Currency Note Authentication on Map Reduce Paradigm

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***ABSTRACT*-In cash transactions, the biggest challenge faced is counterfeit notes. This problem is ever expanding due to the technology available and many fraud cases have been uncovered. Manual detection of counterfeit notes is time consuming and inefficient and hence the need of automated counterfeit detection has arisen. To tackle this problem, we studied existing systems using Matlab. An efficient way of detecting counterfeit can be implemented using Map Reduce.**

KEYWORDS: Counterfeit, Image Processing, Map Reduce, Feature Extraction, Authentication, Indian Currency Notes.

I. INTRODUCTION

Image processing is basically a technique in which an image is converted into a digital form and there are various operations performed on it in order to get an enhanced image and to extract useful information from it. The images are digitized with the help of a scanner or by a video camera which is connected to the frame grabber board in computers. This digitization is done so that it can be stored in computers memory or in a form of media storage like CD-ROMs and hard disks. The image used as input in this technique can be a video frame or photograph and the output received may be an image
or some characteristics associated with that image. It is a type of signal dispensation which treats an image as two-dimensional signal by applying already set signal processing methods. In today's world, with rapid growth of technology, image processing is being used in various fields and is playing a very important role.In this fast-paced world with an ever expanding market, there came a great need to make optimum use of all the resources. With the massive storage of images, there came the realization that images are an indispensable source for the extraction of meaningful information.

Image processing is done by following the below three steps

- Importing the image with optical scanner or digital photography.
- Image is then analyzed and manipulated for data compression, image enhancement and pattern recognition as they are not clearly visible to human eyes.
- Output is the last stage in which result can be altered image or report that is based on image analysis.

Extraction of meaningful information from images is known as Image Processing; mainly taken from digital images by means of techniques of digital image processing. Image analysis tasks can be as simple as reading bar-coded tags or as sophisticated as identifying a person from their face. Digital image analysis is when a computer or electric device automatically studies an image to obtain useful information from it.

The field of Image analysis was developed in the 1950s. It is the quantitative or qualitative characterization of two-dimensional or three-dimensional digital images. 2D images are, for example, to be analyzed in computer vision, and 3D images in medical imaging. It has been rightly said that "A picture is worth a thousand words". Image Processing is the need to observe the objects that are not visible, Restoration and Image sharpening to create a better image, Image retrieval to seek for the image of interest, Measurement of pattern that Measures various objects in an image and Image Recognition to distinguish the objects in an image.

Analysis of images can help us make strategic decisions in fields of business and research..Analysis of images can help us make strategic decisions in fields of business and research.

II. LITERATURE SURVEY

We have seen a Grid Based Feature Extraction where grids are applied to the images for processing them further. The feature sets used in it are geometrical shapes to recognize the denomination, governor declaration and year of printing. There are various algorithms used for finding out these feature set which work as a part of the whole algorithm of processing. Geometrical shapes for denomination are extracted by feed forward neural network classifier, Governor Declaration by region properties and year of print by Optical Character Recognition technique. The algorithm takes the images in RGB and then converted in a binary image. A 3*3 grid is applied to the image both on the top and back side of the image to create 18 blocks. Block 4 is selected for denomination of notes where the neural network classifier extracts the shape in it further classifying the amount of the note. Block 8 is selected for calculating the maximum and minimum orientation in order to recognize the position of the Governor declaration. Block 17 is selected for recognition of year of printing, which segments the characters and matches them with standard template by using correlation technique. Correlation value range from 0-1, if the value is 0 is said to be a minimum match and if 1 the maximum match. The experimental setup is done on sample of 90 images, where 30 images each are of rupees 100,500 and 1000.The average success rate achieved is 92.30%.The best validation performance of neural network classifier is 0.91181 at epoch 59.The advantages of using these techniques have been proved to be very efficient and accurate and have overcome the shortcoming of other algorithms for recognition of Indian currency. After studying the existing systems and the different algorithms and techniques used for processing and analysis for identifying counterfeit in notes, we realized that the different shortcomings in them can be overcome using map reduce platform.

III. IMPLEMENTATION

- See through register

The small floral design printed both on the back and front of the notes in the center of the vertical band next to the Watermark has an accurate back to back registration. The design will appear as floral design when it is seen against the light.

- Water marking

The Series of banknotes contain the Mahatma Gandhi watermark having a light shade effect and multi-directional lines in the watermark window.

- Optically variable ink

This is a new feature included in the Rs.500 note having revised color scheme introduced in November 2000. The numeral 500 on the obverse of Rs.500 note respectively is printed in optically variable ink viz., a color-shifting ink. The color of the numeral 500 appears green when the note is held flat but would change to blue when the note is held at an angle.

- Fluorescence

In fluorescent ink the number panels of the notes are printed. The notes also have optical fibers. These both can be seen when the notes are exposed to ultra-violet lamp.

- Security thread

The Rs.500 note has a security thread with visible features and inscription Bharat (in Hindi) and RBI. When held against the light, the security thread on Rs.500 can be seen as only one single continuous line.The security thread appears to the left of the Mahatma's portrait.

- Intaglio printing

The portrait of Mahatma Gandhi, the Reserve Bank seal, guarantee and promise clause, Ashoka Pillar Emblem on the left, RBI Governor's signature are printed in intaglio , which can be felt by touch, in Rs.500 notes.

- Latent image

On the obverse side of Rs.500 note, a vertical band on the right side of the Mahatma Gandhi's portrait contains a latent image showing the denominational value in numeral. The latent image is visible when the note is held horizontally at eye level only.

- Micro lettering

This feature appears between the vertical band and Mahatma Gandhi portrait. It always contains the word RBI. The notes contain the denominational value of the notes in micro letters. This feature can be seen well under a magnifying glass.

- Identification mark

Each and every note has a unique mark of it. A special feature in intaglio has been introduced on the left of the watermark window. This feature is in different shapes for various denominations and helps the visually impaired to identify the denomination.

- Year of printing

Each note has the year of printing the note on the back side of the note.The year has been started printed on the notes after 2005.Before 2005,there was no year printed on the notes.

SYSTEM ARCHITECTURE

The proposed system architecture will be followed.

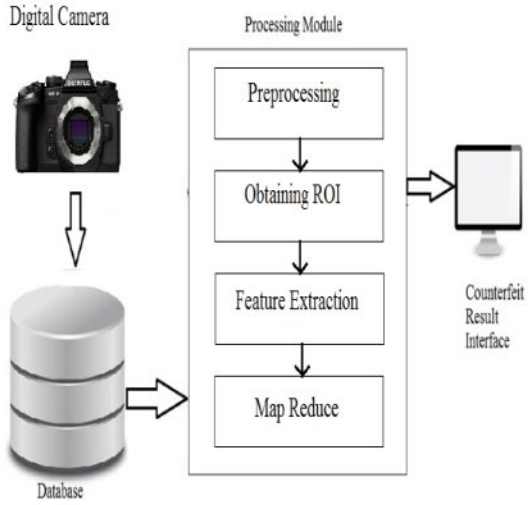

Fig1:SystemArchitecture

IV. METHODOLOGY

- Image Acquisition

Image is taken from a digital camera where we are applying white backlighting against the currency in order to obtain the hidden features.

Fig2:The Original RGB Image

- Image Pre-processing

Pre-processing of image currency note so that we can perform noise reduction prior to feature extraction and image analysis.

Fig 3: The Noiseless Image

- Gray-scale conversion

The acquired image which is in RGB format is getting converted to a gray-scale image which carries only the intensity of the image in order to have easy image-processing.

Fig 4:The Gray Scale Image

- Edge Detection

The gray scale image is then used to detect edges by edge detection using Sobel operator.

Fig 5:Sobel Edge Detection

- Image Segmentation

By performing segmentation we are partioning the image into segments in order to get ourspecificregion of interest.The ROI is then used for feature extraction.

- Feature extraction

After this, features are extracted from the edge detected note in order to subtract the foreground object from the background.

- Decision making

The intermediate results for the unique identification mark and see through register has been obtained by implementing the proposed methodology for a large number of currency notes of denomination 500.The threshold has been decided by studying the computational values obtained after feature extraction.

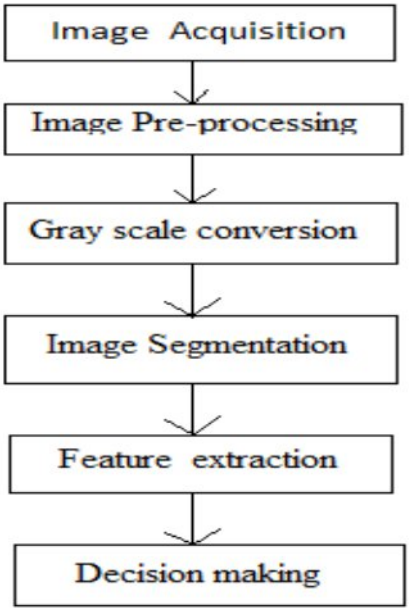

Fig 6:Design Flow

V. INTERMEDIATE RESULT

The proposed methodology has been implemented for the following two parameters:

- Unique Identification Mark

The unique identification mark of Indian currency note of 500 denominations is a circle on the left hand side of the front of the image. This has been extracted using Feature Extraction techniques. The result obtained has been shown below.

Fig 7: The extracted Unique Identification Mark

- See Through Register

The see through register is a floral print with the denomination appearing in the center and it is positioned above the unique identification mark. The obtained result after Feature extraction techniques has been shown as follows.

Fig 8:The extracted See Through Register

VI. CONCLUSION

In this paper, Indian currency note authentication of denomination 500 has been described using image processing and analysis. The methodology includes image acquisition, pre-processing, feature extraction and lastly decision making depending on the threshold value obtained after analysis. Results have been obtained for the Unique Identification Mark and the See Through Register. This system will be developed in order to extract features of parameters like the Security Thread, Intaglio Printing, Optically Variable Ink and Fluorescence. The final decision of counterfeit will be decided using the Map Reduce.

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