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Fake Currency Detection Using ORB Algorithm

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Abstract: ***This paper presents the technique to detect fake currency using the technique of image processing. Fake currency is produced and circulated in the market by antisocial people or group of people in the society. Fake currency affects the economic status of the country and also brings disturbance in the economic development.***
Various methods of image processing techniques that can be used to process and detect fake currency are- image segmentation, image acquisition, edge detection, grey scale conversion, feature extraction and feature matching.
The system presented in the paper deals with feature extraction and feature matching method of image processing in python language. Result will be displayed in terms of accuracy value depicting whether the currency note is original or fake.
Keywords: Image Segmentation, Edge detection, Feature Extraction, Feature Matching and Image Processing

I. INTRODUCTION

Fake currency is the imitated or counterfeit money produced and used illegally. Mostly the higher-level denominations like Rs. 2000, Rs. 500 and Rs. 100 are counterfeited and circulated in the market. According to the figure disclosed in parliament, during 2006-09 7.34 lakh of Rs. 100 note, 5.76 lakh of Rs. 500 note and 1.09 lakh of Rs. 1000 note were found fake. Number of notes per million have increased from 4.4 in 2007-08 to 7.51 in 2011-12. In the end of year 2018, the counterfeit money detected was around 46% that was Rs. 100 denomination while counterfeit notes of Rs. 2000 and Rs. 500 were at 29% together (by number of banknotes).

There are various techniques that are developed by different researchers that could detect fake currency and can be very helpful in this field. Image processing is the widely used technique for the detection of fake currency. It includes methods such as image acquisition, image segmentation, edge detection, feature extraction and feature matching that are performed to detect the fake currency. A blend of some algorithms with image processing can be very helpful in the detection process.

A. Feature Extraction

Feature Extraction can be defined as the first step performed on an image. In feature extraction each pixel of an image is examined to see if that pixel is fit to be termed as a feature. Feature extracted from one image can be compared to the features of another image and can be processed further to get desired results.

Feature extraction can be done using SIFT, ORB, SURF etc. algorithms. These algorithms are pixel processing. These algorithms locate pixel or points on image as feature and match it with another image's Pixel or points. Hence, comparison is made on the basis of feature of an image.

B. Feature Matching

After feature extraction is done, the extracted features are matched between two images. Feature matching means finding corresponding features from two databases based on search distance.

All the feature of an image does not match, there is always some distortion between some matches but there are some good matches (say kn matches) that matches well between two images. ORB, SIFT, SURF, Brute Force, Flann matcher etc. are some of the algorithms that perform feature matching along with feature extraction.

II. LITERATURE SURVEY

In 2012, Mirza and Nanda [1] presented four characteristics such as identification mark, security thread, latent image and watermark for validating the Indian paper currency denomination. This proposed system describes an approach for verification of Indian currency banknotes. The currency will be verified by using image processing techniques. The approach consists of a number of components including image processing, edge detection, image segmentation, characteristic extraction, comparing images. The image processing approach is discussed with MATLAB to detect the features of paper currency. The result will be whether currency is genuine or counterfeit.

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D.Alekhya, G.DeviSuryaPrabha, G.Venkata Durga Rao [2] in their IJRCCT paper discussed about different methods used to detect fake notes. The method included See through register, water marking, optically variable ink, fluorescence, security thread, intaglio printing, latent image, micro lettering, identification mark. They also proposed a system that make use of MATLAB to detect whether the currency is original or fake. The system compares the RGB value of the original note and the input note, and makes the combination of the input RGB values with the original RGB values and save this combination.

Megha Thakur, Amrit Kaur [3] in their paper presents the various fake currency detection techniques. They have reviewed different fake currency detection systems. The method included See through register, water marking, optically variable ink, fluorescence, security thread, intaglio printing, latent image, micro lettering, identification mark. They also discussed about fake currency detection using MATLAB. The systems are developed using different methods and algorithms. The benefits of this study for the reader are that this study will provide information about the different methods and algorithms used for fake currency detection system. They can compare the detection systems. Detection ability depends on the currency note characteristics of particular country and extraction of features.

Ms. Rumi Ghosh and Mr Rakesh Khare [6] in their paper described various methods for the recognition of paper currency. In this survey, they empirically demonstrate the different techniques of Indian currency notes to recognition of currency notes. They discussed about different techniques for recognition of paper currency such extraction of features of banknote, characteristics such as colour, size and texture are used in recognition, a currency recognition system using ensemble neural network (ENN), etc. The paper presented a comprehensive overview of techniques for the recognizing currency using neural network techniques.

In their paper Ingulkar Ashwini Suresh and Prof. P.P. Narwade [8] proposed a system in which recognition of paper currency is done with the help of digital image processing techniques. Around eight characteristics of Indian paper currency is selected for counterfeit detection. The identification marks, optical variable link, see through register and currency colour code decides the currency recognition. The security threads, water mark, Latent image and micro-lettering features are used for currency verification. The characteristics extraction is performed on the image of the currency and it is compared with the characteristics of the genuine currency. The currency is verified by using image processing techniques.

Tushar Agasti, Gajanan Burand, Pratik Wade and P Chitra [9] proposed a system which makes the use of image processing again using MATLAB. This system makes use of process like edge detection, image segmentation, feature extraction etc. The system calculates the intensity value of each feature and if its value is above 70% the note is said to be original otherwise fake. Features of currency note like serial number, security thread, Identification mark, Mahatma Gandhi portrait were extracted. The algorithm proposed here works suitably for the newly introduced 500 and 2000 denomination.

Mayadevi A.Gaikwad, Vaijinath V. Bhosle and Vaibhav D Patil [10] in their paper studied 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 Digital Image processing such as image processing, image segmentation, characteristics extraction, comparing images etc. we can extract the features of genuine notes.

III. IMPLEMENTED SYSTEM

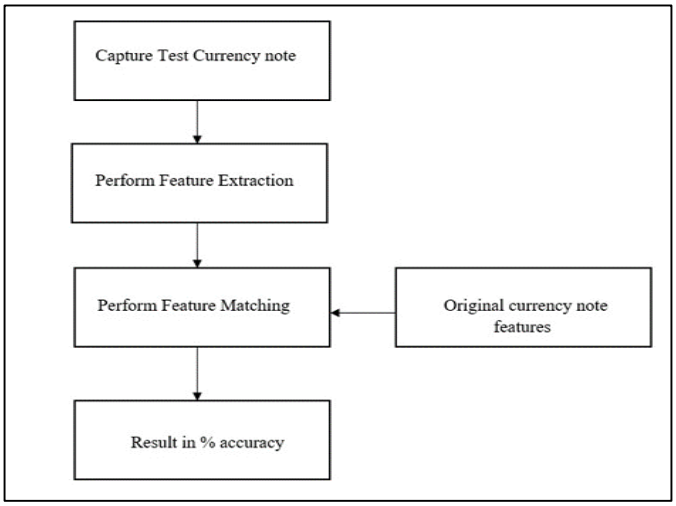


Figure 1: Flowchart of the general working of the system.

In the proposed system the image of any input currency note is captured and then it is processed with original currency note image already stored in the system.

A. *Feature Extraction*

On the input note, feature extraction is performed using ORB algorithm.

1) *ORB (Oriented FAST and Rotated BRIEF) Algorithm:* ORB algorithm is the main algorithm that has been used in this system for the very first step of feature extraction. ORB is a combination of FAST and BRIEF algorithm in which FAST is used in the well-known keypoint detector and BRIEF is used for descriptor.

Combination of both of these algorithms make ORB a good algorithm for extraction of keypoints. In this system, ORB shows the extracted points with green coloured dots that mark all the features.

As the features extracted are marked with green dots as shown in figure 2



Figure 2: Snapshot of Feature extracted in Rs. 500 note.

After extraction of all the features, feature matching is performed.

B. *Feature Matching*

For feature matching Brute Force algorithm is used:

1) *Brute Force:* This is another algorithm that has been used in this system. Brute force algorithm is used to match the extracted features. The features that are matched between the two-currency note are shown through coloured lines. The algorithm works on the basis of distance calculation. Brute Force algorithm checks all the features for match on the basis of divide and conquer technique.

It considers features parts by parts of the currency note and draws the possible matches.

All the features of input note that matches with the features in original note are highlighted with the coloured lines between the two notes as shown in figure 3.



Figure 3: Snapshot of Feature Matching of Rs. 500 note.

After getting the matched features between the two notes, the result is calculated.

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IV. RESULT

The result of the system is obtained as shown below.

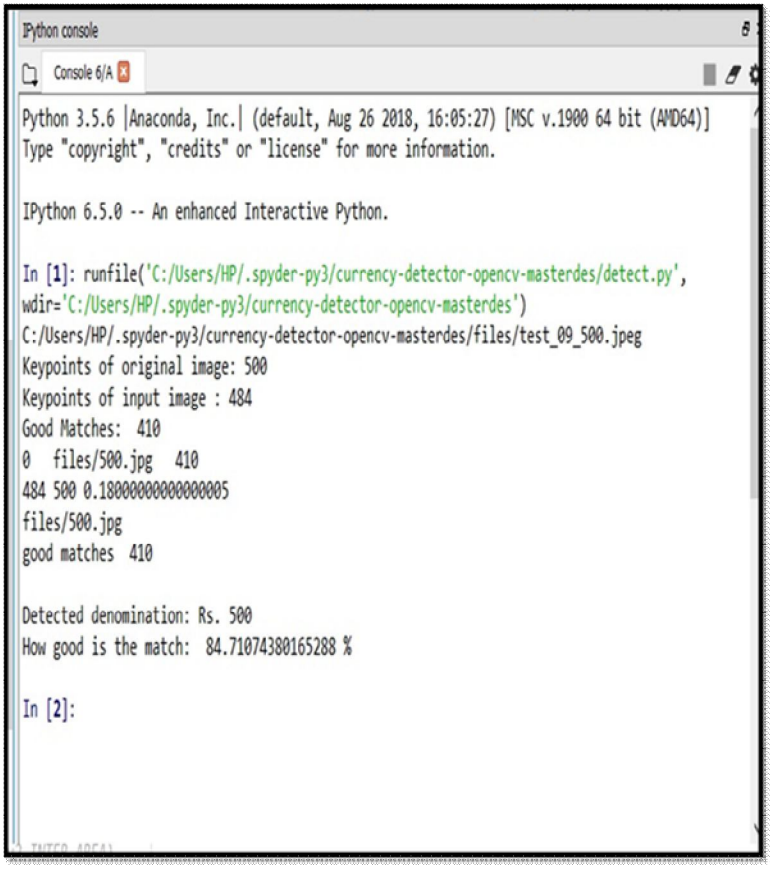


Figure 4: Snapshot of Result of Rs. 500 note

Firstly, the good matches are obtained. Good matches show the number of best matches between the two images among all the possible matches.

Then, the percentage accuracy is calculated. Percentage accuracy depicts that how close the input currency is to the original currency note.

or “Magnetization {A[m(1)]}”, not just “A/m”. Do not label axes with a ratio of quantities and units. For example, write “Temperature (K)”, not “Temperature/K”.

V. CONCLUSION

The fake currency detection system is coded in Python language which makes it easier to understand and implement.

This system can detect old as well as new currency denominations. Hardware implementation of this system can also be done. The algorithm that are used process successfully and give the accurate results.

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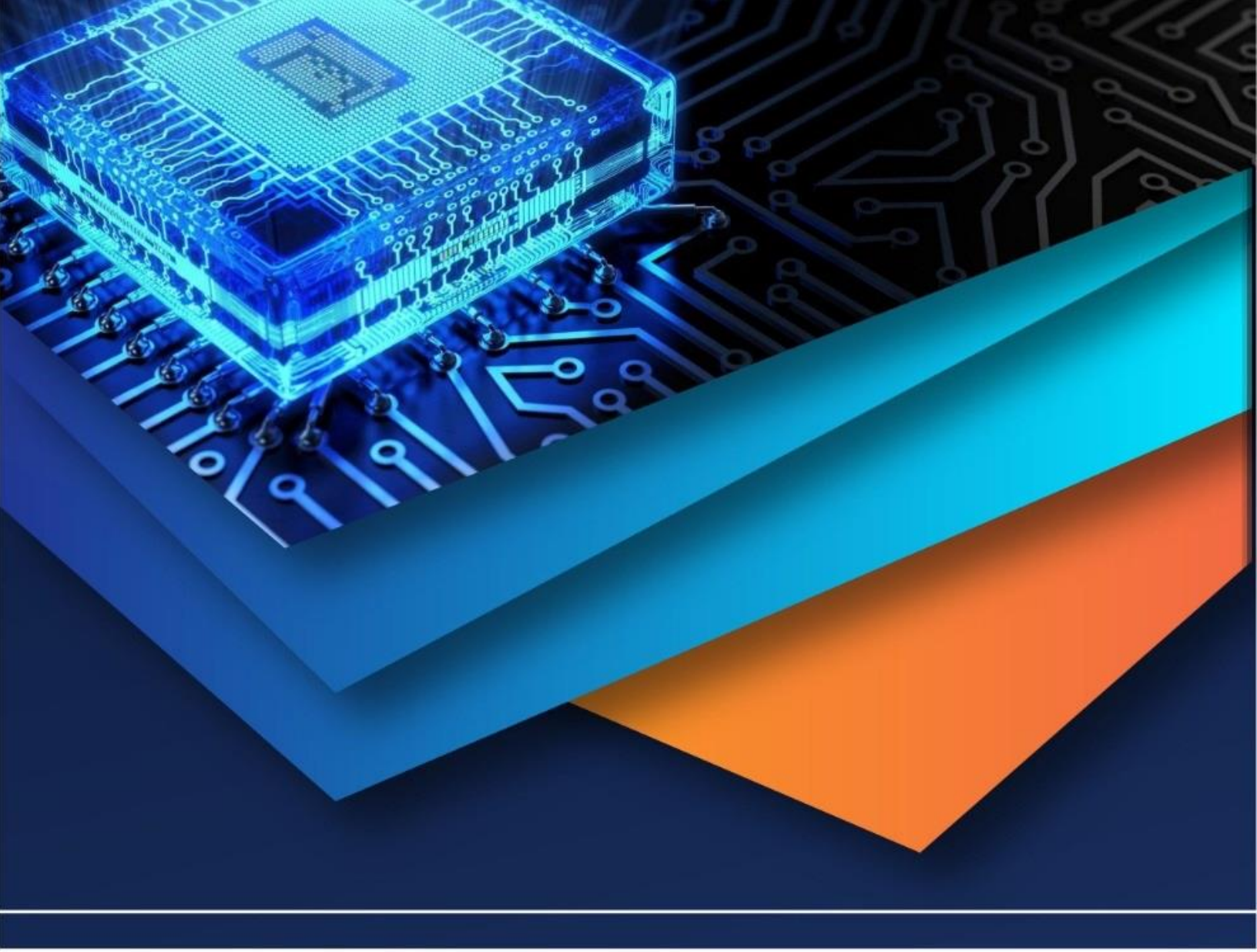
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