FAKE CURRENCY DETECTION USING IMAGE PROCESSING TECHNIQUES

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Abstract— **Counterfeiting of paper currency is a major crisis around the world. Almost every country has been affected by this crisis. The major goal of this paper is to identify Indian paper currency. In this paper, we propose a system for the identification of currency using image processing techniques. There are different traditional methods available for fake currency identification supported the colours, width, and serial numbers mentioned. Paper currency features plays an important role in this recognition. The identification of fake currency involves various steps like edge detection, feature extraction, image segmentation, image accession, grayscale conversion, and comparison of images between real and fake currencies.**

Index Terms—**Indian currency, Image recognition, Edge detection, Matching techniques.**

I. *INTRODUCTION*

Nowadays, every country is facing the counterfeit problem for the currency but in India this problem is very crucial and it is getting worse day by day. The currency detection system aims to extract the specification of the paper currency notes which is genuine and then compares it with the testing currency which we need to check whether the paper currency is real or fake one. This age is known for "Computer's Age" where we can have a lots of software solutions for every problem. With these software techniques we can save our time as well as energy also. In my research work my focus is for the detection of the Indian paper currency to demonstrate that whether the currency is genuine or the counterfeit. Many software methods used for the paper currency detection. The easy way is to extract the visible features of the currency and then find out whether the currency is real or not based on the currency size and colour but it is difficult to detect the currency whether it is fake or the real based on the hidden features of the currency like watermark feature. Due to daily usage of banknotes, the condition of banknotes getting worser and dirtier, by getting damage, the original paper currency may have an information loss. The currency may be damaged and the blurry which is difficult to recognize the genuineness of the paper currency.

By using image processing techniques, the currency can be detected whether it is fake or not. These techniques includes such as image processing, edge detection technique, image segmentation process, features extraction and matching images.

Having great technological progress in the field of colour printing, falsehood and creating forged things, the counterfeiting problem is one of the most serious problems from the past few years. In early days, only the printing houses was able to make counterfeit paper currency but nowadays anyone can print the counterfeit currency at house, at office or any other place by using the required tools like: a computer system, a laser printer etc. So this is a big issue to differentiate the counterfeit currency from the genuine one by using the automatic machine devices or by computer. Counterfeit currency is a quite big problem of many developing and developed countries and India is also affected from this problem.

II. *PROBLEM STATEMENT*

The biggest problem for many countries like India is the detection of fake currency. Even banks and other big organizations have automatically equipped machines designed to identify fake currency notes, whereas ordinary people can hardly distinguish between them. In these days, the production and circulation of inauthentic currency notes have been increasingly sophisticated. Nowadays recognition of fake currency has become challenging issue for many researchers. So the idea is to design a fake currency detection system using machine learning techniques for detecting fake currency and real currency. This system can be utilized by banks and other common people to identify the fake and real notes. This system also prevents the common people from being thug.

III. LITERATURE SURVEY

After demonetization in India it is more important to check whether the newly arrived Indian currency notes are genuine or not. The recently arrived money is in Indian rupees, with notes in denominations of 10, 20, 50, 200, 500 and 2000 rupees. There is only a handful number of research on fake currency. There are various currency detection techniques which have been proposed by various researchers in the field of machine learning and Image processing. They also have proposed various methods to determine the originality of a note. Some of the most relevant study regarding this approach are discussed in this section.

Kalpana Gautam [1], proposed a method using Local binary patterns (LBP), Principal component analysis (PCA) and Euclidian distance algorithm for combining the metrics which has simpler computations. The features of currencies are extracted and stored in MAT files and then these features are matched with the input paper currency to recognize whether it is real or fake, the tool used for this reseach work is MATLAB. The currency is detected with LBP and PCA.

T. Naveen Kumar etal.[2], according to the physical aspect of the Indian currency. Image processing ways were used to exihibit the features of Indian currency notes, similar as the security thread, RBI totem and secerning substantiation imprint, all known to be features of Indian currency. On the pre-processed images, DTCWT is applied to hold the full features. This sea transfigure preserves the most essential features of images therefore minimising losses. A brace of DWT trees make up this sea transfigure.

K. Sawant and C. More [3], proposed a system using Image processing techniques which deals with the extracted denomination value by using Minimum distance classifier. They have taken 4 important features like Aspect ratio, Dominant colour, ID mark and Latent image. This system shows accuracy close to 90%.

Sathisha. K [7] , proposed a system that makes use of a variety of image processing methods and some algorithms.These characteristics of Indian paper money-finding and choosing security threads, markings and watermarks- are highlighted for the purpose of detecting counterfeits. The feature extraction is employed on the images of currency note and then it is compared with the original currency features which are stored in the database. The Sobel operator with the gradient magnitude is used for extracting the features of the currencies.

Snehlata et al. [4], proposed a model which is an object-acquainted used for designing of systematized way for identification purpose, which is enforced in MATLAB. It's a tool for producing the pictorial designs which are classified as static or dynamic design. latterly the images which have been in RGB colour are converted into the Hue-achromatism- value(HSV) format. By this process the entire image has been independently looked as Red,Green., Blue element. also some of the required characteristics are uprooted and compared to display final affair.

Sharan and Kaur [5], proposed an approach to distinguish between real and duplicate notes where the mean intensity of RGB channels of an image is measured and three distinct features, like Latent image, RBI Logo and denomination numeral with Rupee symbol, are collected. The proposed system has a high rate of accuracy.
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IV. PROPOSED SYSTEM

In our proposed system, we will build the system which perfectly recognizes the features of fake note and real notes. Our proposed system will be able to represent the real time detection of fake currency as we are using machine learning algorithm for the execution of image processing techniques which helps us in distinguishing the real and fake images of the currencies.

For example, we have a new Indian 2000-rupee note. First of all we will discuss the features of Rs.2000 currency paper.

(i)COLOR:
The base color of 2000-rupee note is magneta.

(ii)SIZE:
The size of new 2000-rupee note is (170mm x 66mm).

(iii)BLEED LINES:
There are seven "bleed lines " on the left and right side of 2000-rupee note.

(iv)LATENT IMAGE:
Denominational numeral 2000 which can be seen when it is held at 45 degree angle at the eye level.
Denominational numeral 2000 in devnagari font.

(v)ORIENTATION:
Portrait of Mahatma Gandhi is in the centre.

(vi)WINDOWS SECURITY THREAD:
Color shift windowed security tread with inscriptions 'Bharat' in hindi ,RBI and 2000.When the note is tilted the color of thread changes from green to blue.

With the help of the above stated features we will be using just two among them to classify the real and fake currency (i.e. Bleed lines and portrait image of the Gandhiji).

We will be comparing these two features on both the real and fake currency to distinguish the differences among them and to classify the real note.

V. *METHODOLOGY*

This system is designed under python jupyter notebook programming tool to detect the paper currency whether it is real or fake. The technique which is used to classify the paper currency is image processing . It is the method which deals with the manipulating digital images through the computer algorithms.

Image processing is used to enhance an existing image or to extract the important information from it. This image preprocessing techniques plays an major role in many applications, such as face recognition, object detection, and image compression. A hybrid correlation technique is also used to compare and classify the real and fake currencies. It is a useful statistical technique that found the application in the fields like: face recognition and image compression for find out the data of high dimensions as well as matching purpose.

The images which is used for the detection is taken up by the model before. The process which takes place on those images are listed below.

Key Points of Methodology:

There are various techniques involved in the process of currency detection.

1. Image Acquisition : It is a action of retrieving image from the source. Two images is provided to the model. One which is to detected and another one is its corresponding original note.

2. Conversion from RGB to Gray Scale: The RGB image is converted to GrayScale image by copying the radiant component to colour component.

3. Image Segmentation: It is used to partition an image into two or more parts based on the characteristics of the pixels in the image. The image is partitioned to crop Gandhiji image and thin strip image in both real and fake notes.

4. Feature Extraction: It is done to measure the number of black lines on the thin strip of both the real and fake notes.

5. Correlation technique: Employing Correlation techniques for feature extraction. If the correlation value of transparent Gandhiji's image is greater than or equal to 0.5 then the the currency note is legitimate or else the currency is fake

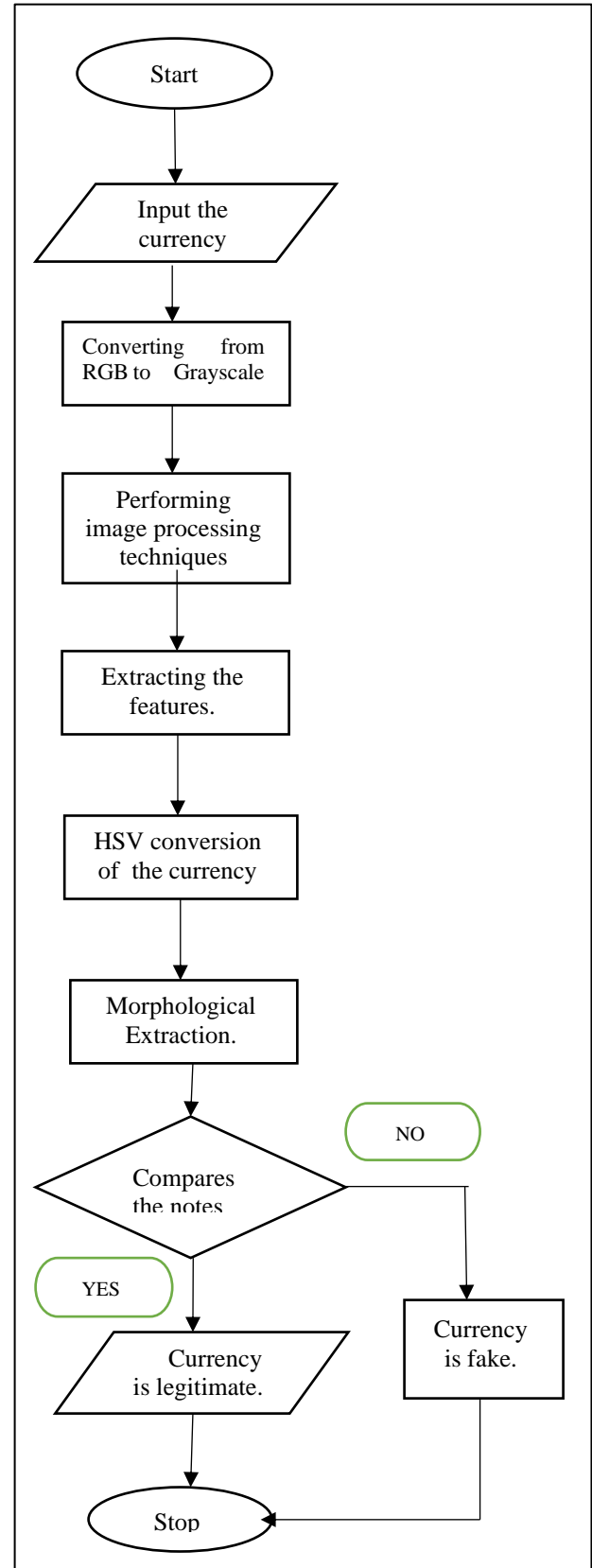6. Final Detection: Finally, The currency is detected to be Real or Fake.

Fig 1: Work flow of the Proposed System.

VI. *RESULTS AND DISCUSSION*

For analysing the output, the results and discussion part is important. The model is built using grayscale image, segmentation and feature extraction. The library used in this approach is OpenCV which contains some of the pre-built functions to work with images. To check whether the currency is fake or real, here the sample currency of Rs.2000 is taken . Both the real and fake notes of the two thousand rupees is taken as input images in the system. The input images given to the system will be converted into grayscale images. Image segmentation is done to crop the Gandhi Ji image and the tin strip of the both the input currencies.

This approach is to compare the real and fake notes based on the image of Gandhi Ji and the thin strip present on the image. After comparing , we will check whether the number of lines in the thin strip in the real note is equal to the number of lines in the thin strip of the fake note.

The comparison of Gandhi Ji's image is done by finding a correlation between two images using a correlation function. If the result of the correlation function is greater than 0.5 then currency is legitimate and we will check for a thin strip. Otherwise, the currency is fake.

For analysing the output, the results and discussion part is important. The results of the currency detection system is given below:
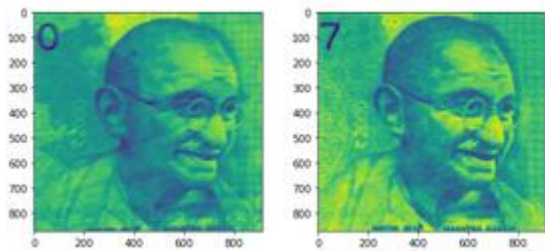
Fig 2: Gray Scale converted input image.
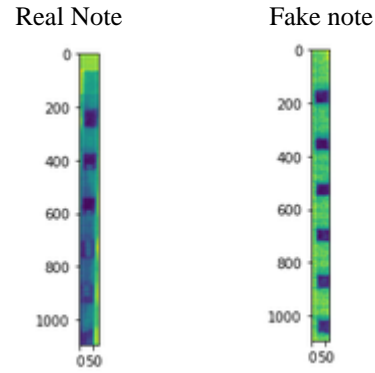
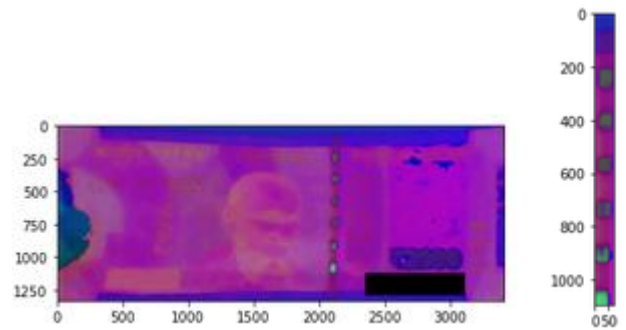**Fig 3:** Segmented image of real and fake note.

Real Note   Fake note

Fig 4: Extracted thin strip.

Fig 5: HSV converted image of the Real note
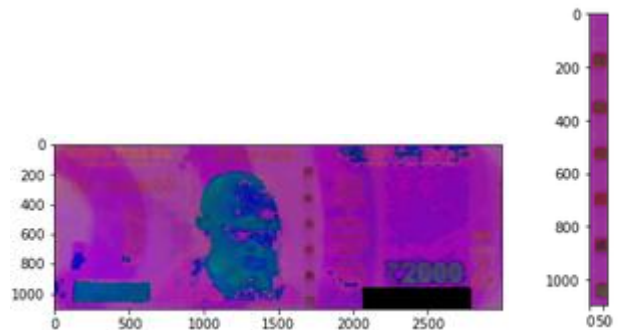
Fig 6: HSV converted image of the Fake note
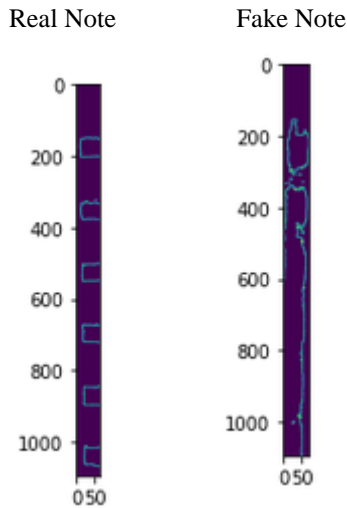
Real Note   Fake Note

Fig 7: Comparing lines in the thin strip.

OUTPUT:

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correlevance of transparent gandhi > 0.5
currency is legitimate
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VII. *CONCLUSION AND FUTURE SCOPE*

It is a ever growing issue for researchers to identify and detect the counterfeit currency with best possible solution. It is found that techniques developed and implemented majorly falls under the area of image processing, pattern recognition and machine learning. In this research , we built a fake currency detection system using image processing techniques such as grayscale conversion, segmentation, and feature extraction in our system to compare real and fake notes.

In this detection process, only just two features are extracted which is Gandhi Ji image and thin strip of the currency to classify whether the input currency is real or fake. But there are various features like present in the currency unique number, denomination and bleed lines etc. So we can improve this system by adding these features to the proposed system.

Also this model can be improved by classifying the denomination of the currency after it has detected to be real. We can implement the currency detection based application for the mobile users so that to increase the availability and to make it handy, in addition to the above mentioned points, the added features. Neural Network can also be considered for the process of training of the images. Because Artificial Neural Network based currency recognition is the one of the most frequently used method in recent times.

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