Currency Recognition using Image Processing

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Abstract- There are around 200+ different currencies used in different countries around the world. The technology of currency recognition aims to search and extract the visible as well as hidden marks on paper currency for efficient classification. Currency Recognition and conversion system is implemented to reduce human power to automatically recognize the amount monetary value of currency and convert it into the other currencies without human supervision. The software interface proposed here could be used for various currencies (we are using four in our project). Many a times, currency notes are blurry or damaged; many of them have complex designs to enhance security. This makes the task of currency recognition very difficult. So it becomes very important to select the right features and proper algorithm for this purpose. The basic requirements for an algorithm to be considered as practically implementable are simplicity, less complexity, high speed and efficiency. The main aim is to design an easy but efficient algorithm that would be useful for maximum number of currencies.

INTRODUCTION

All currencies around the world look totally different from each other. For instance the size of the paper is different, the same as the colour and pattern. The staffs who work at places like money exchange offices have to distinguish between different types of currencies and that is not an easy job. They have to remember the symbol of each currency. This may result into wrong recognition, so they need an efficient and foolproof system to aid in their work. The aim of our system is to help people who need to recognize different currencies, and work with convenience and efficiency. With development of modern banking services, automatic methods for paper currency recognition become important in many applications such as vending machines. It is very difficult to count different denomination notes in a bunch. This project proposes an image processing technique for paper currency recognition and conversion. The extracted region of interest (ROI) can be used with Pattern Recognition and Neural Networks matching technique. The image processing approach is discussed with MATLAB to detect the features of paper currency. Image Processing involves changing the nature of an image in order to improve its pictorial information for human interpretation. There are various techniques for currency recognition that involve texture, pattern or colour based. We use digital image processing techniques to find region of interest, after that Neural Network and Pattern Recognition Technique is used for matching the pattern. The proposed 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. A number of methods for banknote classification have been proposed. Template matching is often used as a simple method to classify banknotes. However, new template or matching rules are required for new bill types.

An effective way to overcome the problem is to extract features from bill images representing unique characteristics of bill data.

After studying different currencies and considering the availability, 4 currencies have been chosen, Rupee, Pound, Dollar, and Yen.

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.

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 equipment, 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, colour blurring RGB to YCbCr conversion. These operations help us in detecting boundaries, cropping the ROI and calculating colour features.

Step 3: Boundary Detection and cropping:

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

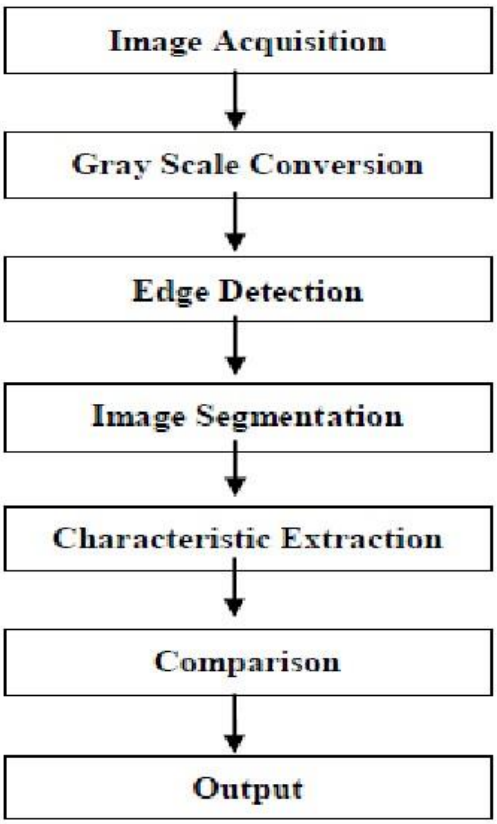
Step 4: Feature extraction:

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 Y, Cb and Cr of particular blocks of the currency. We divide the currency in number of blocks. We extract the YCbCr values of all the pixels and take average of their Y, Cb, Cr features and again compare them with the values from the database. We use Euclidian distance equation for finding out the average values of the differences between the target and Ideal YCbCr features $d\ p, q$ = sqrt((Y2 − Y1) 2 +(Cb2 − Cb1)^ 2 + (Cr2− Cr1) ^2)Where, (Y1, Cb1, Cr1) = Target image feature set (Y2, Cb2, Cr2) = Ideal feature set.

Step 5: Displaying results:

To display the results, a graphical User Interface (GUI) has been built; where feature to calculate currency conversions is provided.



Code

Code for finding mean, colour variance and colour skewness by converting RGB to XYZ colour space and XYZ to LUV colour space

currency_recognition.m | totalfeature.m | edgehist.m | color_luv.m*

```
function colfet=color_luv(rgb_im)
xyzTransformation = makecform('srgb2xyz');
xyzI = applycform(rgb_im,xyzTransformation);
warning('off');
luvTransformation = makecform('xyz2uvl');
luvI = applycform(xyzI,luvTransformation);
L=luvI(:,:,1);
U=luvI(:,:,2);
V=luvI(:,:,3);
 colfet(1)= mean(L(:));
 colfet(2) = std(L(:))^2;
 colfet(3)= skewness(L(:));
    colfet(4) = mean(U(:));
    colfet(5) = std(U(:))^2;
    colfet(6) = skewness(U(:));
    colfet(7) = mean(V(:));
    colfet(8) = std(V(:))^2;
   colfet(9) = skewness(V(:));
colfet=colfet';
end
```

Code for edge detection

currency_recognition.m | totalfeature.m | edgehist.m | color_luv.m

```
function edhist= edgehist(rgb_im)


%edge directional histogram
%Input image should be a rgb image,
%a 1x5 edge orientation histogram is computed (horizontal, vertical,
% 2 diagonals and 1 non-directional)


%convert rgb color space into ycbcr colorspace

new_im=rgb2ycbcr(rgb_im);
%extract only y component

y=double(new_im(:,:,1));

%figure,imshow(y,'initialmagnification','fit');

% define the filters for the 5 types of edges
f1 = zeros(3,3,5);
f1(:,:,1) = [1 2 1;0 0 0;-1 -2 -1]; %vertical
```

currency_recognition.m | totalfeature.m | edgehist.m | color_luv.m

```
f1(:,:,1) = [1 2 1;0 0 0;-1 -2 -1]; %vertical
f1(:,:,2) = [-1 0 1;-2 0 2;-1 0 1];   %horizontal
f1(:,:,3) = [2 2 -1;2 -1 -1; -1 -1 -1];% 45 diagonal
f1(:,:,4) = [-1 2 2; -1 -1 2; -1 -1 -1];%135 diagonal
f1(:,:,5) = [-1 0 1;0 0 0;1 0 -1]; % non directional

% iterate over the posible directions
for i = 1:5
% apply the sobel mask
g_im(:,:,i) = filter2(f1(:,:,i),y);
end
% calculate the max sobel gradient and index  of the orientation
[m, p] = max(g_im,[],3);

%detect the edges using canny
edim = edge(y, 'canny');
im2 =(p.*edim);
edhist=hist(im2(:),5)';

end
```

Code for extraction of the required features i.e. Colour LUV, edges, and grayscale image

currency_recognition.m | totalfeature.m | edgehist.m | color_luv.m

```
function fet=totalfeature(rgbim)
 %color feature
 fet1=color_luv(rgbim);
 %edge feature
 fet2=edgehist(rgbim);
 %texture feature
 %glcm-gray level co occurrence matrix
 glcm=graycomatrix(rgb2gray(rgbim));
 fet3=glcm(:);
 fet=[fet1;fet2;fet3];
```

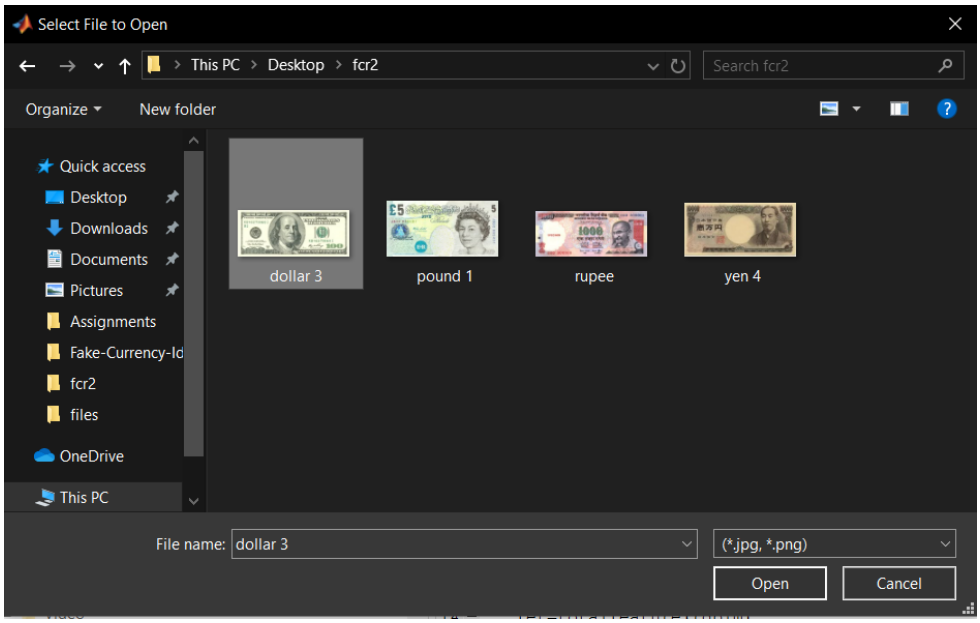
Code for currency recognition

currency_recognition.m* | totalfeature.m | edgehist.m | color_luv.m

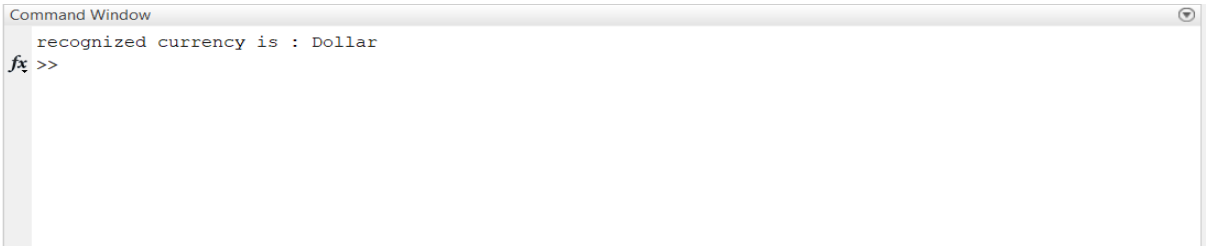
```
clear;clc;
[imname,impath]=uigetfile({'*.jpg;*.png'});
im=imread([impath,'/',imname]);
im=imresize(im,[128 128]);
 r_channel=im(:,:,1);
 b_channel=im(:,:,2);
 g_channel=im(:,:,3);
 r_channel=medfilt2(r_channel);
 g_channel=medfilt2(g_channel);
 b_channel=medfilt2(b_channel);
 rgbim(:,:,1)=r_channel;
 rgbim(:,:,2)=g_channel;
 rgbim(:,:,3)=b_channel;
fet=totalfeature(rgbim);
load db;
k=length(currency);
for j=1:k
    D(j)=dist(fet',currency(j).feature);
end
[value,index]=min(D);
   currency_name=currency(index).name;
   fprintf('recognized currency is : ');
   disp(currency_name)
```

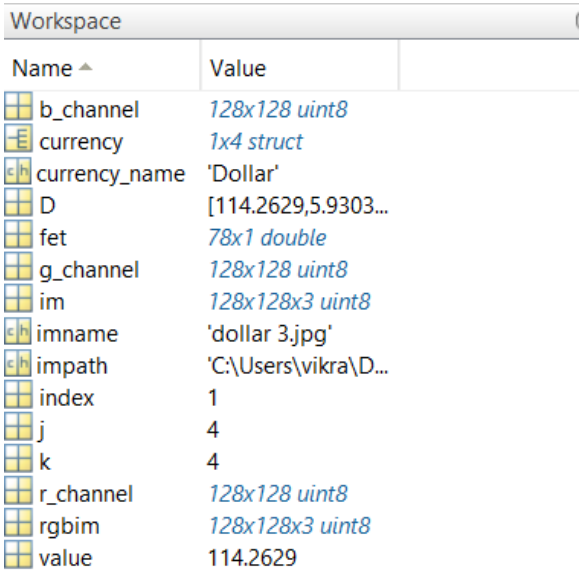
Results

Figure 1: Shows the four currencies' in jpg format available for which the currency recognition system is going to be executed

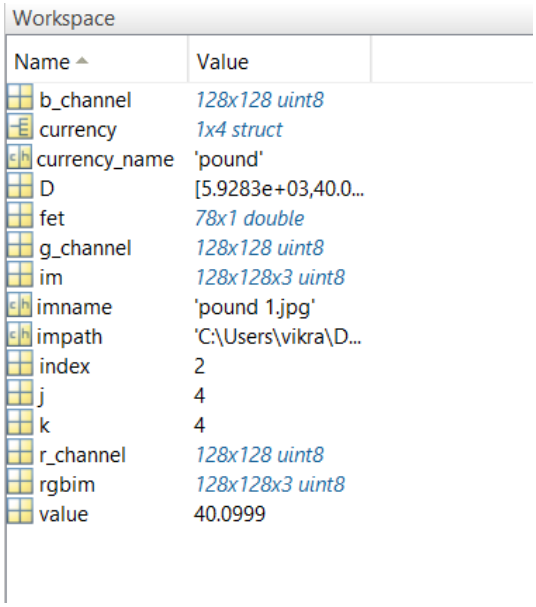


Case 1: Dollar

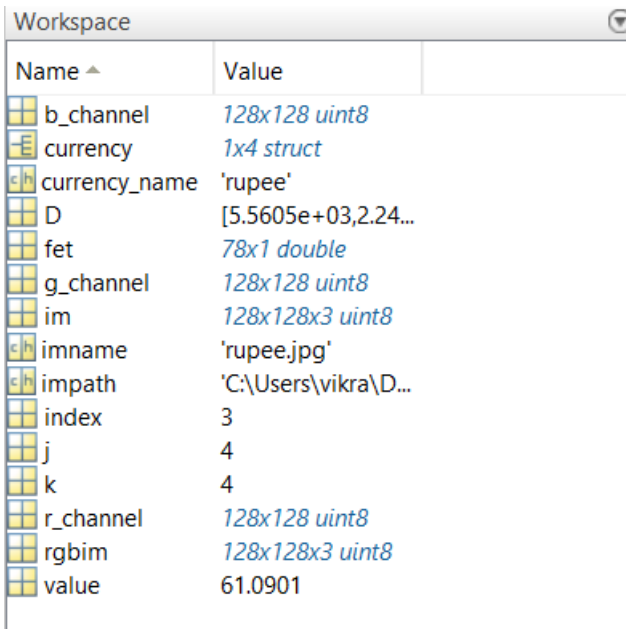




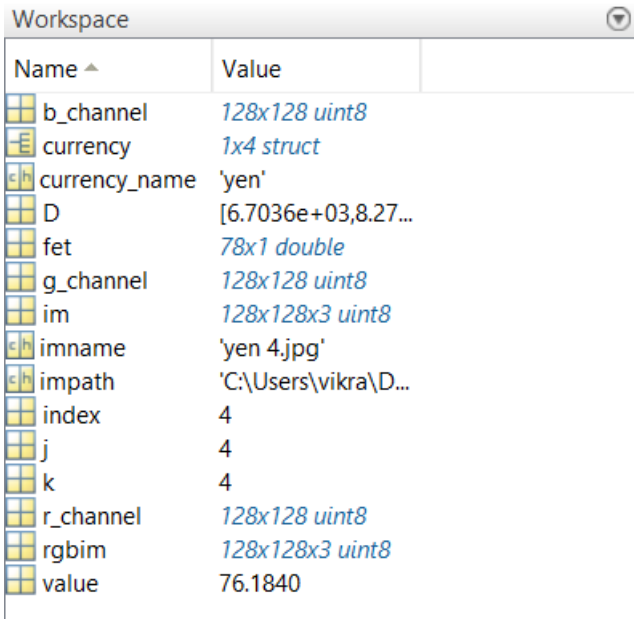
Case 2: Pound



Case 3: Rupee



Case 4: Yen



CONCLUSION

This paper discussed the currency recognition system with a digitalized image processing system. This system can work for assisting visually impaired people to correctly determine the denomination of the currency notes. It can help to distinguish the original note from counterfeit currency. If the image exhibit information loses such as surface damage, noise level, sharpness issues and so on, the recognition may fail and the user has to do the processing again. The system had been programmed by using MATLAB and it will include a user-friendly interface.

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Literature Review

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Year	Paper	Method	Result
2010	International Journal of Latest Trends in Computing (E-ISSN: 2045-5364) 121 Volume 1, Issue 2, December 2010 Paper Currency Recognition System using Characteristics Extraction and Negatively Correlated NN Ensemble	The algorithm for the discussed paper currency recognition system is presented as follows: • Banknote Size (number of pixels on horizontal and vertical axes) is calculated. If its size satisfies equation (2), it is considered as a possible true banknote. • The banknote image histogram is calculated using the bin number set as 52. • The transition matrices (Nx and Ny) are calculated for the banknote, then, the main diagonal elements of the matrices (namely Dx and Dy) are taken out as a feature for distinguishing between different denominations. • The paper currency under observation is assigned to a denomination class if the Euclidean distances between the main diagonal elements of its transition matrices (Dx and Dy) and the main diagonal elements of the corresponding matrices of the reference banknote (DRx and DRy) are smaller than a predefined value. • At the end, the computed histogram in stage ii is compared with the	This paper discussed a technique for recognizing paper currencies of different countries. The technique uses three characteristics of paper currencies including size, color, and template. In this method the system can be trained for a new denomination banknote by just introducing one intact example of the banknote to it. In addition the system may recognize the banknote on each side or any direction. Paper also focuses recognition system using negatively correlated ensemble neural network. The Ensemble network has better performance for recognition than single network. For training the negative correlation learning is used. In negative correlation the entire networks are negatively correlated through the strength of penalty term. The entire ensembles interact with each other and each network has specialized for a particular portion of input vector. So when a noisy pattern is applied the network will be able to recognize as a whole.

		histogram of the winner class in stage iv. If the Euclidian distance between the two histograms is larger than the predefined value, the banknote is assigned to an unknown class.	
2011	International Journal of Computer Trends and Technology- May to June Issue 2011 ISSN:2231-2803 152 IJCTT A Novel Approach of Embedded System for Indian Paper Currency Recognition	The algorithm is one of the techniques for which the objective is to find minimum squared error. This algorithm uses an iterative algorithm that minimizes squared error. This procedure consists of following steps as follows. 1) Read neural network 2) Find Histogram of input image and compare it with histogram of saved images. 3) If the difference in threshold is greater than a specified value then the image is genuine else it is counterfeit. 4) Find the hue and saturation for input image and evaluate the neural network for this values. 5)If the hue and saturation thresholds from the neural network are less than the current image threshold then the current image is genuine else he image is counterfeit. 6) send this information to the AVR (Advanced Virtual Risc) Microconroller ATMega32. The advantage of this algorithm is that it is a very simple method, and it is very easy to implement. Success rate of this algorithm depends on the testing parameter as well as its training parameter. This paper proposes method to determine mean squared error.	MATLAB image processing tools were used to implement system. In below figure, graph shows minimization of error at the time of training, testing as well as validation.The mean squaed error is approximately 106 mse In this paper, we have applied Fitting tool of Neural Network for the purpose of paper currency verification and recognition. After extracting crucial features from Indian banknotes by using Image processing , we have experimented on our Neural Network classifier and achieved very good performance. Furthermore, the proposed classifier has very good generalization ability and needs low computing power. Hence it is very suitable for implementing an automatic verifier for paper currency.Our future work includes recognizing also multiple kinds of foreign Paper currency using same approach.

2012	International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-1, Issue-3, February 2012 Paper Currency Verification System Based on Characteristic Extraction Using Image Processing	• Edge detection Edge detection is a fundamental tool in image processing and computer vision, particularly in the areas of feature detection and feature extraction, which aim at identifying points in a digital image at which the image brightness changes sharply or, more formally, has discontinuities. Edge detection is one of the fundamental steps in image processing, image analysis, image pattern recognition, and computer vision techniques. • Image segmentation sub divides the image into its constituent regions or objects. The level to which sub division is carried depends on the problem being solved. Segmentation algorithm for monochrome images generally are based on one of the two basic properties of image intensity values • Discontinuity • Similarity. In the first category, the approach is to partition an image based on abrupt changes in intensity such as edges in an image. The approach in the second category is based on partitioning an image into regions that are similar according to a set of predefined criteria.	In pre-processing step four different kinds of images are obtained from color image, viz. the binary image; the gray scale image using Sobel mask; the gray scale image using Prewitt mask; and the gray scale image using Canny mask. Then features are extracted by calculating the sum of pixels of each of the four images. Also, the Euler number is calculated for each of the images, then computed the correlation coefficient of input image after converting it to gray scale. After feature extraction paper currency classification is done by using two different methods called Weighted Euclidean Distance (WED) and Neural Networks using feed forward back propagation. The minimum distance classification method by taking the Weighted Euclidean Distance shows 96.4% accuracy rate while the Neural Network with feed forward back propagation classification technique provides almost 85.1% average of accuracy for the best case. Therefore, author concluded that the Weighted Euclidean Distance approach is better than the Neural Network. Figure 2, shows graphical representation of comparison between various paper currency recognition techniques discussed so far.
2013	International Journal of Computer Applications (0975 – 8887) Volume 66– No.23, March 2013 26	Salient features of the method: • Author has used three layer perception for	This paper focused on existing techniques and systems for currency recognition based on image processing. We have

	Comparative Study of Different Paper Currency and Coin Currency Recognition Method	classification and RBF for validation. • Three layer perception is used for pattern recognition which is very effective tool for classifying paper currency. • RBF network has a potential to reject invalid data because it estimates probability distribution of sample data effectively.	discussed both coin recognition and paper currency recognition methods separately. Finally we summarized their work in tabular form which is very helpful for study at a glance. Even though there is lot of research work done on this topic, still there are some issues related to the accuracy and efficiency of the method. Thus achieving maximum efficiency and getting 100% accuracy for heterogeneous currency, when physical state of currency is not that much good, will always be a challenge for researchers.
2014	International Journal of Engineering Science and Innovative Technology (IJESIT) Volume 3, Issue 4, July 2014 An automatic recognition of fake Indian paper currency note using MATLAB	1. See through register The small floral design printed both on the front (hollow) and back (filled up) of the note in the middle of the vertical band next to the Watermark has an accurate back to back registration. The design will appear as floral design when seen against the light. 2. Water marking The Mahatma Gandhi Series of banknotes contain the Mahatma Gandhi watermark with a light and shade effect and multi-directional lines in the watermark window. 3. Optically variable ink This is a new feature included in the Rs.1000 and Rs.500 notes with revised color scheme introduced in November 2000. The numeral 1000 and 500 on the obverse of Rs.1000 and Rs.500 notes respectively is printed in optically variable ink viz., a color-shifting ink. The colour of the numeral 1000/500 appears green when the note is held flat but would change	The main motivation behind development of this project was to make a system for easy and quick detection of genuine and fake Indian currency notes. This is a MATLAB based system for automatic recognition of security features of Indian currency. The low cost system, using effective and efficient image processing techniques and algorithms, provide accurate and reliable results at good throughput as shown by experimental results. The developed algorithm works for Indian denomination 100, 500, 1000. The system is also interfaced with input device CCD camera and output device LCD display.

		to blue when the note is held at an angle. 4. Fluorescence Number panels of the notes are printed in fluorescent ink. The notes also have optical fibers. Both can be seen when the notes are exposed to ultra-violet lamp. 5. Security thread The Rs.500 and Rs.100 notes have a security thread with similar visible features and inscription „Bharat‟ (in Hindi), and „RBI‟. When held against the light, the security thread on Rs.1000, Rs.500 and Rs.100 can be seen as one continuous line. The Rs.5, Rs.10, Rs.20 and Rs.50 notes contain a readable, fully embedded windowed security thread with the inscription „Bharat‟ (in Hindi), and „RBI‟. The security thread appears to the left of the Mahatma's portrait. 6. 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 i.e. in raised prints, which can be felt by touch, in Rs.20, Rs.50, Rs.100, Rs.500 and Rs.1000 notes. 7. Latent image On the obverse side of Rs.1000, Rs.500, Rs.100, Rs.50 and Rs.20 notes, a vertical band on the right side of the Mahatma Gandhi‟s portrait contains a latent image showing the respective denominational value in numeral. The latent image is visible only when the note is held horizontally at eye level.	

		8. Micro lettering This feature appears between the vertical band and Mahatma Gandhi portrait. It always contains the word „RBI" in Rs.5 and Rs.10. The notes of Rs.20 and above also contain the denominational value of the notes in micro letters. This feature can be seen well under a magnifying glass. 9. Identification mark Each note has an 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 (100-Triangle, Rs.500-Circle, and Rs.1000- Diamond) and helps the visually impaired to identify the denomination.	
2015	International Journal of Computer Applications (0975 – 8887) Volume 115 – No. 20, April 2015 1 A Review Paper on Currency Recognition System	Humans cannot recognize currencies of different countries easily. The modern technologies make it necessary to develop an automated system and check its authenticity (validity). The proposed approach that was implemented acquires the image. The image is then pre-processed .The process then proceeds by extracting the textural and nontextural features. The textural features are extracted using DWT (Discrete Wavelet Transform). The non-textural features are used to usually check authenticity. They are such as serial number, color, etc. Textural features are used to classify them. According to classification result i.e. pattern matching we get the required result (Denomination). After the denomination is known	Fake currency recognition is done after the currency denomination is recognized. The three different authenticating features proposed by this paper consist of security thread, RBI microprint and serial numbers detection. The security thread is a security feature of many banknotes to protect against counterfeiting. It consists of a thin ribbon that is threaded through the paper notes. Usually, the ribbon runs vertically, and is woven into the paper. It has characters engraved on it. Threads are embedded within the paper fiber and can be completely invisible or have a star burst effect, where the thread appears to weave in and out of the paper when viewed from one side. However when held up to the light the thread will always appear as a solid line. Features

		authentication is done. The authentication process consists of checking the security thread, RBI microprint and recognizing serial number to determine whether the currency is fake or not.	can be built into the thread material e.g. it is a difficult feature to counterfeit but some counterfeiters have been known to print a thin grey line or a thin line of varnish in the area of the thread. Security threads can also be used as an anti-counterfeiting device in passports. Security thread The RBI microprint is present on currency notes. This can be found by cropping the required area and then zooming it to recognize whether the note is valid or not. The zoomed part is displayed. This feature appears between the vertical band and Mahatma Gandhi portrait. It contains the word „RBI“ in Rs.5 and Rs.10 note. The notes of Rs.20 and above contain the denominational value of the notes in microletters. Zoomed Microprint The Serial number detection is most important part of fake currency detection. The rightmost corner of the image is required part which is cropped. The segmentation is done on a particular threshold. Threshold value will binarize the image. Only the relevant part of the cropped image is stored as objects. The labelling of image is done to separate the objects. The objects of serial number are marked with specific label. So labelling helps to differentiate objects. Each labelled object is compared with the saved or already existing template to know whether that object is character or not. If characters match then they are stored in document. This document is compared with the database containing fake serial numbers. If the

			match is found the note is considered fake
2016	International Journal of Emerging Trends & Technology in Computer Science (IJETTCS)	After getting features of currencies, it is essential to recognize the pattern of the currencies on the base of these features, which should be practiced by an effective recognition system called classifier. The input of the classifier will be the test currency images and the output of the classifier will be the corresponding currency name. A Neural network based recognition system is used in which the extracted features are fed into a multilayer perception, that is trained for recognition. A Neural network based recognition scheme is used for Bangladeshi banknotes [3]. The scheme can efficiently be implemented in cheap hardware which may be very useful in many places. The recognition system takes scanned images of banknotes which are scanned by low cost optoelectronic sensors and then fed into a multilayer perception, trained by back propagation algorithm, for recognition. Baiqing Sun [4] proposes a kind of currency recognition system, in which a three-layer feed forward neural network is used as a classifier, They proposed it in order to improve the performance of currency recognition system. The classifier here we used is feed-forward back	Despite an intense research in this field, many issues related to currency recognition system still remain unanswered and provides researchers a vast field to explore in future, especially in certain areas. Based on our study we found that Artificial Neural Network based currency classification is one of the most frequently used methods. Various types of neural network such as Feed Forward, network, Back Propagation Neural Network, Ensemble Neural Network. Also RBF network was utilized by some researchers as it possesses a proper data approximation property, which seems a good tool for rejecting unknown data [10].There are various models developed by the researchers to recognize the paper currencies. Among them is Markov Chain concept is employed by many researchers as a random process to model the texture of paper currencies [11]. GMMRF model was used by researchers in image segmentation [12].RGB Color based classification had also been used by many authors to classify currency notes based on the fact that in each note, only one of these color component is uniquely prominent. However some other authors considered classification based on analysis of color histogram, hue, saturation and intensity value by [13]. They suggested that

		propagation model which classifies effectively with high performance.	advantage of HSV color space is that it is closer to human conceptual understanding of colors and has the ability to separate chromatic and achromatic components. Although a number of currency detection techniques had been developed till date yet the development of a robust background model adaptive to changes in varying environments is still a challenge.
2017	INTERNATIONAL JOURNAL OF ADVANCE SCIENTIFIC RESEARCH AND ENGINEERING TRENDS An Automated Recognition of Fake or Destroyed Indian Currency Notes(Review)	A. Edge detection Edge detection is a fundamental tool in image processing and computer vision, particularly in the areas of feature detection and feature extraction, which aim at identifying points in a digital image at which the image brightness changes sharply or, more formally, has discontinuities. Edge detection is one of the fundamental steps in image processing, image analysis, image pattern recognition, and computer vision techniques. B. Image segmentation Image segmentation sub divides the image into its constituent regions or objects. The level to which sub division is carried depends on the problem being solved. Segmentation algorithm for monochrome images generally are based on one of the two basic properties of image intensity values- 1.) Discontinuity 2.) Similarity In the first category, the approach is to partition an image based on abrupt changes in intensity	In order to implement the proposed solution of finding Counterfeit notes, we simulate the operations of image processing with the help of MATLAB. The given image involves two types of services - Real and Fake. The segmentation of the image is as follows. 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 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

		such as edges in an image. The approach in the second category is based on partitioning an image into regions that are similar according to a set of predefined criteria	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. The following figure shows the detection of edges to extract features. Pattern matching is a family of tools for finding similar objects in different sources. In image processing, the pattern matching is Pattern matching is a family of tools for finding similar objects in different sources. In image processing, the pattern matching is used for locating a small image (called model) from a bigger one (called target image). The following figure shows the matched images of the comparison between fake and real notes.
2018	Asian Journal of Convergence in Technology	Input (Image Acquisition) A digital camera is used for image preprocessing. The starting step of the paper currency recognition system would be image segmentation that means separating the note image from the background. When using a digital camera perform image transfers, some noise will appear on the image. Image noise is the random variation of brightness in images. Removing the noise is an important step when image processing is being performed .•Browsing: Proposed System browse these images	In this system the ultrasonic sensor are used to sense the obstacle. The sensor is set a threshold limit if any obstacle is found within that range it gives beep speech through speaker. The microcontroller read the distance of the obst acle using the sensor and also sends the command to the buzzer. The vibrator is connected in parallel with the buzzer for vibration sensation. The light sensor is used to inform the users if it

		file in the system and this image will be given for feature segmentation and template matching. •Image processing: It is method to convert an image into digital form and perform some operations on picture or image, in order to obtaining an enhanced image or to extract some useful information from image or picture. Here, we use Template matching for finding small parts of image. •Template matching: It is 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. •Finally, we get output which shows the whether currency is Original or Duplicate. After applying Template matching Algorithm, so blind person can know whether note is real or fakethrough the audio signal	is day or night or any particular place dark or bright,the moi stures sensor is used to detect the water pit or any puddles , if present. The entire signal is send to the microcontroller which in turned send signal to the b uzzer thereby alerting the user a nd another most important system we can used in this stick, is c urrency recognition system . In preprocessing, different images of banknotes are taken. These banknote images Constitute images of different denominations. To make feature extraction easier, image resizing can be done. Image enhancement technique helps to increase the contrast among bright as well as dark points. This makes the image clear and so it will be further helps feature extraction. It produces feature points which are nothing but feature descriptors. Feature descriptors of both sample input image and query image are calculated and are compared to find probability of highest match points to generate final result. In this system, to deal with the common problem for blind people we have propose a currency recognition blind walking stick to

			recognized currency as well as obstacle to help the bind person in their daily lives. In this system we get the output in the form of audio signal. By using digital image processing, analysis of Currency image is more accurate as well as this method is efficient in terms of cost and time consuming compared to existing techniques. Extracted features of currency image will be using for currency value recognition as well as for its verification. Application based system shall be designed to get proper result whether currency image is fake or its genuine. All the study which had been review show that, there are no. of technique for making a currency recognized ultrasonic blind walking stick for blind people. The advantage of this system lies in the fact that it can prove to be a very low cost solution millions of blind person worldwide.
2019	CIKITUSI JOURNAL FOR MULTIDISCIPLINARY RESEARCH Object Detection and Currency Recognition Using CNN	Our system needs to be taught how a currency or object looks like in order to teach him to recognize that currency or object. We must teach the system how an Rs10,Rs100,and Rs1000 currency note and so on looks like before it can recognize it. The accuracy of the system can be increased with the increase in number of labeled images the system takes to train the classifier. This type of learning is known as Supervised Learning. Before	With the help of machine learning, the classification of images into different categories can be done. Therefore, we need a large and continually growing data source to create a more accurate system. The model's accuracy with CNN is much better than the model made with SVM and K-Nearest Neighbours. All values are high, such as precision, and F1, meaning high accuracy. The classification and detection of images by different methods

		starting with the preparation of system's model architecture, collecting proper data to train the model is an important step, in this case data refers to collection of images of various categories which the system must recognize. A computer can perform numerical computations and cannot interpret images as humans do. So in order to make the system understand, we need to convert the images to numbers. In image processing, there are two common ways to do this: 1. Grey scale: The original image is converted to grey scale image then the computer assigns a value to each pixel in the image based on the darkness of the pixel. This collection of numbers is passed to the computer in an array for further computations. 2. RGB value: The computer extracts each pixel's RGB value (a combination of 0 to 255 ranging from red, green, and blue). These values are passed on in an interpretation array. When the computer interprets a new image, the image will be converted to an array using the same technique, which will then compare the number patterns to the already known objects. Then the computer allocates scores of confidence for each class. Usually the class with the highest score of confidence is the one predicted.	proves that the construction and fine tuning of the image classifier using Convolution Neural Network remarkably improves the accuracy of recognition as compared to supporting vector machines and k-nearest neighbours. We also monitored that when we used CNN, the error percentages was lower.