IJFANS INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES
ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 10, Iss 4, Dec 2021

Identification of Fake Currency Notes Using Multi Resolution Segmentation

M. Suresh[1], M. Nagaraju Naik[2], R Sathya[3], B Pradeeptha[4] and K Prathyusha[5]

[1,2,3,4,5]CMR College of Engineering and Technology, Department of ECE, Kandlakoya, Hyderabad.

Abstract:

The ease of access to modern technology has rapidly changed the way people go about their day-to-day activities. Today, anyone with a laptop can build a software application which can empower the world with new possibilities of technological advancements. Therefore, access to modern technology has given the power to a common man to build anything they want, be it groundbreaking or not. But at the same time, this brings up a lot of problems to the society and the way it functions too. One of those problems is the circulation of counterfeit currency notes. Back then, the currency notes had to be officially printed in a mint or a publicly authorized print house. But now, anyone with a laser printer can print a currency note without compromising the accuracy in features. Due to this advancement in the printing technology, counterfeit currency has become a huge problem worldwide. This adds to the already existing issues like black money and corruption. Therefore, there is an urgent need for counterfeit currency detectors which can function with maximum accuracy and efficiency. The proposed system will detect the counterfeit nature of the currency by using various image processing techniques like Edge detection, Segmentation, Feature extraction with the help of MATLAB programming.

Introduction

As the old saying goes, "*With more power, comes more great responsibility".* The fact that modern cutting-edge technology is accessible to the common man, brings up so many opportunities but at the same time raises a lot of concerns. It always depends on how the common man leverages the vast amount of technological power presented to him. Likewise, the recent developments in the printing technology has made it easy for any one with a laser printer to produce counterfeit currency without losing significant accuracy of the features of the original currency notes. As per the latest records produced by the NCRB (National Crime Records Bureau), the number of fake currency notes (FICN) seized in 2020 has risen sharply by over 190% to 8,34,947 from 2,87,404 in 2019. The problem of counterfeit currency circulation adds to the already prevailing problems like corruption and black money. Therefore, there is an urgent need to tackle this problem. A lot of researchers have done their share of research in regard to the counterfeit currency detection and have come up with numerous algorithms and techniques in the process of finding a solution to this problem. The proposed system can detect the counterfeit nature of the currency note in a quick and efficient manner. This was made done by using MATLAB and "The Image Processing Toolbox" provided by MATLAB. Four denominations of Indian currency notes (100, 200, 500, 2000) were tested and the results were obtained. In paper [1] Fake Currency Detection using Image Processing by Ms. Monali Patil, Prof. Jayant Adhikari, Prof. Rajesh Babu, the proposed system makes use of a K-means algorithm for clustering during the segmentation process and SVM to compare the trained data with the obtained data.

In paper [2] Automatic Indian New Fake Currency Detection Technique by Mayadevi A. Gaikwad, Vaijinath V. Bhosle, Vaibhav D. Patil,

Research paper UGC CARE Listed (Group -I) Journal Volume 10, Iss 4, Dec 2021

the proposed system works by making use of features like the distance between Gandhiji's portrait and the features that are nearer to the portrait.

In paper [3] Currency Recognition and Fake Note Detection by Renuka Nagpure, Shreya Shetty, Trupti Ghotkar, the proposed system distinguishes between the real and fake notes by making use of the floral designs provided by RBI.

In paper [4] Feature fusion for fake Indian currency detection Neeru Rathee, Arun Kadian, Rajat Sachdeva, Vijul Datel, Yatin Jaie, the proposed system not only employs image processing, it also makes use of supervised machine learning to obtain the results with increased precision.

In paper [5] Analysis of Counterfeit Currency Detection Techniques for Classification Model which was done by Akanksha Upadhyaya, Vinod Shokeen, Garima Srivastava, the proposed system has proven that using both image processing and logistic regression, yields an accuracy of above 99% which almost completely ensures that the counterfeit nature of the currency is detected.

In paper [6] A Study on Diverse Recognition Techniques for Indian Currency Note which was done Ms. Rumi Ghost, Mr Rakesh Khare, they have presented a comprehensive overview of various neural networks techniques and their performance and accuracy. In their study, they achieved an accuracy of "100" for RBF, "100" for Back propagation, "100" for Ensemble, "85.1" for Multilayer Perceptron.

In paper [7] Survey of Currency Recognition System Using Image Processing, done by Amol A. Shirsath, S.D. Bharkad, the proposed system can distinguish between a fake or real note of currencies of various countries. The problem is that some of the currencies may have similarity in colour and size and to counter this problem, they have made use of algorithms like Markov chain concepts and local binary pattern technique. They made use of a classifier that has a neural network that uses Gaussian function.

In paper [8] Fake currency using image processing, which was done by M. Deborah and Soniya Prathap, they have achieved a decent accuracy on the results using different performance metrics such as Peak Signal-to-Noise Ratio (PSNR), Mean Squared Error Rate (MSE), Structural Similarity Index (SSIM), Root Mean Squared Error Rate (MSE).

In paper [9] Detection method for Counterfeit Currency Based on Bit-Plane Slicing Technique, done by Mohammed H Alshayeji, Mohammad Al-Rousan and Dunya T. Hassoun, the proposed system made use of Canny operator as the edge detection algorithm and applied on eight bit-planes. It was observed that the sixth and the seventh bit-plane provide better results in recognizing edges and hidden features of images. Canny operator seemed to have produced better results when the input image was a grey scale image as it had a very low error rate and decent localization of edges, where there is not much distance between the computed edges and the actual edges, which seems to be the case with many other edge detection algorithms. All the strong edges and the weak edges connected to the strong edges were found out using this canny operator without being deceived by image noise. The results have shown that applying the Canny operator on one of the higher bit-planes yielded better performance of the overall system.

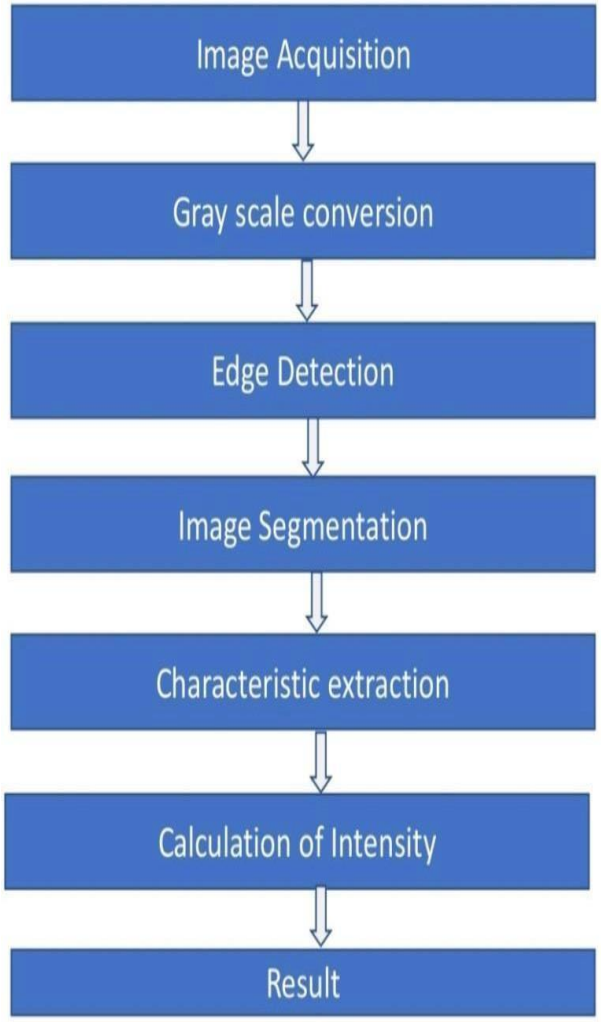
In paper [10] Android Based Currency Recognition System for Blind, done by Nayana Susan Jose, Shermin Siby, Juby Mathew, Mrudula Das, the proposed system is an android solution to

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 10, Iss 4, Dec 2021

the counterfeit currency detection problem. The system is implemented on limited processing power and memory since it is a solution designed for mobile phones. The main takeaway from this system is that segmentation plays a key role in the image processing workflow as it helpful for the retrieval process.

In paper [11] Characteristic Extraction Parameters for Genuine Paper Currency Verification Based on Image Processing, which was done by Rubeena Mirza, Vinti Nanda, they have verified paper currency of India using four characteristics of paper currency including identification, security thread, latent image, and watermark. The system might extract hidden features i.e., latent image and watermark of the paper currency. The proposed work was an effort to suggest an approach for the characteristic extraction of Indian paper currency.



Implementation process

1. Image Acquisition – It is the process of acquiring an image by the means of a digital camera or some other photographic equipment.
2. Gray Scale Conversion – It is the process of converting an RGB image that was acquired before to a gray image so as to reduce the number of computations. An RGB image pixel is usually represented using 24 bits but in case of a gray scale image, it is just 8 bits. Therefore, there is a huge number of computations that can be saved if the gray scale image is processed instead of the RGB image.
3. Edge Detection - Then, the gray scale image is sent for edge detection where the edges in the image are detected. Whenever there is a sudden abrupt change in the intensity of the pixel, then

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 10, Iss 4, Dec 2021

it is considered an edge.

4. Segmentation - The next process is segmentation where the identical parts of the image are segmented and cropped. It is basically like assigning names to a bunch of pixels.
5. Characteristic Extraction - After segmentation, characteristics of currency note are extracted.
6. The obtained dataset is compared to the trained dataset.
7. If the threshold is reached, then the currency note is said to be original otherwise fake.

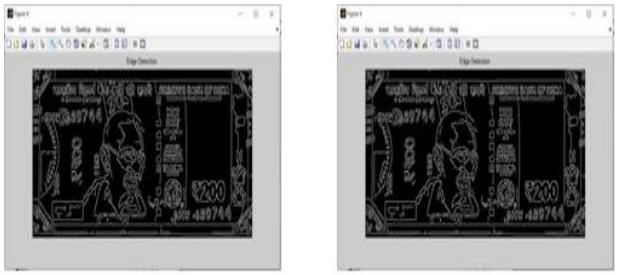
Result:
For 200 Denomination:

(Fig 1&2) This is the input image that is being uploaded using the MATLAB code.

(Fig 3&4) This is the output after noise removal. The removal of noise is done as follows.

- Split the image into 3 channels. (Red, Blue, Green)
- Apply 2-D median filtering using *medfilt2* function on each of the three channels.
- Recombine the channels.

(Fig 5&6) The Denoised image is then converted to Gray scale for obtaining the results quickly by reducing the number of computations required.

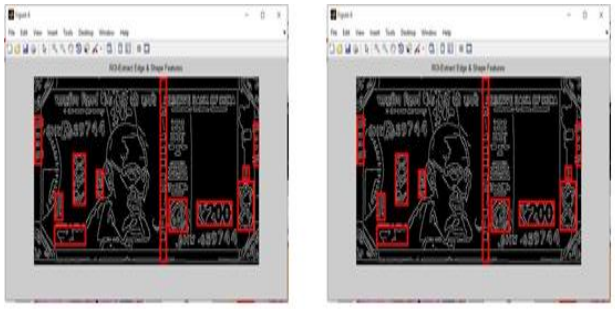


(Fig 7&8) The Gray scale converted image then undergoes edge detection. This is done using the Canny operator. The Canny filter is a multi-stage edge detector. It uses a filter based on the derivative of a Gaussian in order to compute the intensity of the gradients. The Gaussian reduces the effect of noise present in the image.

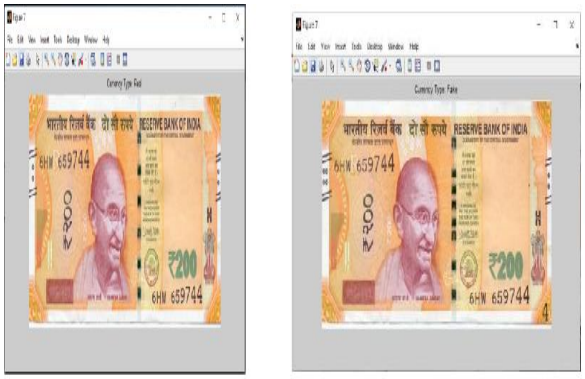
(Fig 9&10) In this image, the ROI (Region of Interest) is the Texture and Statistical Feature extraction.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 10, Iss 4, Dec 2021



(Fig 11&12) In this image, the ROI (Region of Interest) is the Edge and Shape Feature extraction.



(Fig 13&14) After computing various

For 100 denomination:

(Fig 15&16) This is the input image that is being uploaded using the MATLAB code.

Fig (17&18) This is the output after noise removal. The removal of noise is done as follows.

- Split the image into 3 channels. (Red, Blue, Green)
- Apply 2-D median filtering using *medfilt2* function on each of the three channels.
- Recombine the channels.

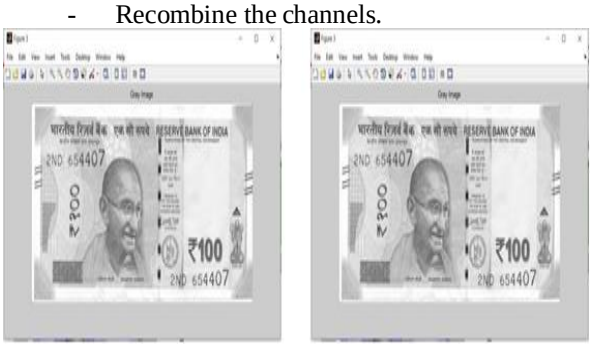


Fig (19&20) The Denoised image is then converted to Gray scale for obtaining the results quickly by reducing the number of computations required.

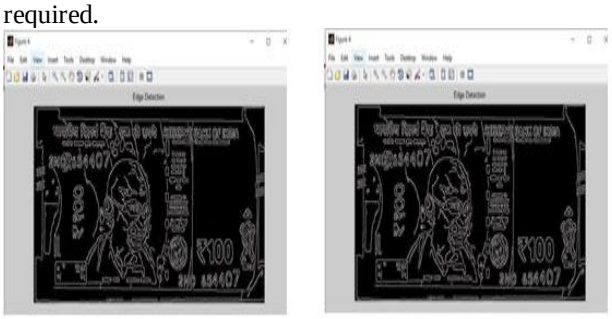
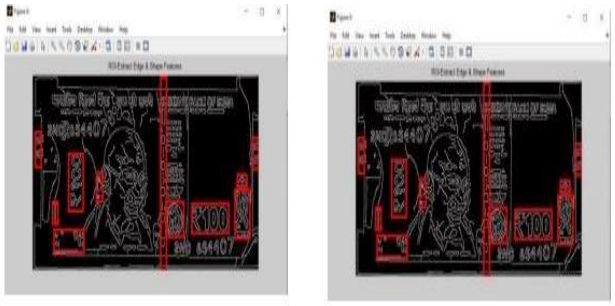


Fig 21&22) The Gray scale converted image then undergoes edge detection. This is done using the Canny operator. The Canny filter is a multi-stage edge detector. It uses a filter based on the derivative of a Gaussian in order to compute the intensity of the gradients. The Gaussian reduces the effect of noise present in the image.

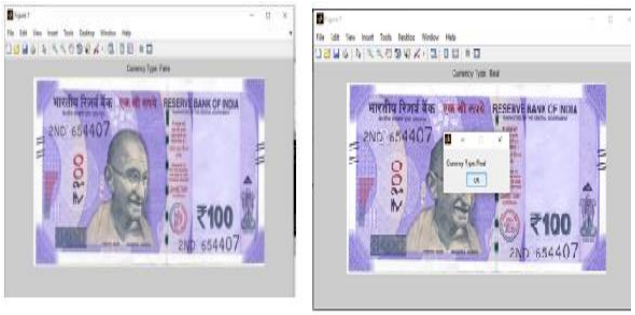
(Fig 23&24) In this image, the ROI (Region of Interest) is the Texture and Statistical Feature extraction.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 10, Iss 4, Dec 2021



(Fig 25&26) In this image, the ROI (Region of Interest) is the Edge and Shape Feature extraction.



(Fig 27&28) After computing various parameters like Mean, Variance, Kurtosis, Energy, Contrast, Entropy, Homogeneity, Circularity, Eccentricity, Convexity, Area, Compactness, Extent, Solidity and comparing all those parameters with the trained data using SVM, the test image was declared as a real currency note or fake currency note.

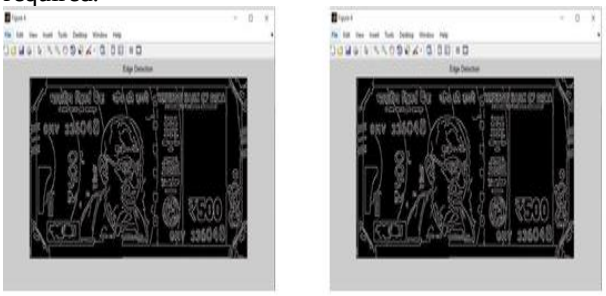
For 500 Denomination :

(Fig 29&30) This is the input image that is being uploaded using the MATLAB code.

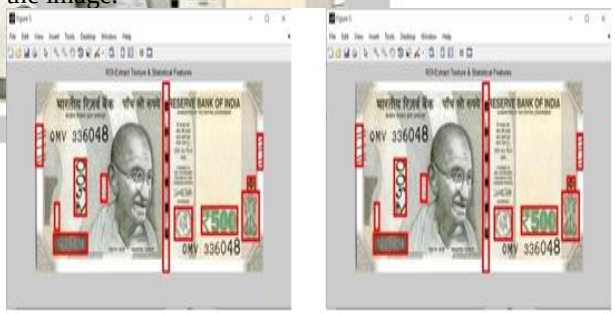
(Fig 31&32) This is the output after noise removal. The removal of noise is done as follows.

- Split the image into 3 channels. (Red, Blue, Green)
- Apply 2-D median filtering using *medfilt2* function on each of the three channels.
- Recombine the channels.

(Fig 33&34) The Denoised image is then converted to Gray scale for obtaining the results quickly by reducing the number of computations required.



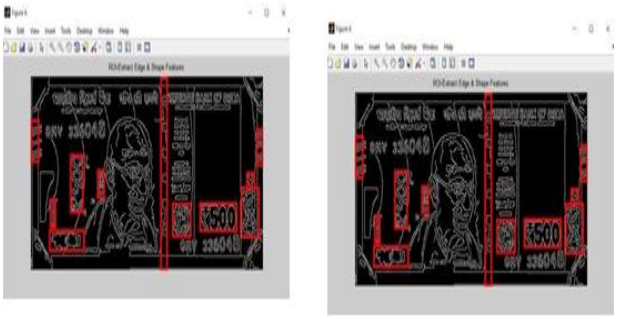
(Fig 35&36) The Gray scale converted image then undergoes edge detection. This is done using the Canny operator. The Canny filter is a multi-stage edge detector. It uses a filter based on the derivative of a Gaussian in order to compute the intensity of the gradients. The Gaussian reduces the effect of noise present in the image.



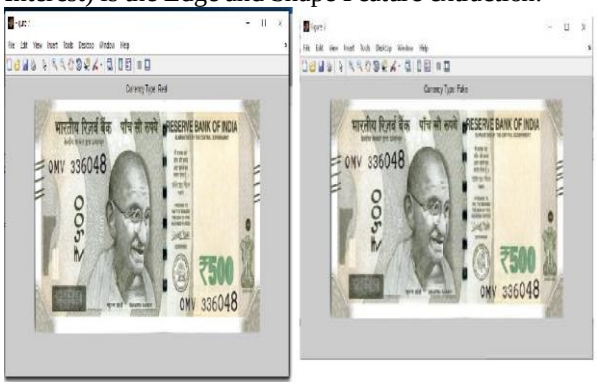
(Fig 37&38) In this image, the ROI (Region of Interest) is the Texture and Statistical Feature extraction.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 10, Iss 4, Dec 2021



(Fig 39&40) In this image, the ROI (Region of Interest) is the Edge and Shape Feature extraction.



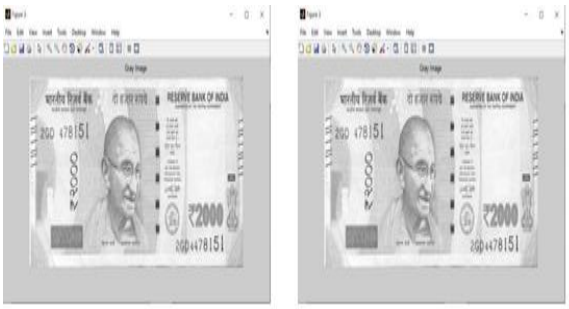
(Fig 41&42) After computing various parameters like Mean, Variance, Kurtosis, Energy, Contrast, Entropy, Homogeneity, Circularity, Eccentricity, Convexity, Area, Compactness, Extent, Solidity and comparing all those parameters with the trained data using SVM, the test image was declared as a real currency note or fake currency note.

For 2000 Denomination :

(Fig 43&44) This is the input image that is being uploaded using the MATLAB code.

(Fig 45&46) This is the output after noise removal. The removal of noise is done as follows.

- Split the image into 3 channels. (Red, Blue, Green)
- Apply 2-D median filtering using *medfilt2* function on each of the three channels.
- Recombine the channels.



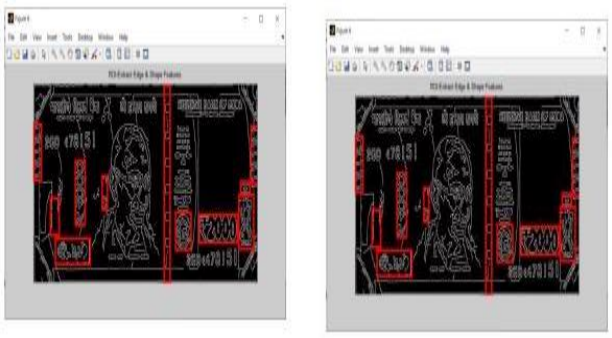
(Fig 47&48) The Denoised image is then converted to Gray scale for obtaining the results quickly by reducing the number of computations required.

(Fig 49&50) The Gray scale converted image then undergoes edge detection. This is done using the Canny operator. The Canny filter is a multi-stage edge detector. It uses a filter based on the derivative of a Gaussian in order to compute the intensity of the gradients. The Gaussian reduces the effect of noise present in the image.

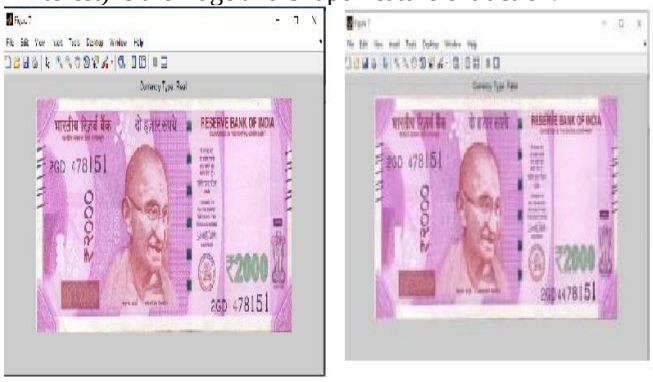
(Fig 51&52) In this image, the ROI (Region of Interest) is the Texture and Statistical Feature extraction.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 10, Iss 4, Dec 2021



(Fig 53&54) In this image, the ROI (Region of Interest) is the Edge and Shape Feature extraction.



(Fig 55&56) After computing various parameters like Mean, Variance, Kurtosis, Energy, Contrast, Entropy, Homogeneity, Circularity, Eccentricity, Convexity, Area, Compactness, Extent, Solidity and comparing all those parameters with the trained data using SVM, the test image was declared as a fake currency note or real currency note.

4 Conclusion

The proposed system of fake currency detection can detect the counterfeit nature of the currency note using MATLAB programming and the Image Processing Toolbox provided by MATLAB. Firstly, the image is captured, then converted to gray scale and by using canny operator the edges are detected and then the texture and statistical feature extraction is done. Finally, the obtained results are compared with the trained data using SVM (Support vector machine). If the threshold is met, then the currency is said to be an original one, otherwise it is said to be a fake currency. For better processing speed, the program can be run on a computer with superior processors. Therefore, an efficient solution for the fake currency detection has been achieved.

REFERENCES

[1] Fake Currency Detection using Image Processing. Ms. Monali Patil, Prof. Jayant Adhikari, Prof. Rajesh Babu Department of Computer Science and Engineering Tulsiramji Gaikwad Patil College of Engineering Mohgaon Nagpur Maharashtra India..

[2] "Automatic Indian New Fake Currency Detection Technique" Mayadevi A.Gaikwad, Vaijinath V. Bhosle Vaibhav D Patil College of Computer Science & Information Technology (COCSIT).

[3] Renuka Nagpure, Shreya Sheety, Trupti Ghotkar, "Currency Recognition and Fake Note Detection", IJIRCCE, vol. 4, 2016.

[4] Neeru Rathee, Arun Kadian, Rajat Sachdeva, Vijul Dalel, Yatin Jaie "Feature fusion for fake Indian

currency detection". Maharaja Surajmal Institute of Technology, New Delhi,India.

[5] Akanksha Upadhyaya Research Scholar, Vinod Shokeen Associate Professor, Garima Srivastava "Analysis

of Counterfeit Currency Detection Techniques for Classification Model" AIIT Amity University Noida,Noida,

India

[6] Ms.Rumi Ghosh, Mr Rakesh Khare, —A Study on Diverse Recognition Techniques for Indian Currency Note‖, IJESRT, Vol.2, Issue 6, June 2013.R. Nicole, —Title of paper with only first word capitalized,‖ J. Name Stand. Abbrev. In press.

[7] Amol A. Shirsath S. D. Bharkad, —Survey Amol A. Shirsath S. D. Bharkad, —Survey of Currency Recognition System Using Image Processing‖, IJCER, Vol.3, Issue 7, pp 36-40, July2013.

[8] M.Deborah and Soniya Prathap —Detection of Fake currency using Image Processing‖.

IJISET- International Journal of Innovative Science, Engineering & Technology, Vol. 1, Issue 10, 2014.

[9] Faiz M. Hasanuzzaman, Xiaodong Yang, and YingLi Tian, Senior Member, IEEE Robust and Effective Component-based Banknote Recognition for the Blind IEEE Trans Syst Man Cybern C Appl Rev. 2012 Nov; 42(6): 1021–1030.

[10] Mohammad H Alshayeji, Mohammad Al-Rousan and Dunya T. Hassoun, Detection Method for Counterfeit Currency Based on BitPlane Slicing Technique ,International Journal of Multimedia and Ubiquitous Engineering Vol.10, No.11 (2015).

[11] Nayana Susan Jose, Shermin Siby, Juby Mathew, Mrudula Das, Android Based Currency Recognition System for Blind, International Journal of Engineering Research in Computer Science and Engineering (IJERCSE) Vol 2, Issue 4, April 2015.

[12] Rubeena Mirza, Vinti Nanda, Characteristic Extraction Parameters for Genuine Paper Currency Verification Based on Image Processing, IFRSA International Journal of Computing, Volume 2, Issue 2, April 2012.