/rapid phenomena. In smoothing, the data points of a signal are modified so individual points are reduced, and points that are lower than the adjacent points are increased leading to a smoother signal. Smoothing may be used in two important ways that can aid

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in data analysis by being able to extract more features from the image data. The algorithm use for smoothing is non linear algorithm which is called as median filter as described below. In Median filter, a median filter is based upon moving a window over an image and computing the output pixel as the median value of the brightness within the input window. If the window is $J \times K$ in size we can order the $J \times K$ pixels in brightness value from smallest to largest. If $J \times K$ is odd then the median will be the $(J \times K + 1) / 2$ entry in the list of ordered brightness. Note that the value selected will be exactly equal to one of the existing brightness so that no round off error will be involved if we want to work exclusively with integer brightness values. The algorithm as it is described above has a generic complexity per pixel of $O(J \times K \times \log(J \times K))$. Fortunately, a fast algorithm exists that reduces the complexity to $O(K)$ assuming $J \geq K$. Thus we are done with the image pre-processing and output of this step are forward further.

3. Image Binarization is usually performed in the pre-processing stage of different document image processing related applications such as optical character recognition (OCR) and document image retrieval. A gray scale document image is converted into a binary document image and accordingly it facilitates the ensuing tasks such as document skew estimation and document layout analysis. As more and more text documents are scanned, fast and accurate document image binarization is becoming increasingly important.

4. Image Segmentation can determine region boundaries in an image. It can explore many different approaches to an image segmentation & thresholding. A threshold is said to be globally optimal if the number of misclassified pixels is minimum. Histogram is bimodal (object and background). Ground truth is known OR the histograms of the object and the background are known.

5. Feature Extraction It is a challenging work in digital image processing. In any currency recognition system, feature extraction is one of the most challenging tasks. Here, the aim is to analyse and identify the unique and distinguishing features of each denomination under various challenging conditions such as old notes, worn out notes, also under different illumination and background. [2]

IV. RESULTS AND DISCUSSION

4.1 RESULTS

Counterfeit Currency Detection and Classification means finding fake currency from the currencies. With the advancement of the modern banking services, automatic methods for paper currency detection has become important in most of the applications such as in automated teller machines and automatic goods seller machines. Images are processed by using various techniques of image processing and further various features are extracted from the images. Automatic methods of banknotes recognition are required in many applications, such as automatic selling goods and vending machines, among others. Hence there was a need to produce a system for proper detection of the currency note. [3]

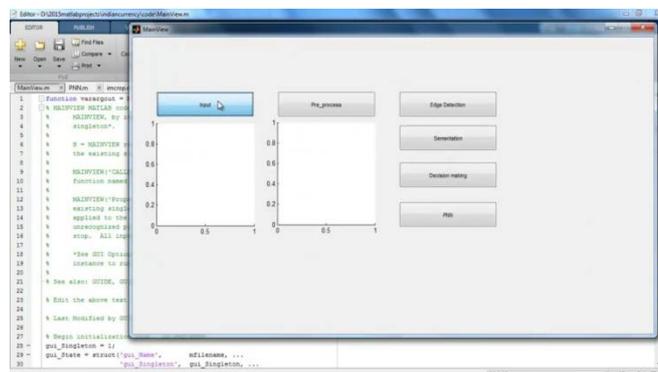


Fig.2: Input

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Vol. 6, Issue 11, November 2017

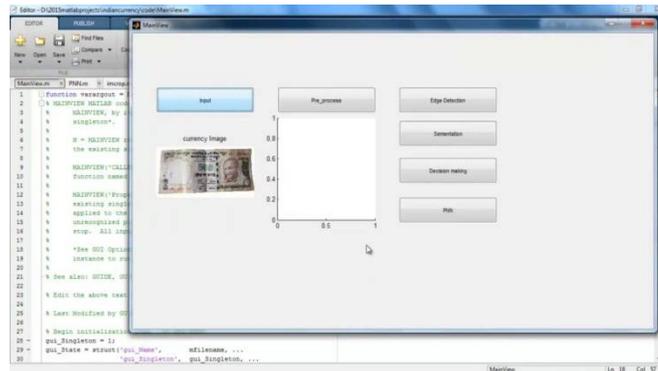


Fig.3: Input Image

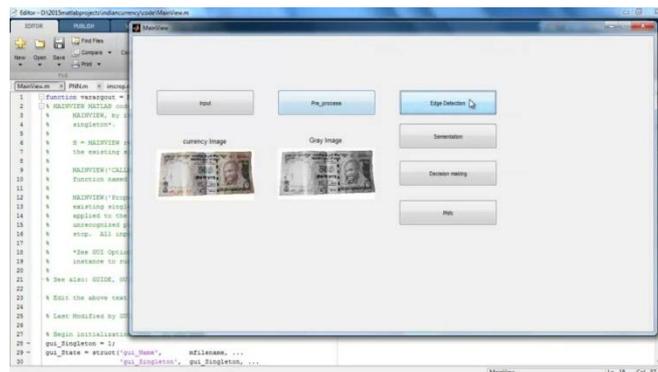


Fig.4: Gray Scale converted image

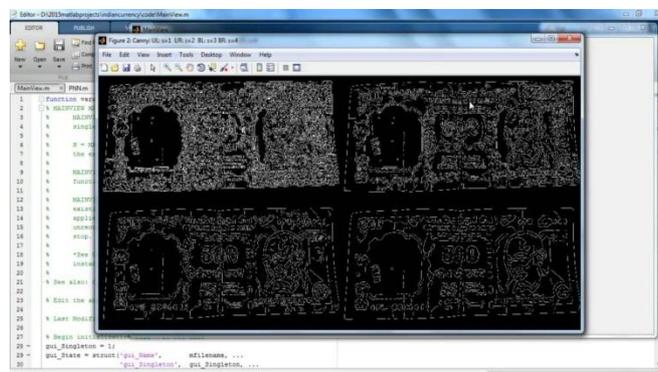


Fig.5: Edge Detection

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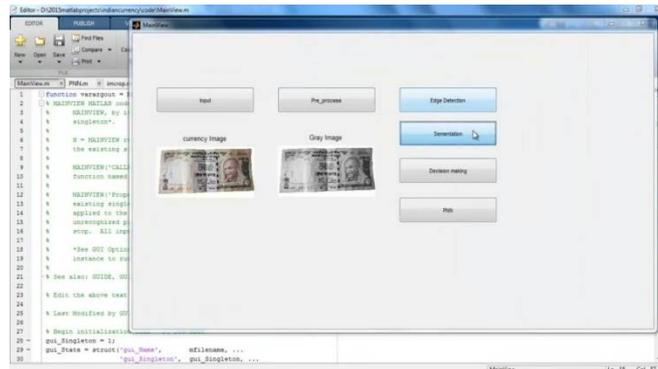


Fig.6: Segmentation Step

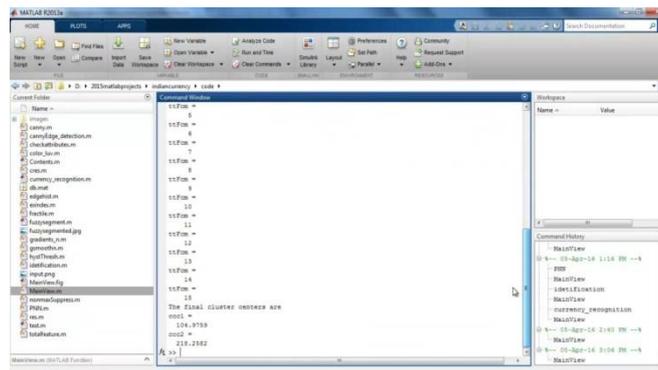


Fig.7: Corresponding values after segmentation

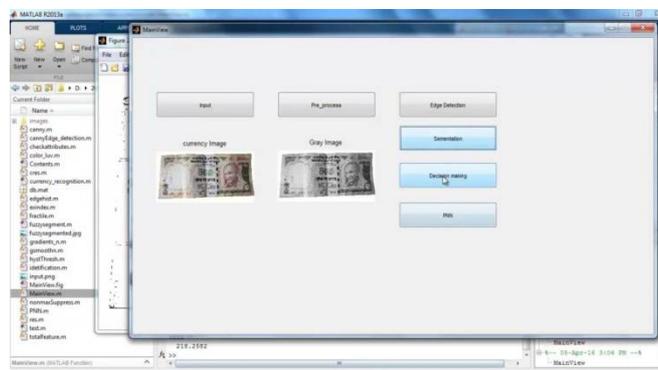


Fig.8: Decision making step

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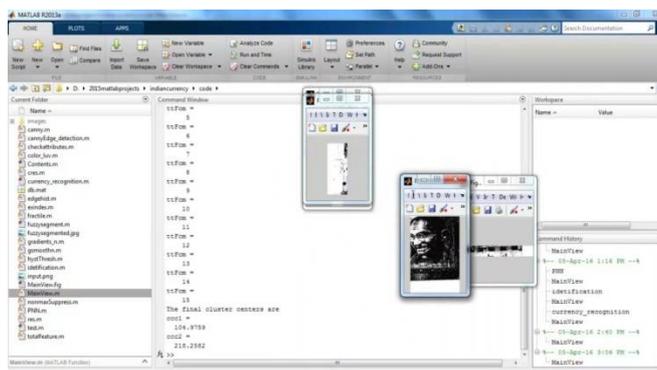


Fig.9: Comparison of input image with authentic currency

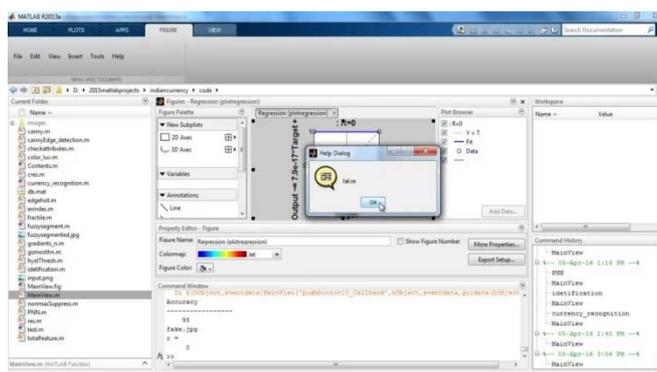


Fig.10: Result of comparison

V. FUTURE SCOPE

Machines available today are not only fake note detector but they provide an extra facility of counting them. This feature can be added with our device that would make it as most reliable counterfeit currency detector along with counting feature that would be helpful for banking purpose. This project discussed a technique for verifying Indian paper currency. This project is an effort to suggest an approach for extracting characteristic of Indian paper currency. Approach suggested from the beginning of image acquisition to converting it to gray scale image and up to the word segmentation has been stated. The work will surely be very useful for minimizing the counterfeit currency. In Future, Mobile app can be developed which would be useful for normal as well as visually impaired persons, the same system can be developed for the remaining Indian currency notes and other country's currency notes. Also the app's interface can be further modified as per the user requirements. This will increase its utilization by increasing its user network since India is going to establish the largest digital network in the world in the coming years. Thus the application will be available in all android devices and IOS devices in future if worked upon.

VI. CONCLUSION

This project helps to detect the fake currency using image processing. This would eliminate the circulation of fake note in the system to some extent. It would provide an opportunity for the user to properly detect the authenticity of note actually without going to the banks. This project discussed a technique for verifying Indian paper currency. This project is an effort to suggest an approach for extracting characteristic of Indian paper currency. Approach suggested from the

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