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A Review on Recognition of Indian Currency Note Using Cross Co-Relation Technique

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Abstract - In recent years it has become a very essential to develop an automatic methods for paper currency recognition as its more likely to be used in most of the areas such as vending machines, shopping centers, educational sectors, banking systems in case of huge transactions and so on. As the technology is growing fastly it has become more easy to use such systems. Now a days using automated machines any one can easily get to know whether the currency is a genuine or counterfeit and also the denomination of that currency. The technology has also provided a better way of life for peoples. There is a need to design a system that is helpful in recognition of paper currency notes with fast speed and in less time. This approach basically provides an easy method for recognizing the denomination of an Indian currency note .This proposed approach works on all the notes such as Rs.10, Rs,20, Rs.50, Rs.100, Rs.500, Rs.1000.Indian currency features such as extracting geometric shape ,denomination object are extracted from a 4*4 grid of Indian currency image. Feature extraction plays an important role in successfully achieving value/ denomination of an Indian note. The approach consists of a number of components including image acquisition, converting RBG to HSV image, image pre-processing, Feature extraction, images are compared. The Artificial neural network is used to identify value denomination of an Indian currency note.

Keywords—Feature extraction, Indian Currency recognition, color features, neural network.

I.INTRODUCTION

Paper money is still a widely accepted mode of money transaction besides so many alternates. The attractive features of the paper currency include privacy, simplicity, durability and complete control. But as a means of value transaction it lacks intrinsic value, and mechanism of reversal in case of repudiation, except the credential support by the state. Recent phenomena of financial self service being supported by the banks and other financial institutions have started various services of automated banking systems which have the currency recognition as its key activity making automated currency recognition and classification a key problem. Ample amount of the effort has been devoted for the same [1, 2, 3, 4, 5, and 6]. Neural networks (NN) are widely used in the field of currency recognition. Takeda et al. [2] have used a random mask for preprocessing the data and used a multi-layer neural network as the classifier for recognition of paper currency. ER-HU Zhang et al. [3] have extracted the edge information on paper currency and then used a three-layer BP NN for recognition. Although the NN technology has the ability of self-organization, generalization and parallel processing, and has a good fit for pattern recognition, it also has some weakness. First, it needs a large number of training samples, which are used to avoid over fitting and poor generalization. Second, if the distribution of training sample is not uniform, the result will probably converge to a local optimal or will even diverge unreasonably. Therefore, the selection of the training set is a crucial issue for the NN. In currency circulation, the original information on paper currency may have a loss because paper currency may be worn, blurry, or even damaged. Furthermore the complex designs of different kinds of paper currencies make automatic currency recognition difficult to work well. So it is important how to extract the characteristic information from currency image and select proper pattern recognition algorithms to improve the accuracy of currency recognition. The method we present here has an excellent performance. Automatic methods for paper currency recognition become important in many applications such as automated teller machine and automated goods seller machines. This

system is designed to recognize and verify the Indian paper currency. The approach consists of a number of steps including image acquisition, gray scale conversion, edge detection, feature extraction, image segmentation and comparison of images [1]. This is a challenging issue to system designers. Every year RBI (Reserve bank of India) face the counterfeit currency notes or destroyed notes [2]. Handling of large volume of counterfeit notes imposes additional problems. Therefore, involving machines (independently or as assistance to the human experts) makes notes recognition process simpler and efficient. Automatic method for detection of fake currency note is very important in every country. In this approach we extract the general attributes of the paper currency like identification mark and serial numbers of currency. The identification marks helps to know the denomination of currency [7]. The serial number of currency helps to detect fake or genuine. The system is designed to check Indian currency notes of 100, 500 and 1000 rupees. The system will display currency denomination and either currency is genuine or fake.

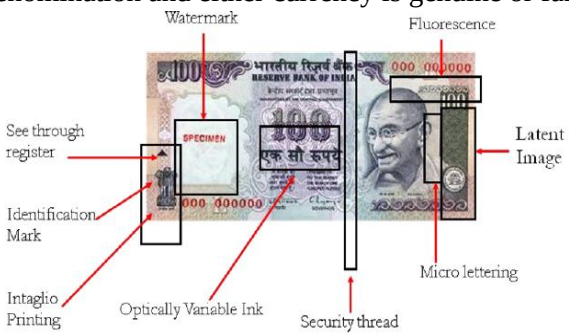

Fig. 1 Security features of indian curency notes [4],[5]

Since from the ancient times gold, silver, copper and bronze coins were used as currency without any denomination till 6th century in India. Later on,in 18th century many banks originated and they started printing paper currency .In 1996, Mahatma Gandhi series of notes were introduced. Currency is a term which refers to intermediate of exchange. Each country possess its own currency. There are huge number of currencies in the word. The currency of India is Rupee. The First paper money was introduced by the Government of India in the year 1861 by issuing Rs.10 notes. In the year 1864, Rs. 20 note, Rs.5 in 1872, Rs.10,000 in 1899, Rs.100 in 1900, Rs.50 in 1907 and Rs.1000 in 1909. In present generation, India is having currency system as the Rs.5, Rs.10, Rs.20, Rs.50, Rs.100, Rs.500, and Rs.1000.Indian currency notes are having their own features such as face value of the banknote, shape, color; quality, texture etc. Visually disabled people also can identify the denomination of Indian currency based on special identification marks. At the top right end every Indian currency note has its fixed denomination that one can feel by sensitive touch. But marker may gets fade after many the distribution of copies of a periodically among readers. It is very important to develop automatic system to extract feature and recognize Indian currency note it is important in various areas such as bus station, railway station, shopping malls, banking and ATM machines so that it could help the people especially for visually disabled peoples. In image processing, the potential features are extracted from Indian currency notes such as, identification mark and denomination object. So as to identify the denomination of that Indian currency. Automatic Methods for paper currency denomination recognition have become very important in most of applications. The system is designed to recognize and verify the denomination of an Indian currency. The challenging task for system designers is the every year RBI faces the problem of counterfeit currency notes[4].Every Indian bank note contains these features.

i. Optical Variable Ink: The color of the number 500 appears green when the banknote is held flat but would change to blue when the banknote is held at an particular angle. The font size is also decreased.

ii. Latent Image: when keeping note at right angles to the vertical, the vertical band on the right shows an image of the number 500.

iii. Security Thread: The note also has a three millimeter wide security thread with the inscriptions: one thousand, the word 'Bharat' in Hindi and RBI.

iv. Micro lettering: The 'RBI' and the digit, "500" -which can be seen with the help of a magnifying glass -are between the Mahatma Gandhi portrait and the vertical band.

v. Watermark: When the note is held opposite the light, the image of Gandhi and an electrolyte mark display the number 500 appear in the white region.

vi. Identification mark :An identification mark is being used in the Indian currency for the benefit of visually impaired people. They can identify the denomination based on the intaglio printing by a touch and it is having different geometrical shapes for various denominations,

such as for Rs.20 having rectangle shape,Rs.50 having a square shape, Rs.100 having triangle shape,Rs.500 having circle and Rs.1000 having rhombus shape.

vii. Fluorescence: The unique number on the notes are printed from fluorescent ink. The bank notes are having optical fibers. They can be seen when viewed under a ultra violet light. A different and unique kind of font style is used. The numbers will be thick and written in red color.In the proposed work ,Instead of dividing entire note into 3*3 grid[1] and to avoid extra noise that comes in extracting the features. Dividing the entire currency into 4*4 grid and extracting the features. Instead of applying only to the notes such as Rs.100, Rs.500, Rs.1000. Better to be applied on all notes such as Rs.10,Rs.20,Rs.50, Rs.100, Rs.500, Rs.2000,as they differ in geometric shape. Every single denomination has different geometric shape.

II.LITERATURE REVIEW

In[1],proposed "Grid Based Feature Extraction For The Recognition Of Indian Currency Notes ",The approach provides to identify the denomination of an Indian currency note using grid technique. The extraction of features from a 3*3 grid image makes possible to identify the value of a currency .Based on geometric shape, year of print, and denomination of currency the notes such as Rs.100, Rs.500, Rs.2000 are determined using neural network as a classifier.

In [2],proposed “Indian Currency Denomination Identification Using Image Processing Technique”, The paper mainly provides an image processing technique to extract Indian paper currency denomination. The ROI is extracted and converting it into grayscale and setting up level. The Denomination value can be obtained by integrating the sobeledge filter, average filter and laplacian filter. The use of image processing techniques to identify specific region of interest and then applying neural network classifier and pattern recognition techniques have been used to identify the denominations.

In [3],proposed “Recognition of Indian Paper Currency based on LBP”, The paper makes use of local binary pattern(LBP) to extract the features and helps into recognizing the Indian currency denomination. The LBP operator is used on gray scale image and difference between original image and input image is carried out. The Euclidean distance is used as a classifier. The proposed algorithm has advantages of being simple and having high speed. The observed results show that this method has a high recognition rate. The recognition ratio can achieve 100% in case of good quality images.

In [4], proposed “Recognition of Indian Currency Note Based on HSV Parameters”, The paper basically allows to identify the image of Indian currency note is genuine or counterfeit. The RGB image is converted to HSV .The features are extracted by using histogram, hue, saturation, intensity/value. The histogram of input image is compared with saved images. If, threshold is greater than specified value then the image is considered as a genuine. Calculating the hue and saturation of given image and if threshold is less than the given image then it's a genuine. The neural network is used as a classifier. The above suggested approach works for all the Indian currencies.

In [5], proposed "Indian Currency Recognition and Verification System Using Image Processing", The paper helps us to identify the given image is genuine or not. It makes use of two features to identify i.e. identification mark and serial number. The RGB image is converted to gray scale and then edges are detected using sobel operator. The features are extracted from a segmented image and comparison is made .The count of black pixels from a segmented image matched then the currency is considered as a genuine. This technique is easy to implement in real word application.

III.PROPOSED ALGORITHM

A. *Algorithm:*

- Obtain the image of the target currency using one of the possible methods (e.g. : Camera, Scanner, etc).
- Use Image Pre processing algorithms to change the nature of the image in order to extract required information.
- Detect the boundaries and extract the ROI (Region of Interest) using cropping.
- Extract the desired features.
- Compare the extracted feature values with ideal feature values that are calculated.
- Display the outputs.

B. *Description of the Proposed Algorithm:*

Aim of the proposed algorithm is to develop an algorithm which can be easily applied to number of different currencies and has good efficiency and high speed.

Step 1: Obtaining the Image:

An Image can be obtained using number of different equipments, such as cameras or Scanner. The only precaution we need to take is, try to maintain a controlled environment so that the external factors won't affect the feature values.

Step 2: Pre processing Operations:

Pre processing operations are required to alter the nature of the image, which makes extraction of features easier. In this particular case, pre processing operations involve, blurring, grayscale conversion, thresholding, noise removal using filters, color blurring RGB to HSV conversion. These operations help us in detecting boundaries, cropping the ROI and Calculating color features.

Step 3: Boundary Detection and cropping:

For boundary detection, we require a binary image, which has only 2 colors, black and white. All we do in this process is simply, separate the background and the foreground, and separate the ROI.

Step 4: Feature extraction:

The next step is to extract required information from the cropped ROI image. So from the binary image we find out the dimensions of the currency and find out the aspect ratio, aspect ratio remains same in all light conditions, so it becomes an important feature for recognizing image. Then we compare the aspect ratio of the target image with the ideal aspect ratios of all the denominations of that particular currency. The other features we extract are H, S and V of particular blocks of the currency. We divide the currency in number of blocks. We extract the HSV values of all the pixels and take average of their H, S, V features and again compare them with the values from the database.

IV.PROPOSED ARCHITECTURE

The proposed work deals with implementation of an automated recognition system, which helps us to recognize the denomination of Indian Currency.

The proposed system of recognizing the denomination of Indian currency notes is divided into different steps. The acquired image is first preprocessed by reducing the size of data dimensionalities and extracting its required features by using image processing tool box in MATLAB. Once the features are extracted then the neural network classifier is used to recognize and finally the result is obtained i.e. determines the denomination of the given input. The proposed data flow diagram is used to identify the value of an Indian currency. The work involves processing of different images of Indian currency and to recognize the denomination of the input image. Extracting the features from the input image, the RGB image is converted in HSV and totally 18 features are obtained, then image is divided into 4*4 grid to get specified features and to avoid unnecessary noise during the extraction phase. The geometric

A. Image Preprocessing

The aim of image processing is to improve the image data and suppresses the undesired distortions or unwanted areas. These methods are classified according to the size of pixel, those are used for the calculation of new pixel. In the system we are resizing the image and then dividing into grid so that features can be more clear and extracted easily. The image features which are important for additional processing and study includes Image adjusting: When the image is obtained from a camera or any other device the size of the obtained image is too big for the processing. In order to minimize the calculation the image size is reduced. The Captured images are resized to 200*400 pixels to reduce computational time. That occurs during processing of images. By resizing, the storage efficiency can also be improved. Converting color image to gray scale: Note that only front images are converted to black, because in color image red, green, blue colors have same frequency from 0 to 255, hence it will create ambiguity in extraction as it is difficult to differentiate the colors using color code. When an color image is converted to gray scale then the whole image has the frequency from 0 to 255 hence it is easy to perform extraction. To

convert color image to gray scale image MATLAB provides a function b=rgb2gray (a), where a is a color image and this function converts that image to gray scale image and returns it into a another variable.

B. Image Filtering:

During the image transfers, some noise may be present on the image. Removal of the noise is an very important step to be performed. The presence of the noise may affect during extraction and segmentation or during matching. Filtering is a process of removing noise from the image for better results. MATLAB provides a function beware open, which take input black and white pixels and it contains two parameter first is an black and white image and second is an integer number, in an image if white pixels are grouped less than or equal to specified limit then all pixels are converted to black and it returns a filtered image. Later on it is stored in another variable.

V.CONCLUSION

In this work, we proposed a model for recognizing the denomination of Indian currency note. It performs an efficient and quick recognition of Indian currency note using Cross Correlation Technique. In this project we reviewed number of articles related to currency recognition system.

So we can conclude that with above proposed algorithm, we can recognize currencies, which have good differentiation in color and size related to features. Also Template Matching based approach give quicker results.

We have also successfully retrieved currency conversion rates from the internet, using web service .In order to make this project widely useful and accurate, we can work on involving first line inspection methods in the algorithm and with these improvements, this system could be a very useful tool in order to prevent high order counterfeiting by taking advantage of cheaper and high quality equipment.

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