

Proxy Notes Recognition And Eradication For Betterment Of The Society

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Abstract— The economy of the country can be calculated based on the circulation of the currency in it. Faux notes circulation is one of the major problems of the various countries. Due to the circulation of the faux note the economy of the countries will be affected drastically. So in order to remove the counterfeit notes from the circulation various methods have been proposed. But there are some drawbacks in the proposed methods. In order to increase the rate of accuracy to determine the faux note the proposed system uses the machine learning with the help of MatLab to increase the rate of accuracy to determine the faux note in the circulation

Keywords— *Faux, Counterfeit, MatLab, Machine Learning, Circulation*

I. INTRODUCTION

The currency is the major exchange values through which the people can buy sell their commodities and their basic needs. The economy of the country dwindles with the increase in the faux notes in the circulation. The faux note is nothing but the copy of the original notes which have been produced in the illegal way. The production and the circulation of the bank notes in illegal according to the legislations of the various countries. The person who circulates the counterfeit notes will be punished severely. There is two methods which are frequently used in the faux note identification process, they are machine learning and image processing. The machine learning is the way to encourage the machine to learn itself. It can be divided it three major categories they are supervised learning, unsupervised learning, reinforcement learning.

In supervised learning the system is trained under the control of the trainer (supervisor). In unsupervised learning the system is trained without the trainer. In reinforcement learning the machine is trained to obtain the feedback from the surroundings (environment) to train itself. In image processing the images are processed to obtain the excellent quality of the images.

Image processing deals with the acquisition, enhancement, restoration, compression and segmentation of the images. Acquisition is nothing but gathering of images in the digital format. Enhancement deals with the increasing the quality of the images. Restoration deals with the restoring the images to original appearance of the image. Compression reduces the size of the images so that it can be stored in the effective manner. Segmentation divides the images into various segments for the further processing. Numerous methods have been incorporated to identify the faux notes from the original notes in the circulation.

In [1] the counterfeit notes can be found by using machine learning with the help of the help of sensors. The sensors determine morphological state of the notes such as length, height, thickness etc. [2] proposes that the fake notes in the circulation can be found using machine learning and state vector machine (SVM). With the help of SVM the faux notes can be separated from the original one in the manner of grouping. [3] states that the fake note can be identified among the original one in the circulation with the aid of the class leaning. It states that the currencies can be classified into two classes namely original and fake, based on the characteristics of the currency it can be added in to any one of the above mentioned classes. [4] states that the counterfeit notes can be distinguished from the real in the circulation with the help of deep learning.

Deep learning is a machine learning technique in which the machine learns itself if an example is provided i.e. if the characteristics of the original note are given then it learns to identify the difference between the fake and the real one. Deep learning has a multiple levels as same as the neural networks. The real notes can be differentiated from the counterfeit one with the assist of HSV (Hue, Saturation, and Value) as mentioned in [5]. Hue is nothing but the colours like red, blue, green etc. saturation is anything but the original value of the colour without the mixing of the other colours. Value refers to the brightness of the colour if the value is high then the brightness of the colour is high and vice versa. The HSV of the original one is compared with the HSV of the note which id under the question if it matches then the note is said to be original else it is said to be a faux one. The image processing techniques can be also used to determine the fake notes.

[6] states that the characteristics of the original which are derived with the help of image processing will be compared with the characteristics of the note which is under the investigation. If both the characteristics matches then the note is said to be real one else it is said to be fake

one. [8] Proposes that the counterfeit currency note can be identified with the help of classification model. The classification model can be divided into two forms they are logistic regression and linear discriminant analysis. The logistic regression provides more accuracy than the linear discriminant analysis.

Section I contains the introduction of types of methods which are available to determine faux notes from the real one's in the circulation, Section II contain the related work of authors to determine the counterfeit note from the original note in the circulation., Section III contain the methodology in which the proposed system works. Section IV contain the result of the process. Section V contains the conclusion.

II. RELATED WORK

In related works many authors proposed various ways to determine the faux notes, in which some of them provide high accuracy but it takes more time or it provides average accuracy with less time. [9] uses the combination of many methods such as image processing, image histogram, moments of the color, the characteristics of the note and their morphological conditions. Histogram is nothing but the classical diagrammatic representation of the data in bars or charts.[10] states that the currency can be determined by combining the features of the SURF (speed up robust features) and LBP features and the SVM technique is used as the classifiers.

[11] proposes that the currencies can be classified with the aid of the neural networks. Neural network is nothing but the digital imitation of the neurons in the brains. The information is passed between the networks if the condition is met otherwise the information will not be passed. [12] Conveys a simple method to find the faux note among the group of original note. The method is to extract the features of the original note and the note which is under the question, then the both the features are compared if both of them are similar then the note under the investigation is said to be original one else it is said to be fake one.

The differentiation of notes can be achieved with the help of CNN(convolutional neural network) [13], the working procedure is same as mentioned in [4] with the difference is that SSD model (single shot multiple detector). A system can be designed to assist the visually impaired people to determine the types of currencies to exchange for example the system can be developed to distinguish between 10, 20, 50 and 100 rupees notes[14].

The currencies can be differentiated with the help of artificial neural networks for the color based images. The working procedure is same as [4][13] but the only difference is that this method issued for color based images[15].

III. METHODOLOGY

Image acquisition is the first step to be carried out in the entire process. Acquisition is nothing but the gathering of the corresponding image in the digital format as shown in

Fig.1. After the acquisition of images pre-processing are carried out. Pre-processing is nothing but removal of noises in the images. The noises are removed in order to enhance the quality of the images as well as the accuracy of the output.

The filter used in the pre-processing step is anisotropic diffusion filter. Anisotropic diffusion filter is mainly used in the filtering of the colour images. It filters the images with removing the important components of the images namely edges, lines etc. The filtered image is shown in Fig2. For the enhancement of the images a tech called adaptive coherence mean improvement is used. It enhances the images closely to the provided image for the better clarity and to make it simple for the further process. Segmentation is the process of classifying the images into various segments from which the characteristics of the images can be extracted. Adaptive region growing segmentation is used in the process of segmentation. Adaptive region growing segmentation is achieved using hybrid clustering. Two K-Means algorithms have been implemented. The first one clusters the pixel information from an input image based on the RGB colour of each pixel and the second one clusters the information on pixel intensity. The segmented image is shown in Fig4. Then the features are extracted from the segmented images. Second Order Gray-level co-occurrence matrix (GLCM) is used in feature extraction. CNN(Convolution Neural Network) is used as classifier in order to differentiate the fake note from the real one's.

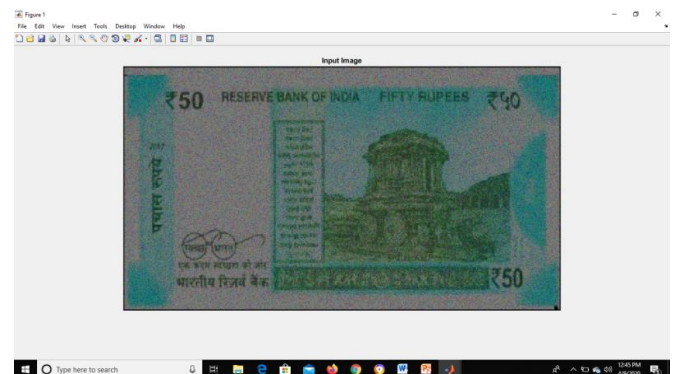


Figure.1 Input Image

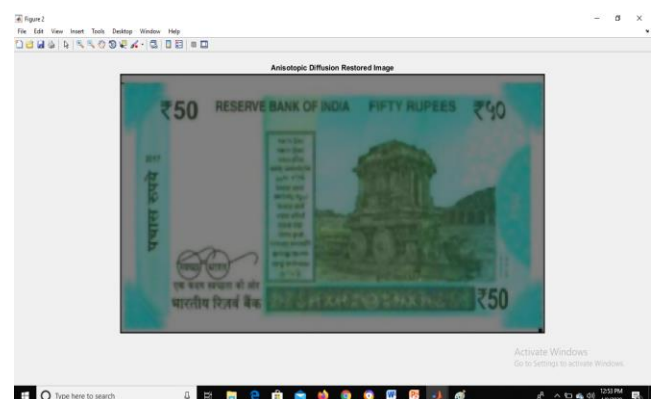


Figure.2 Filtered Image

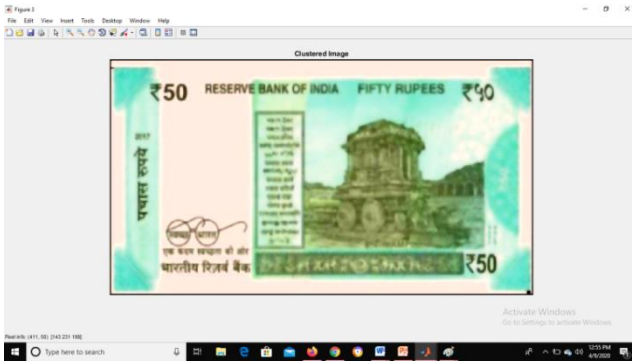


Figure.3 Clustered image

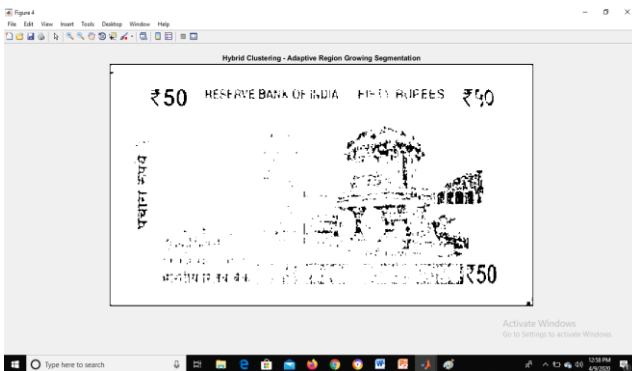


Fig.4 Segmented image

IV. RESULTS

In a set of 50 notes out of which 34 notes are original and 16 notes are fake. In the 34 notes, 33 notes are relevant. In terms of 16 fake notes, 14 notes are relevant so that the precision of original notes is $33/35 = 0.94$ while its recall is $33/50 = 0.66$ and precision of fake notes is $14/16 = 0.875$ while its recall is $14/50 = 0.28$. The recall, precision and accuracy of a system are calculated from the results taken from the dataset and observing results. These experimental results indicate that use of CNN Algorithm which gives better performance for accuracy.

V. CONCLUSION

The analysis of image is more accurate using digital image processing. This method is efficient in terms of cost and also time consuming compared to existing techniques. The MATLAB Software is used for image analysis. The research work is increasing day by day in this field and various image processing techniques are implemented to get more accurate results. The proposed system is worked effectively for extracting features of Indian currency images. The extracted features of currency image will be using for recognition of the currency as well as for its validation and verification.

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