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# DETECTION OF INDIAN COUNTERFEIT BANKNOTES USING NEURAL NETWORK

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**Abstract**— Banknotes notes are issued by the Reserve Bank of India (RBI), in the year 1934. They are currently issued in the denomination of Indian rupees ₹10, ₹20, ₹50, ₹100, ₹200, ₹500, ₹2000. In the proposed work, detection of the counterfeit banknotes using multispectral images is implemented by Neural Network technique. It will reduce the cost when neural networks are used. It shows good performance and a low level of complexity. From the results, by using Pattern Recognition algorithm is used to train and test the image at an advanced level to compute the recognition rate level. So that, the performance metrics are increased when compared to the existing work.

**Keywords**: Banknotes, Reserve Bank of India (RBI), Neural Networks, Pattern Recognition.

## I. INTRODUCTION

In India RBI, is the one and only bank which has full authority rights to issue banknotes. Counterfeit money is imitation currency produced without the legal sanction of the government. Producing or using counterfeit money is a form of fraud or forgery. A form of counterfeiting is the production of documents by legitimate printers in response to fraudulent instructions.

Money/Coins are used as the medium of exchange for goods and services. Indian currency consists of seven major denominations (₹10, ₹20, ₹50, ₹100, ₹200, ₹500, ₹2000), with each having different features such as size, prominent color, identification mark [3].

To prevent and detect the circulation of counterfeit notes and its system must be developed. Currency with the legal sanction of the government have some certain security features such as intaglio printing, fluorescence, watermark, identification mark, security thread, see through register, micro lettering, latent image and year of printing as seen in Fig. 1

Over the recent few years, as a result of the great technological advances in color printing, duplicating, and scanning, fake money is spread in system largely and problems have become more and more serious [4].


**Fig. 1 Different Techniques for Detecting Fake Currency**

## II. EXISTING WORK

In this paper, the fake currency detection using the image processing is performed. It is a process of finding the forgery currency. After chosen, the image preprocessing method is applied. In pre-processing, the image is smoothened and adjusted. Convert the image into gray scale level. After conversion apply the image segmentation. Finally, compare the image into original or fake.

**FLOW CHART:**

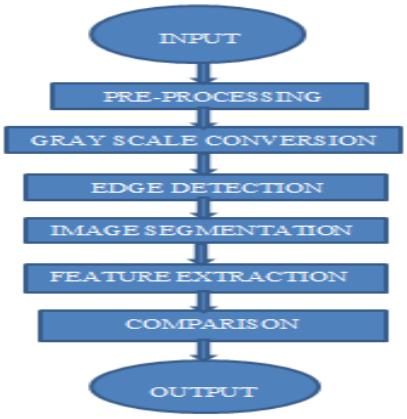


**Fig. 1 Block Diagram**

**ALGORITHM:**

**STEP 1:** Image currency of ₹.100 will be acquired as an input image.
**STEP 2:** RGB image converted as gray scale image.
**STEP 3:** Edge detection will be performed. After detecting edges, the currency will be sharpen and segmented.
**STEP 4:** After segmentation, the characteristics of the paper currency will be extracted.
**STEP 5:** The characteristics of final output image of security thread (black stripes) are compared with the original pre-stored image in the system.
**STEP 6:** If it matches then the currency is original otherwise fake.

**INPUT IMAGE:**


**Fig. 2 Input Image**

**OUTPUT IMAGE:**

In feature extraction, the security thread can be obtained to check the authenticity of the image.

 

**Fig. 3 Output Image**

## III. PROPOSED WORK

**FLOW CHART:**

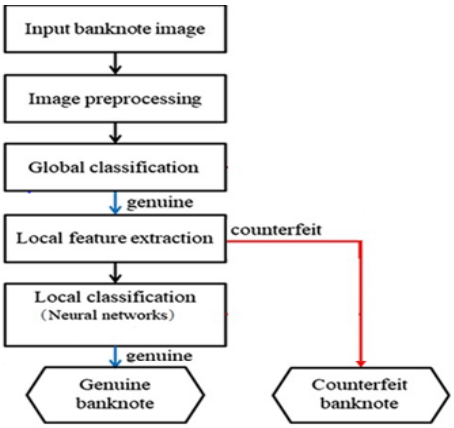


**Fig. 4 Block diagram**

**ALGORITHM:**

**STEP 1:** Image of paper currency Rs.100, 200 and 2000 images will be acquired as an input image.
**STEP 2:** In pre-processing, noise can be removed by the smoothening process.
**STEP 3:** In gray scale conversion, the image is converted from RGB to gray scale.
**STEP 4:** In feature extraction, RGB image can be converted as BW image, from that we can identify the original Black stripes and Identification marks to find the currency is genuine or counterfeit.
**STEP 5:** It compare the images, if it matches then the currency is genuine. And it goes to the Neural Network technique.

## IV. METHODOLOGY

**ACQUISITION IMAGE:**

The first stage of input is an image acquisition stage. Input of Rs.100, Rs.200, Rs.2000 original and fake images are given as an input.

 


**Fig. 5 Input Images**

## PRE-PROCESSING:

In pre-processing, it enhances the images and improves the datasets, also said to be Image restoration. It involves the correction of distortion and noise. More filter operations are used to remove the noise by smoothening process.


**Fig. 6 Pre-processing Images**

## GRAY SCALE CONVERSION:

The image is converted to gray scale level because it carries only the intensity information which is easy to process instead of processing three components R (Red), G (Green), B(Blue).

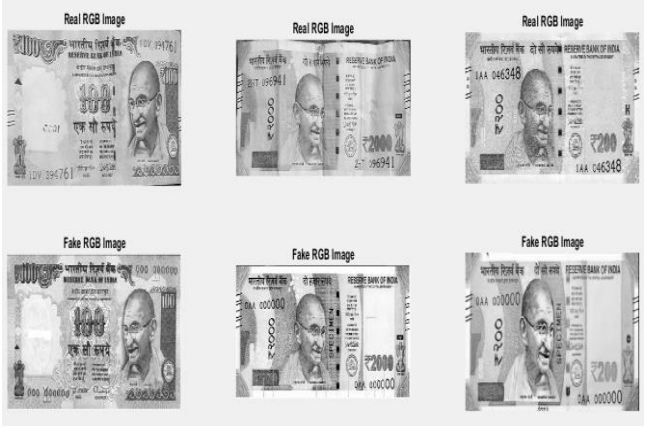


**Fig. 7 Gray Scale Images**

**FEATURE EXTRACTION**:

It is a special form of dimensional reduction. Transforming the input data into the set of features is called feature extraction. Finally the features are extracted through the security thread as black stripes, fluorescence, see through the register, five angular bleed lines for ₹.200, seven angular bleed lines for ₹.2000 and identification marks.

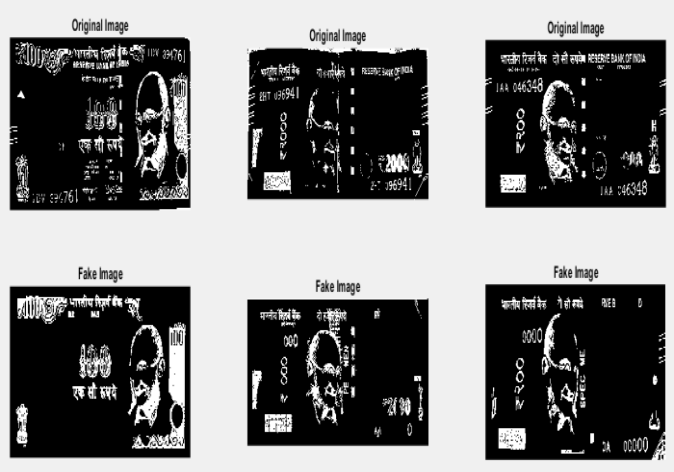


**Fig. 8 Feature Extraction**

**NEURAL NETWORK**

Neural networks is the ability to derive complicated data, can be used to extract patterns and detect too complex to be noticed by either humans or other computer techniques. In this technique, Pattern Recognition algorithm is used for training and testing the image at advanced level to compute the recognition rate level.

| Recognition Rate | Training Data | Tested Data |
|---|---|---|
| ₹ 100 | 100 % | 91.66 % |
| ₹ 200 | 100 % | 91.66 % |
| ₹ 2000 | 100 % | 87.71 % |

**Table 1 Training and Tested Data Recognition rate**

## V. EXPERIMENTAL RESULTS:

**Mean Squared Error Rate (MSE):**

It quantifies the difference between an estimator and the true value of the quantity being estimated.

$$\mathbf{MSE = 1/MN\ [\sum_{i=1}^{n}(y - y1)\ \hat{}\ 2]} \qquad \mathbf{(1)}$$

**Root Mean Squared Error Rate (RMSE):**

The square root of the MSE rate value is known as RMSE.

$$\mathbf{RMSE = sqrt\ (MSE)} \qquad \mathbf{(2)}$$

**Peak Signal-to-Noise Ratio (PSNR):**

The quality between the enhanced image and the original image.

$$\mathbf{PSNR(dB) = 10*log10\ (256*256/MSE)} \qquad \mathbf{(3)}$$

 

**TABULATION:**

| Denomination Of Bank Notes | Existing Values | | Proposed Values | |
|---|---|---|---|---|
| | PSNR(dB) | RMSE | PSNR(dB) | RMSE |
| **100** | 31.70 | 6.65 | 42.51 | 1.91 |
| **200** | 39.17 | 2.81 | 41.08 | 2.26 |
| **2000** | 51.02 | 0.71 | Infinity | 0 |

**Table 2 Comparison of Existing and Proposed work performances**

## VI. CONCLUSION

The proposed method is implemented by Pattern recognition in Neural Network technique. It reduces the cost of fake banknote detection. This algorithm was trained and tested with banknotes. When neural networks were used, the experimental results showed better accuracy for banknotes. It shows good performance, low level of complexity, and more advantages that showed better recognition rate level.

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