# Fake Currency Detection In Image Processing Using Matlab

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**ABSTRACT**

In India,' currency' is the means of Transaction so there is more value for currency in our social and economic devel- opment. Here, currency exists in the form of coins, banknotes and electronic data. Fake money or counterfeit notes is the dangerous or acute problem in front of whole world, and India is also a  part of this fake currency. Modernization in the financial system is a milestone in protecting the economic development and now   a days Indian government has become conscious about this so demonetization of Rs 1000 and Rs 500 notes is the latest example of it. But again we have Rs 2000 as a new currency in market. So as the highest value note there is a chance that corrupt people will try to make it as a counterfeit. So main objective of this paper     is to study different key features of new genuine currency and use such techniques to detect and verify new currency circulated by Reserve Bank Of India. There are Different techniques which are used to distinguish between counterfeit notes and genuine one. By using different components  of  Image  processing  such as image acquisition, pre analysis , initial segmentation, post processing , grayscale conversion ,feature extraction , comparing images etc. we can extract the features of genuine notes. It is a very challenging task for detecting fake currency.

*Index Terms*—Image Processing, feature extraction, detection. Segmenting feature of currency, canny, financial system , genuine note.

## 1.INTRODUCTION

Economic development of every nation is mostly dependent on its currency and every person is the part of Economy but some of the unsocial group of people damage this process   and unbalances the social harmony of the nation. For  ex.  Now a days, in process of demonetization, there are long queues in front of banks and ATM Machines of those common people who contribute to our economy by paying taxes but on the other hand many corrupted people are issuing the money directly by evil sources and it is directly effecting on economic status of India. As we know, in India, Ministry Of Finance and RBI(Reserve Bank Of India are authorized to issue currency notes and coins. But corrupt people take the advantage of high printing and scanning technologies to print fake notes by using latest hardware tools and  techniques.

Fake currency detection means finding the fake currency  from the original one. Generally, currency recognition system is mostly used in banks, business firms, shopping malls, rail- way stations, government sector, organizations etc.But com- mon people do not have any source of currency detection and they are unable to identify the real original currency. That's why the malpractice of fake currency is carried out openly     in our economy. Till date, many researchers have given their contribution in finding the technique of identifying the genuine currency notes  from the fake notes.

## 2.MATERIALS AND METHODS

MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and pro- gramming in an easy-to-use environment where  problems  and solutions are expressed in familiar mathematical nota- tion. MATLAB stands for matrix laboratory, and was written originally to provide easy access to matrix software devel- oped by LINPACK (linear system package) and EISPACK (Eigen system package) projects. MATLAB has many advan- tages compared to conventional computer languages (e.g., C, FORTRAN) for solving technical problems. MATLAB is an interactive system whose basic data element is an array that does not require dimensioning. The software package has been commercially available since 1984 and is now considered as a standard tool at most universities and industries worldwide. It has powerful built-in routines that enable a very wide variety of computations. It also has easy to use graphics commands that make the visualization of results immediately available. Specific applications are collected  in  packages  referred  to  as toolbox. There are toolboxes for signal processing, sym- bolic computation, control theory, simulation, optimization, and several other fields of applied science and engineering. MATLAB library comes with a set of many inbuilt functions. These functions mostly performs mathematical operations like sine,cosine and tangent.They perform more complex functions too like finding the inverse and determinant of a matrix.

## 3.EXISTING SYSTEM

In existing system, Image processing Is being used with legacy version of machine learning algorithm. Also they are using local database which reduces the portability of system and because of their system is limited to PC device user friendliness is not good. Current Existing system is a computer vision based approach for Indian paper currency detection. In this approach, extract currency feature and develop an own datasets used for the currency detection.The mainly use ORB (Oriented FAST and Rotated BRIEF) and Brute-Force matcher approach to extract the feature of paper currency, so that can more accurately detection the denomination of the banknote both obverse and reverse. Here the main contribution is through using ORB and BF matcher in OpenCV based, the average accuracy of detection is up to 95.0

## 4.PROPOSED SYSTEM

The proposed system is detecting fake currency by Image Processing using MATLAB as a tool .Feature extraction of image is difficult piece of work in digital image processing. It includes the extrication of invisible and visible features of In- dian currency notes. This application consists of various steps like image acquisition, edge detection, grey scale conversion, feature extraction, image segmentation and decision making. Acquisition is giving image as an input via path . Image is then stored for further processing . In the proposed statement , acquired image of currency note through the camera is checked to real or not. To check the currency note is real or fake on the basis of counting the number of interruptions in the security thread. The camera pictures of notes are analysed by MATLAB program installed on computer. The proposed system is to check the Indian currency notes of 100, 500 and 2000 rupees. If the note is real, the respective message is appeared on the command window and vice versa

### A. IMAGE ACQUISITION

It is the action of retrieving an image from source. This is the first step in which we give the image path as the input image. It goes through the entire image and checks the features that need to be checked in the further steps involved. At each step of the further processing it involves various features of extraction. Imread is great for reading images from the URL path. It takes the path of the image as an input then extracts the features of the entire input image.

### B. PRE-ANALYSIS

It is the next step of image processing. Pre-Analysis is a familiar name for operations with images at the lowest level of abstraction – both input and output are intensity images. The aim of Pre-Analysis is an improvement of the image data that suppresses unwanted distortions or enhances some image features essential for further processing ,converting from RGB to HSV helps in the better detection of the object. It converts RGB image into the hue, saturation and value. The black thin strip consists of the saturation that is quite high, which makes sense as black could be considered as a "colour" that is pure
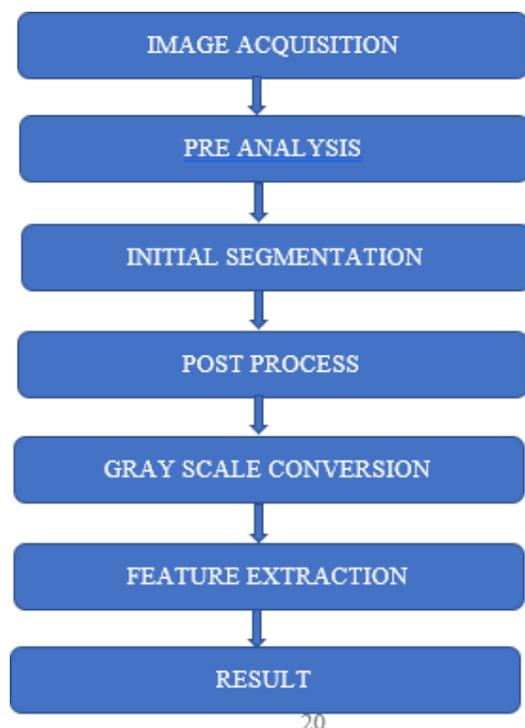


saturation (devoid of white light). The value component has its strip with values to be very low, which also makes sense as value captures the
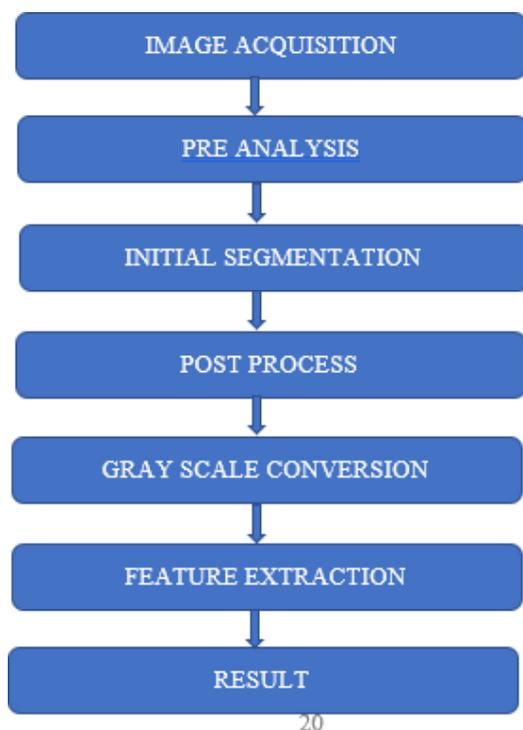
lightness / strength of the colour.

### C. INITIAL SEGMENTATION

The Saturation of the black thin strip is quite high, which makes sense as black could be considered as a "color" which is pure saturation (devoid of white light). The component value has its strip with very low values , which also makes sense    as it captures the value which lightness / strengthen the color. Any points that have a combined saturation that is rather high and values that are rather low are candidates that are part of the black strip. We are going to crop out just the strips by themselves to make things easier (as you have already did too). Take note that the position of the strips in each image  differ, so we have to adjust accordingly. While leaving the rows and slices we simply extract out the right columns. These value and saturation thresholds are rather ad-hoc, so we had to play around with these to get good outcome. Saturation is the image processing technique for the better feature extraction of the image.

### D. POST PROCESS

Adjusting exposure, contrast and brightness and also ad- justing colors, hues, tones, saturation and light levels. It also checks the true and fake pixels of the image. In this process   to get rid of the edges along with the pixels that does not belong to the strip is observed by the area open image part. It also counts the number objects present in the image. In this process we close the space lines with 6 pixel line to make better difference. Also removes the noisy pixels in the image.

```
IMAGE ACQUISITION
        ↓
PRE ANALYSIS
        ↓
INITIAL SEGMENTATION
        ↓
POST PROCESS
        ↓
GRAY SCALE CONVERSION
        ↓
FEATURE EXTRACTION
        ↓
RESULT
```

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You will see that each black line is separated by a quite few pixels when we take a look at the thin black strip of the fake note , while the real note really has no separation. In the real black strip that is mentioned above is still having disconnection in some parts of the line . As such, let's try and connect the line without any separations . Performing this process is safe because , if we do this on a fake image the parts of an image are so far that it should not make any difference while closing that and helps in the analysis of real image . As such, we closed these images by 6 pixel line that is vertical.

### G. *GRAY SCALE CONVERSION*

This step is used to improve the gray image to highlight dark lines in lighter background and also helps in checking the black strips of the real note . It also detects exact features of the note after converting the image into grey scaling. Without loss of information it converts the image for the better extraction. Gray scale conversion is needed to maintain the intensity of the image from black at the weakest intensity to the white at the strongest intensity.

Consider a color image, given by its red, green, blue components R, G, B. The range of pixel values is often 0 to 255. Color images are represented as multi-dimensional arrays

- a collection of three two-dimensional arrays, one each for red, green, and blue channels. Each one has one value per pixel and their ranges are identical. For grayscale images, the result is a two-dimensional array with the number of rows and columns equal to the number of pixel rows and columns in the image.

### H. *FEATURE EXTRACTION*

Extracts the features that are needed to be compared and to conclude whether the note is fake or real . In the over all processing each step is having the unique way of extracting the features of the real and fake note. Extracts the black strips of each image finally converts from grayscale to thresholding as a way to select areas of interest of an image, while ignoring the parts which are not concerned with. By this we can easily identify the difference between real and the fake note.

## 5.SIMULATIONS AND RESULTS

The corresponding results explains how the image is pro- cessed and shows the results of the each step . The code is written in such a way that if executed in MATLAB software we get the result in the form of figures where we can differentiate the real and a fake note . The real note is having different features as compared to the fake note.

### A. *PRE - ANALYSIS*

It involves the operations required prior to data analysis and information extraction. Here image resizing is done. In this step for better object detection it converts red,green,blue values of an RGB image to hue,saturation and values of an HSV image.Here hue is responsible for the color's position

, then 0 indicates a neutral shade and 1 indicates maximum saturation , next value describes RGB components of a specific color.



Fig. 1.  Pre Analysis Real



Fig. 2.  Pre Analysis Fake

### B. *INITIAL SEGMENTATION*

It is a type of Image segmentation where we change the pixels of an image to make image easier to analyse which is known as thresholding.Thresholding the image by looking at the saturation and value planes by this position of the strips differ.Real note strip have more connectivity than fake.It converts into black and white .
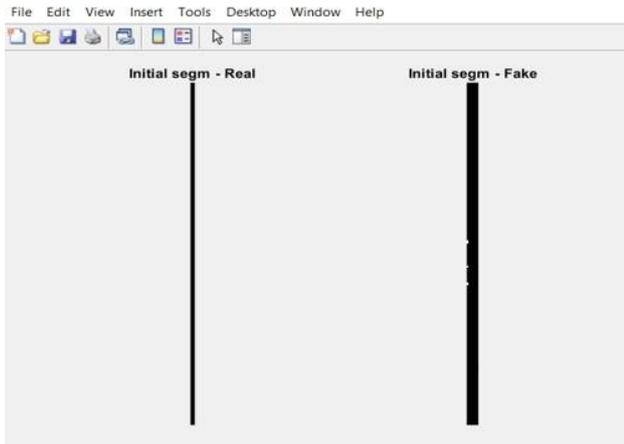
Fig. 3. Initial Segmentation Real and Fake

### C. POST PROCESS

In this step we are closing a lines with 6 pixel line to make better difference ,it also checks the true pixels of the image.Using Area opening method through bwareaopen to remove noisy pixels.This function removes pixel areas in black and white image that have less than a certain area .

### E. 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 analysis and identify the unique and distinguishing features of each
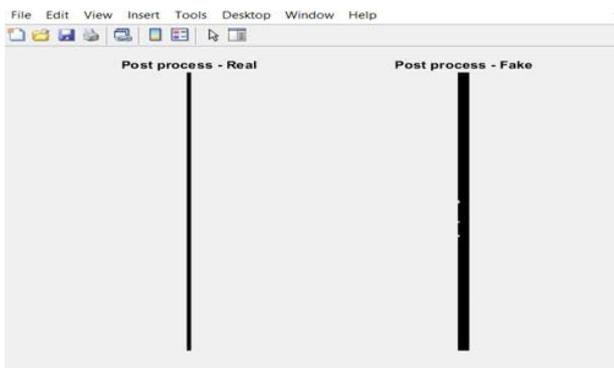


Fig. 4. Post Process Real and Fake

### D. GRAY SCALE CONVERSION

Closing the RGB image so that the darker line segments are removed or deemphasized , then converts this closed image to grayscale.This additionally smoothens the signal and finds the number of segments .
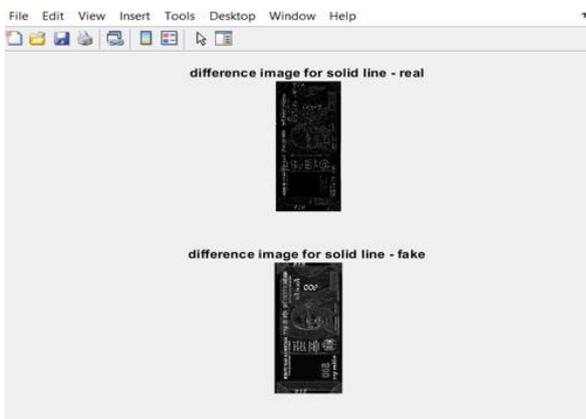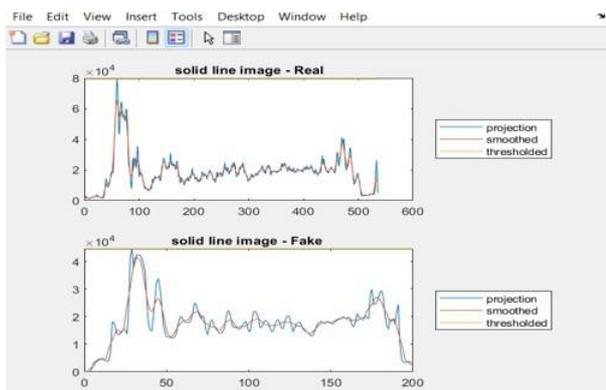


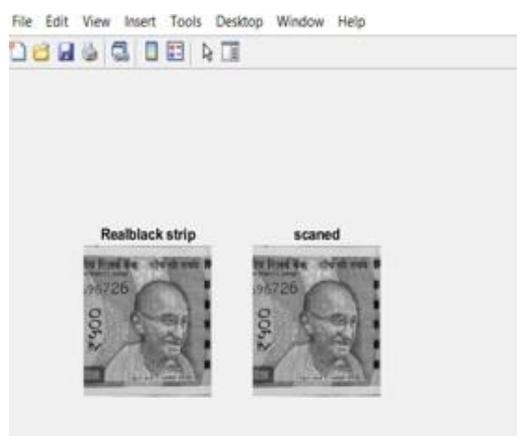Fig. 5. Solid Line Difference

Fig. 6.   Solid Line  Difference



Fig.  7.   Feature Extraction

## 6.CONCLUSION

The survival of the financial symmetry may be affected with its value, rapidity, output and wellbeing by counterfeiting of bank notes. It deals with different literature which describes different techniques of paper currency recognition. With devel- oping of latest banking services , significant methods for paper currency recognition become important in many applications such as in ATM and automatic goods seller machines. The sys- tem has a best performance for both agreeing valid banknotes and deleting invalid data.It also shows the techniques for currency recognition using image processing. We have began developing an interactive system that solves this problems (ie.,) paper currency identification system for Indian currency using MATLAB. The Indian currency notes have been identified and counterfeit notes has been found. This work is done by using various filters. This method is very easy to implement in real time world. At last we have concluded that if we propose some efficient preprocessing and feature extraction method then we can improve the accuracy of identification system. We can also develop app for detection of fake currency.

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