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Identification of Fake Notes and Denomination Recognition

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Abstract: Currency recognition technology focuses on searching and retrieving visible and hidden tags in paper currency for an efficient classification. The currency recognition and conversion system is implemented to reduce human power to perceive the measure of the currency value and to convert it to other currencies without human supervision. The software interface we suggest here could be utilized for various monetary standards. Habitually, banknotes are blurry or damaged; many have complex recommendation to increase security. This makes the errand of perceiving the money exceptionally troublesome. So it is predominant to choose the right functions and the right algorithm for this aspiration. The fundamental prerequisites for an algorithm that can be considered as practicable are simplicity, less complexity, high speed and efficiency.
Keywords: Recognition, classification, currency

I. INTRODUCTION

Image processing is a rapidly growing area of research with application to various aspects of business. Image processing is used to convert an image to digital as well as to obtain certain types of information from the same. The image processing and processing modes include analog and digital image processing. Digital image processing techniques helps to manipulate digital images with computers. The system uses computer algorithms for image processing which is better than analog processing and prevents various processing problems such as noise and signal distortion that provides more complex algorithms and implementation of methods that are not possible in analog design. Currency is used as the medium of exchange for goods and services. Human error is a huge concern in cases where large amounts of cash transactions are conducted, leading to a push for increase in automation of transactions in the banking sector. Indian paper currency consists of six major denominations, with each having distinguishing features, such as size, prominent color, identification mark. With the development of sophisticated printing techniques, counterfeit currency has become a significant concern. Some of the consequence of counterfeit notes on society are a reduction in the value of real money, increase in prices due to more money being circulated in the economy and decrease in acceptability of money. To prevent circulation of counterfeit notes, a system to detect fake notes must be developed. Notes with the legal sanction of the government possess certain security features such as intaglio printing, fluorescence and watermark.So far, many different approaches have been proposed to solve the problem of paper currency recognition and verification. The trade-off between accuracy, complexity and response time becomes the main hurdle to overcome.

II. LITERATURE SURVEY

Barani.S proposed Currency Identifier for Indian Denominations to Aid Visually Impaired. Identification of various denominations of currency is not an easy task for visually impaired people. In India though there are special symbols embossed on different denominations, still the task is tedious for blind people. The lack of identification devices motivated the need of a handheld device for segregation of different denominations. This work attempts to design a device using IR sensors, for Currency identification of Indian Denominations (CiID) to aid visually impaired people. The variation in the voltage level of various currencies, are observed and detection has been implemented. This device has an accuracy of 86%. Vishnu R, Bini Omman proposed Currency Detection Using Similarity Indices Method. The determination of the currency denomination is an issue in paper currency recognition system. This paper proposes a robust method to recognize the paper currency using the pattern matching. In the proposed algorithm a similarity measure is used to classify the currency based on the similarity of the extracted features. To evaluate the performance of the proposed method experiments were conducted over 200 of currencies of different denominations. On performing the experiment the proposed method gives 97% accuracy MrigankaGogoi, Syed Ejaz Ali Subra Mukherjee proposed Automatic detection and recognition of Indian currency note has gained a lot of research attention in recent years particularly due to its vast potential applications. In this paper we introduce a new recognition method for Indian currency using computer vision. It is shown that Indian currencies can be classified based on a set of unique non discriminating features such as color, dimension and most importantly the

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Identification Mark (unique for each denomination) mentioned in RBI guidelines. Firstly the dominant color and the aspect ratio of the note are extracted. After this the segmentation of the portion of the note containing the unique I.D. Mark is done. From these segmented image, feature extraction is done using Fourier Descriptors. As each note has a unique shape as the I.D. Mark, the classification of these shapes is done with the help of Artificial Neural Network. H. Hassanpour A. Yaseri G. Ardeshiri proposed a new technique for paper currency recognition. In this technique, three characteristics of paper currencies including size, color and texture are used in the recognition. By using image histogram, plenitude of different colors in a paper currency is computed and compared with the one in the reference paper currency. The Markov chain concept has been employed to model texture of the paper currencies as a random process. The method proposed in this paper can be used for recognizing paper currencies from different countries Chengxiang Liu, Shuangchen Ruan and Guiming Huang proposed –Paper currency identification is widely applied in many fields such as bank system and automatic selling-goods system. How to extract high-qualified monetary characteristic from currency images is an important technology needing to be solved now. Infrared images can reveal the Intaglio Printing of paper currency, which extent the traditional touching the concavo-convex effect to use images to identify the counterfeit. The contrast of infrared images is not great. It is influenced by uneven surface and other disturbances (such as fold, holes etc.), so using traditional processing and enhancement technologies are hard to identify the counterfeit. In this paper, the original infrared images have been embossed process firstly. Then we gain the binary images by using closing operation. At last, we use template matching to identify.

A. Existing System

The proposed system gives the algorithm with low computational complexity, which can meet the high speed requirement in practical applications. It is also important to note that the proposed technique may not be able to distinguish counterfeit notes from genuine notes. The proposed system till now gives 97% accuracy on a data set of scanned currencies of different denomination. The device used by blind community to differentiate various denomination of Indian rupee used IR sensors, where The sensors used are sensitive to light hence the design of the device should be in such a way that light intensity does not affect the performance of the device. The processing time of the proposed system extend up to 2.52sec which effected the real time

III. METHODOLOGY

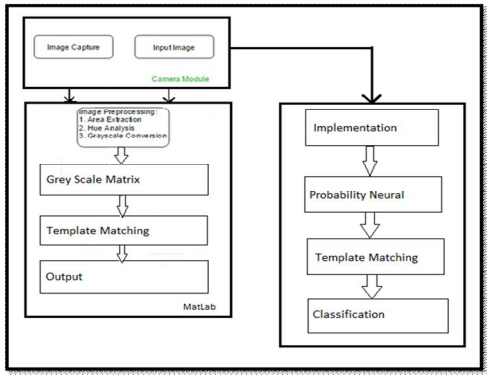


Fig 1: System Architecture

A. Note Extraction

Noise Removal- Median filter: It is a non-direct computerized procedure, frequently used to expel noise from images. This is performed utilizing a window comprising of an odd number of tests. The arrangement into numerical request is done based on the values in the window.As a few calculations are inspected, each of which is relevant to settled and irregular esteemed motivation commotion models B = medfilt 2 (A) performs middle sifting of the picture an of every two measurements.

B. Feature Extraction

A strategy of analyzing the texture that content the relationship of pixels is the Gray-Level Co-occurrence Matrix (GLCM). Gray-Level Spatial Dependence Matrix. The texture filter functions, depicted in Texture Analysis can't give data about shape, that is, the spatial connections of pixels in an image. After generating the GLCMs, using gray co-matrix, several statistical measurements utilizing graycoprops can be obtained from them. These measurements yield details about the surface of an image.

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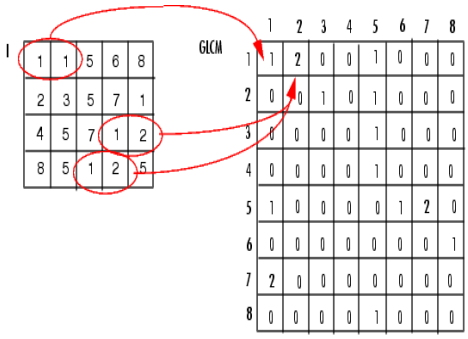


Fig 2: Denominations

C. Preprocessing

Noise Removal: Digital images are subjected to different kinds of noise. There are certain ways that noise can be brought into an image.

1) *Remove Noise by Linear Filtering:* You can utilize linear filtering to evacuate certain kinds of commotion. Certain channels, for example, averaging or Gaussian channel
2) *Remove Noise By Adaptive Filtering:* This case demonstrates to utilize the wiener2 capacity to apply a Wiener channel to a picture adaptively.
3) *Template matching:* Template matching is used for classification. The examination of two pictures is done in view of connection coefficient.

D. Classification:

Probabilistic neural networks can be used for classification problems. When an input is presented, the first layer computes distances from the input vector to the training input vector. The second layer sums these contributions for each class of inputs to produce as its net output a vector of probabilities.

E. Template Matching

It's a technique in digital image processing for finding small parts of an image.which match a template image. It can be used in manufacturing as a part of quality control, a way to navigate a mobile robot, or as a way to detect edges in images.



(a) (b)

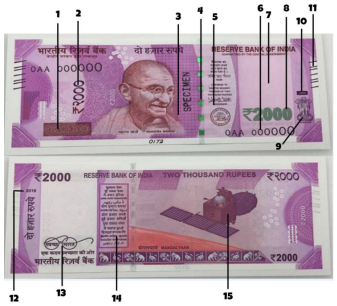


Fig 3: Templates Matching

F. Note Features

1) Latent image with denominational numeral
2) Denominational numeral written in Devnagari
3) Rs '2000' and 'RBI' in Micro letters written on the left side of the banknote
4) The security thread has inscriptions of RBI, 'Bharat' in Devanagari.
5) Governor's signature and RBI emblem is towards the right.
6) It is a number panel with numerals growing from small to big.
7) The watermark image of Mahatma Gandhi
8) The denominational numeral changes colour from green to blue.

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9) The presence of Ashoka Pillar emblem on the right.
10) Rs 2000 in the rectangle above the emblem.
11) Seven angular bleed lines.
12) The printing year of the note.
13) The logo of Swachh Bharat along with slogan.
14) Language panel with "rupees 2000" written in various Indian languages.
15) Motif of Mangalyaan

G. Denominations

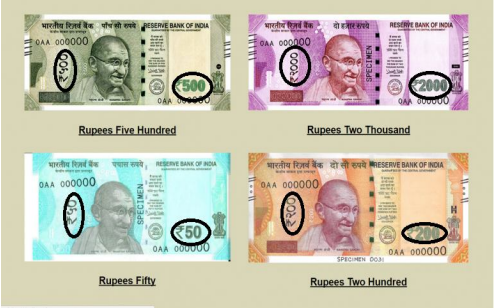


Fig 4: Denominations

Denomination (₹)	Length (mm)	Width (mm)	ID Mark	Colour
10	137	65	N/a	Orange-Violet
20	147	65	▌	Red-Orange
50	147	73	■	Violet
100	157	73	▲	Blue-Green
500	167	73	●	Olive-Yellow
2000	177	73	♦	Pink

IV. EXPERIMENTAL IMPLEMENTATION AND SAMPLE SCREENS.

In order to implement the proposed solution of finding Counterfeit notes, we simulate the operations of image processing with the help of MATLAB. The following figure shows the input image.



Fig 5 : scanned input image

Fig 5. After the image has been acquired and segmented, it will be transformed to the gray scale format. The original input image is in RGB color. It is converted into gray scale because it carries only the intensity information which is easy to process instead of

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processing three components - R (Red), G (Green), B (Blue). In this, the image of the currency notes gets converted into gray scale from file format to pixel values. Converting to gray scale does not reduce the required level of information of currency notes. Then a new set of values has been generated from original gray scale pixel values by having a linear combination of the former values. After the transformation, edge detection is performed to extract the image's identity as what is used to recognize by the system. Edge detection reflects sharp intensity changes in the colors of the image. Then this detected edge information is extracted and arranged in a format required by the network.

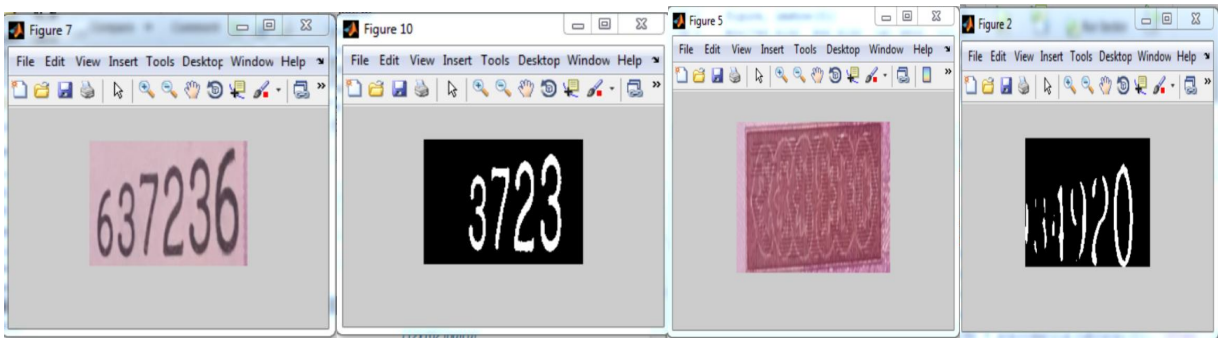


Fig 6: features extracted

The figure 6 shows the detection of edges to extract features.



Fig 7:user interface for currency detection

The given image involves two types of services - Real and Fake. The segmentation of the image is as shown in the fig 7. The next stage is identification of denominations for various Indian currencies such as is 2000, 500, 200, 50, 10 for this a user interface is been created which is as shown in the Fig 8.

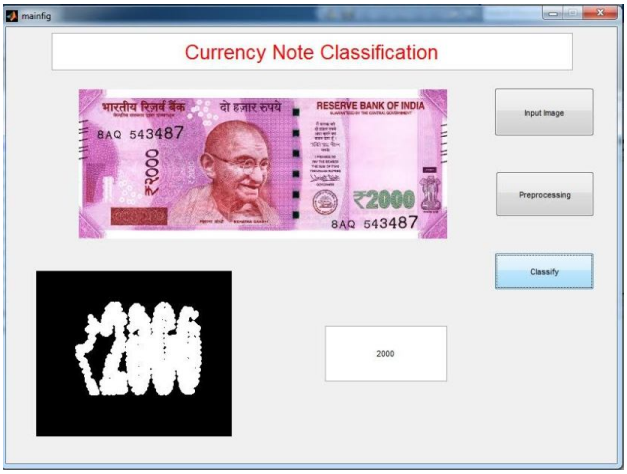


Fig 8:user interface for currency classification

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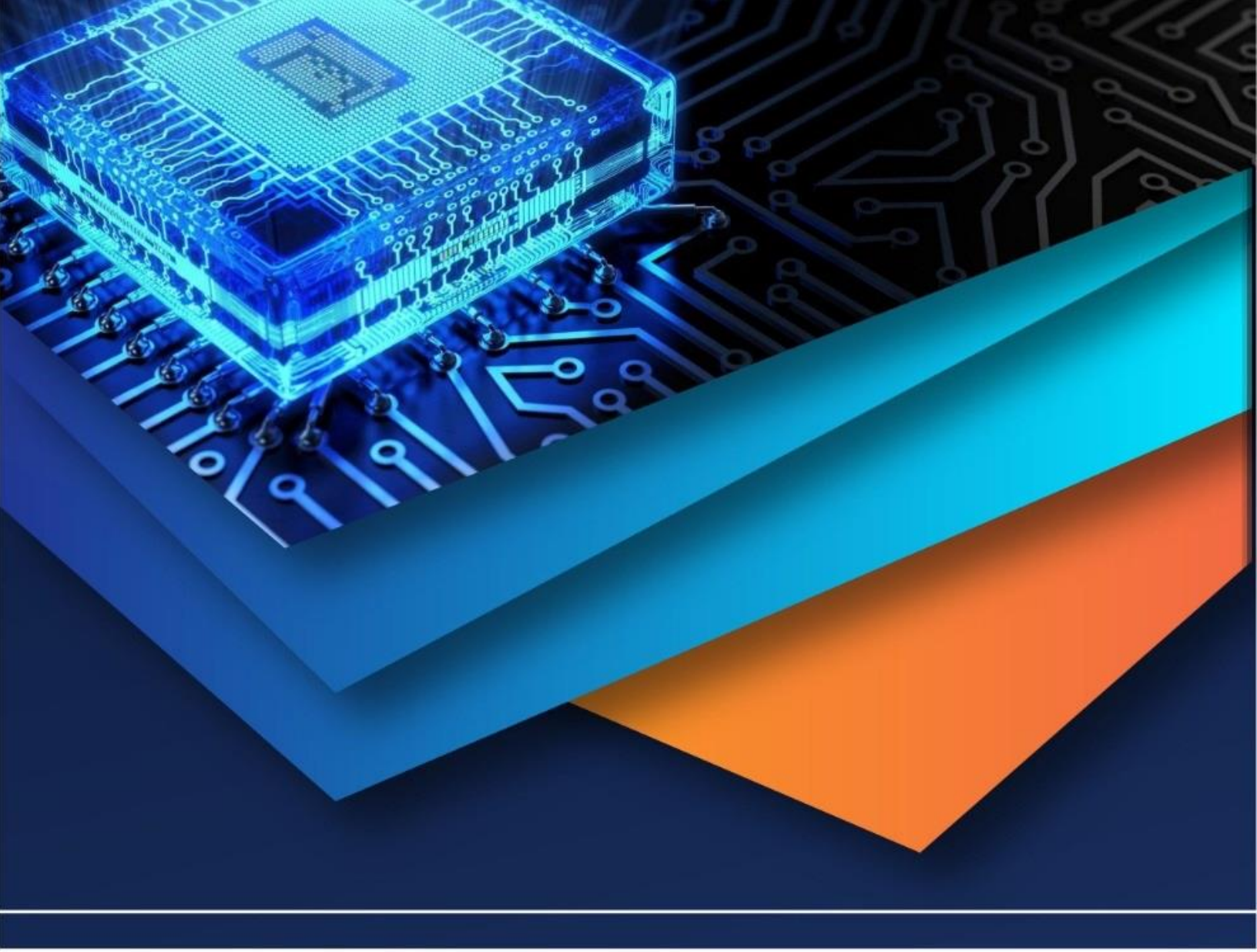
V. CONCLUSION & FUTURE SCOPE

The authentication of Indian paper currency is described by applying image processing. Fake note or Counterfeiting of bank notes affects the survival of the financial symmetry as its value, rapidity, output and wellbeing may be affected. Majority of countries uses paper money for transactions, overwhelmed by this difficulty. Counterfeit currency recognition systems have become an important part of the banking sector. The proposed methods to classify denomination and identify counterfeit notes have high accuracy of 100% and 90% respectively, while still maintaining low system complexity. As systems to take pictures of both the obverse and reverse of the note already exist, using them in conjunction with the proposed algorithm allows for the time taken for computation to be low. As the techniques used have the advantage of low processing time, low intricacy and reliability, it is suitable for real time applications. Each and every currency note will be link to central RBI server database and hence duplicate note tracking will be easy. Nobody can introduce a duplicate currency note in the market and increases security. Costumer will get 100% reliable note from ATM. Currency checking makes ATM more efficient and reliable.

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