International Journal of Computational Intelligence Research
ISSN 0973-1873 Volume 13, Number 5 (2017), pp. 945-953

http://www.ripublication.com

Enhancement of Sift algorithm to check authenticity of Indian Currency

Sandeep Kaur*
M.Tech. Student (Computer Engineering)
Yadavindra College of Engineering, Punjabi University
Guru Kashi Campus, Talwandi Sabo, India

Seema Baghla
Assistant Professor (Computer Engineering) (Supervisor)
Yadavindra College of Engineering, Punjab University
Guru Kashi Campus, Talwandi Sabo, India

Sunil Kumar
Assistant Professor
Yadavindra College of Engineering, Punjab University
Guru Kashi Campus, Talwandi Sabo, India

Abstract

The image analysis is a technique of image processing that helps to analyze various properties of the input image. In the recent times various application of the image analysis has come into existence. The current detection is the application of image analysis which is used to define that whether currency is fake or genuine. Various algorithms has been proposed based on SIFT algorithm to analyze external features of input currency. In the existing algorithm, only external features are analyzed that has accuracy of detection. In the proposed work, new technique has been proposed to analysis on to analyze internal features of the image for the detection. The internal features of the image are strip values of the currency. Simulation has been performed in MATLAB. Peak signal to noise ratio (PSNR), root mean square error (RMSE), fault detection rate (FDR) and accuracy values of the proposed and existing algorithm are compared to validate the proposed system.It is been found that accuracy of detection has increased up to 10 percent and fault detection rate is reduced up to 8 percent.

Keywords: SIFT algorithm, image processing, currency detection, fault detection, strip values.

I. INTRODUCTION

Computer imaging is defined an acquisition and processing of visual information by computer [1]. Computer imaging can be separated into two primary categories: computer vision and image processing. In computer vision application, the processed images output are used by a computer, whereas in image processing applications the output images are used for human consumption. JPEG compression is a standard stage in the camera pipeline in most consumer level digital cameras [1].

The extraction of image content description and their associated matching is called feature detection. The main steps required are memory consuming and redundant raw images. The main techniques of feature extractions are Sobel Edge Detection, Canny Edge Detection, and Hough Transformation [1]. Currency is a token which is exchanged for buying services and goods. Currencies can be in many forms like metal, paper and polymer etc. Paper currencies are easy to handle and are used in different countries for transactions. A currency recognization system recognizes the currency and predicts the denomination by calculating its value. There is a need of efficient recognizer to effectively and accurately recognize the currency [2].

Some methods use physical properties as the extrinsic features of the currency. Internal features can also be used. But there are many countries which do not use internal properties due to false detection of same currency. The basic distribution is same, head portrait at the right side, a white area in the left side. In left side water mark is available with some texts on the top. The values position of the currency is distributed at the corner [3]. A Bayesian method is a graphical model to find out relationship among variable features. The Bayesian network structure is a directed acyclic graph and nodes are in one-to-one correspondence relationship among their features [3]. SIFT is scale invariant feature transform provides motion tracking, multi view geometry and recognition. Applications include object recognization, robotic mapping and navigation, image stitching, 3D modeling, gesture recognition, video tracking, individual identification of wildlife and match moving etc. Features of SIFT are highly distinctive, relatively easy to extract and allow for correct object identification with low probability of mismatch [3].

II. LITERATURE REVIEW

Yadav et al. (2011) [1] developed a methodology to detect fake notes automatically. The technique used feature extraction with HSV color space for image processing. Authors implemented a fake note detection unit in MATLAB. **Hassanpour et al. (2007) [3]** used three characteristics of paper currencies including size, color, and texture in feature recognition. By using image histogram, plentitude of different colors in a paper currency was computed and compared with the one in the reference paper currency. The Markov chain concept has been applied to model texture of the paper currencies as a random process. This method has been used for recognization of

paper currencies from different countries. **Saini and Kaur (2015) [6]** examined shifts in system-created documents, incorporating documents with printed and plain foundations. The manipulation of the documents was finished with the assistance of picture processing software applications including Adobe Photoshop and paint. The documents were analyzed for alterations and results were obtained. The results showed that various features were connected with picture manipulation. **Santhanam et al. (2013) [7]** proposed a method to identify wrong currency. It encompasses polarization concept, image processing technique and holographic detect method to detect fake currency on the physical properties of the currency rather than existing methodology of its chemical properties. This scheme is implemented using mathematical label, experimental verification and lab view simulation and also through automation to enhance reliability and accuracy efficiently manner. **Liu and Shimamur (2014) [8]** proposed an approach for LP analysis of cross correlation sequence between speech signal and its zero crossing waves. The proposed used performed speech analysis under a white noisy environment simulation results showed that proposed method produced better results as compared to existing. **Vishnu and Omman (2014) [11]** proposed method to identify features like numeral, shape, colors etc. Principal component analysis (PCA) has been used to reduce the dimensions and a similarity based classifier is constructed to predict test sample. Results are also validated by constructing models using classifier implemented using WEKA and testing with unseen samples not considered method feature extraction. This result showed that centre numeral results in an accuracy of 100% with all family of currencies. **Jain and Vijay (2013) [12]** presented that an image processing technique to extract paper currency. The extracted ROI has been used with neural networks and pattern matching techniques. Authors used different pixel level for the denomination of notes. The pattern recognition and neural network matcher technique was used to match the currency of the paper notes.

III. **METHODOLOGY**

In the proposed technique, the currency is taken and each currency has their unique identification irrespective matched. The proposed match various features of the currency note to its denomination check the note is legitimately of note. These features of font type are numeric, shape, RBI seal and latent seal. All these features are extracted using SIFT and features are matched using nearest neighbour classifier (NNC). Previously SIFT technique with nearest neighbour classifier has been used to detect fake currency. In the proposed technique SIFT technique has been used with Bayesian classifier (BC) and DWT tool.

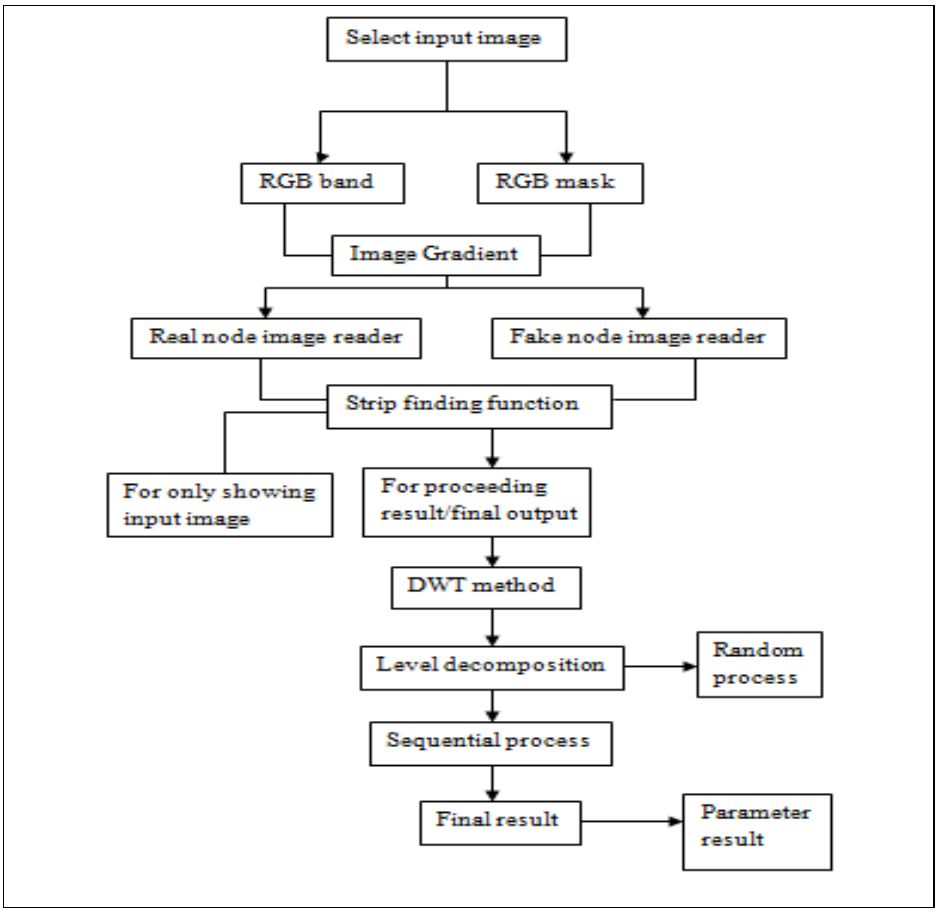

Figure 1: Flowchart of proposed work

Figure 1 shows the flowchart of the proposed implementation for currency recognization. The image is taken as input and converted into gray scale. To detect the font of the character, SIFT algorithm has been applied to analyze the image and to detect image edges. Image segmentation has been applied in next step to detect numeric from the input image. In the last step, the numeric text is extracted and compared with the genuine numeric to check whether currency is genuine or fake. Peak signal to noise ratio (PSNR), root mean square error (RMSE), fault detection rate (FDR) and accuracy values of the proposed and existing algorithm are compared to validate the proposed system.

IV. RESULTS

Figure 2 shows the image of the note input to the proposed system. The RGB bands of the image are extracted using the designed system to identify the legitimacy of the input image the features extracted from the input image are validated against the features of the original note. The proposed technique has been used to check whether

the input image is of fake currency or not by comparing the properties and features of input note image with original note image.

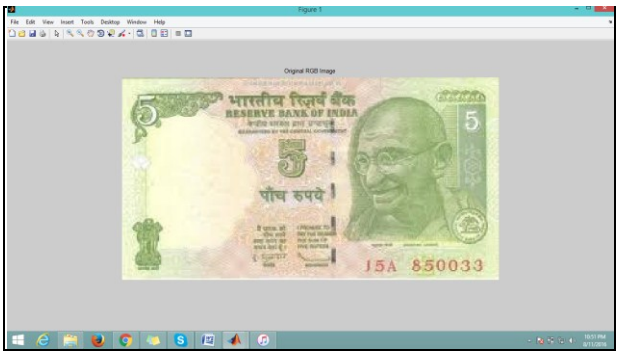

Figure 2: Input of currency Image

Figure 3 shows the image of the note input to the proposed system. The red, green and blue color of the image has been masked and intensity of the colors has been found out using gradient function.

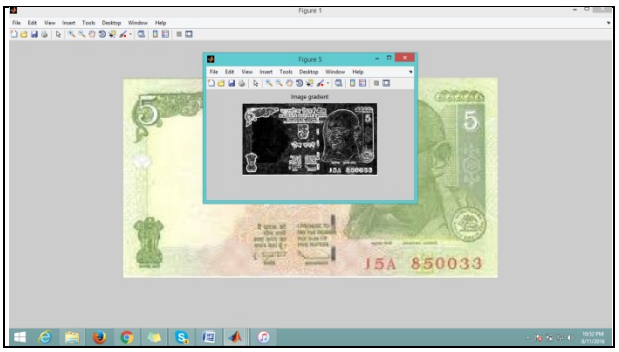

Figure 3: Extraction of RGB band

Figure 4 shows the image of the note input to the proposed system. The image features has been analyzed using morphological scanning. The DWT technique has been applied to extract features of the input image. The strip part of the image has been extracted for efficient analysis of the image.

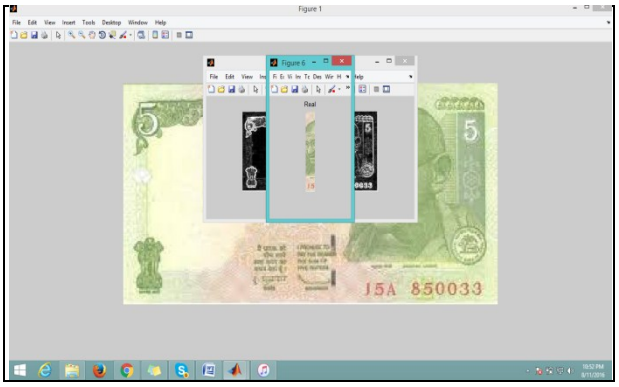

Figure 4: Strip Extraction

Figure 5 shows the image of the note input to the proposed system. The image features has been analyzed using morphological scanning. The DWT technique has been applied to extract features of the input image. The strip part of the image has been extracted for efficient analysis of the image.

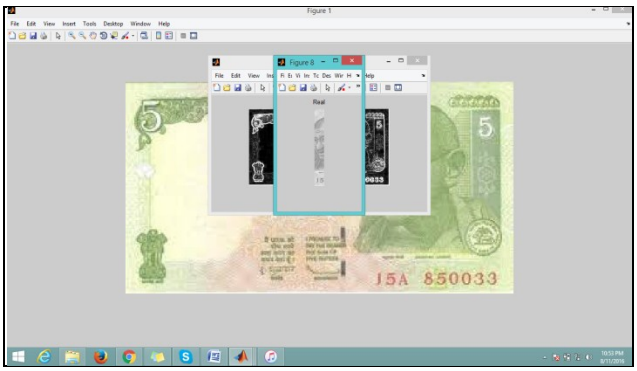

Figure 5: Strip Extraction

Figure 6 shows the image of the note input to the proposed system. The image features has been analyzed using morphological scanning. The DWT technique has been applied to classify extracted image features.

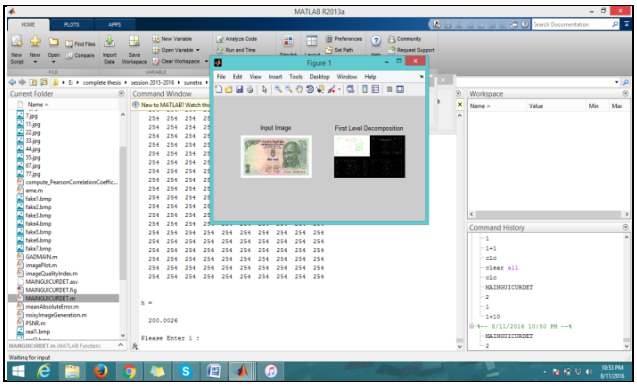

Figure 6: Decomposition of the input image

Figure 7 shows the image of the note input to the proposed system. The image features has been analyzed using morphological scanning. The DWT technique has been applied to classify extracted image features. A boolean variable has been defined whose value depends on the properties and features of the currency notes. The variable has been calculated for each input currency note image by mapping with original currency note image. If the value of the variable is '0', it indicates that the input note image is of fake currency. If the value of the variable is '1', it indicates that the input note image is of original currency.

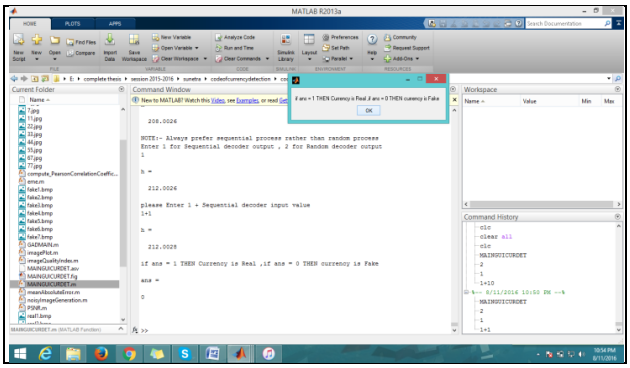

Figure 7: Detection of fake or legitimate currency

Table 1 lists the values of the output parameters viz. PSNR, RMSE, FDR, and accuracy for existing and proposed methodology.

Table 1: Table of Comparison

Parameters/Technique	**Existing method**	**Proposed method**
	SIFT+ NNC	**SIFT+BC+DWT**
PSNR	9.1620	17.48
RMSE	31.04	34.08
FDR	0.498	0.502
Accuracy	70.33	87.74

Figure 8 shows the graphical representation of the results detailed in table 1. It can be seen that the PSNR, RMSE, FDR and accuracy for the proposed system is more than the existing method. So it can be concluded that the proposed method is better than the existing methods.

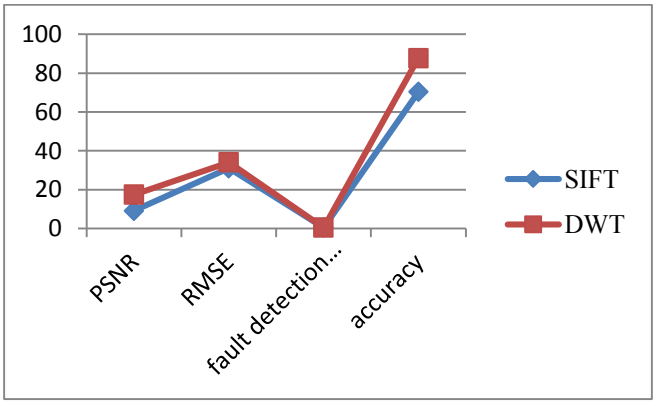

Figure 8: Graph of results

CONCLUSION

SIFT algorithm has been used to analyze external features of an image by various researchers in the past. The currency detection is the application of image analysis, in which SIFT algorithm along with nearest neighbor classifier has been applied to analyze external features of the checking the originality of currency notes. In the present work, method using SIFT algorithm with Bayesian classifier and DWT has been proposed for checking the originality of currency notes. The value of Peak signal to noise ratio (PSNR), root mean square error (RMSE), fault detection rate (FDR) and accuracy values of the proposed and existing algorithm (SIFT algorithm with nearest neighbour classifier) are compared to validate the proposed system. The results confirmed that the proposed technique is better as compared to the existing technique for checking the originality of the currency notes.

REFERENCES

[1]. B. P. Yadav, C. S. Patil, R. R. Karhe, P. H. Patil (2014), "An automatic recognition of fake Indian paper currency note using MATLAB", International Journal of Engineering Science and Innovative Technology, Vol. 3, Issue 4, pp. 560-566.

[2]. F. H. Kong, J. Q. Ma, J. F. Liu (2006), "Paper currency recognition using Gaussian mixture models based on structural risk minimization", International Conference on Machine Learning and Cybernetics, pp. 3213-3217.

[3]. H. Hassanpour, A. Yaseri, G. Ardeshiri (2007), "Feature extraction for paper currency recognition", IEEE International Symposium on Signal Processing and its Applications, pp. 1-4.

[4]. H. Wang, G. Li, Z. Ma, X. Li (2012), "Image recognition of plant diseases based on back propagation networks", International Congress on Image and Signal Processing, pp. 894-900.

[5]. J. Qian, D. Qian, M. Zhang (2006), "A digit recognition system for paper currency identification based on virtual instruments", IEEE Information and Automation, pp. 228-233.

[6]. K. Saini, S. Kaur (2015), "Forensic examination of computer-manipulated documents using image processing techniques", International Association of Law and Forensic Science, pp. 1-7.

[7]. K. Santhanam, S. Sekaran, S. Vaikundam, A. M. Kumarasamy (2013), "Counterfeit currency detection technique using image processing, polarization principle and holographic technique", International Conference on Computational Intelligence, Modeling and Simulation, pp. 231-235.

[8]. L. Liu, T. Shimamura (2014), "Linear prediction analysis of cross correlation sequence for voiced speech", Signal and Information Processing Association Annual Summit and Conference, pp. 1-4.

[9]. M. Deborah, C. Soniya, M. E. Prathap (2014), "Detection of fake currency using image processing", International Journal of Innovative Science, Engineering & Technology, Vol. 1, Issue. 10, pp. 151-157.

[10]. R. Mirza, V. Nanda (2012), "Design and implementation of Indian paper currency authentication system based on feature extraction by edge based segmentation using sobel operator", International Journal of Engineering Research and Development, Vol. 3, Issue 2, pp. 41-46.

[11]. R. Vishnu, B. Omman (2014), "Principal features for Indian currency recognition", Annual IEEE India Conference (INDICON).

[12]. V. K. Jain, R. Vijay (2013), "Indian currency denomination identification using image processing technique", International Journal of Computer Science and Information Technologies, Vol. 4, pp. 126-128.

[13]. X. Zhou, S. Zhang , X. Xie , M. Yang, Y. Bi , L. Li (2014), "Application of BP neural networks to water demand prediction of Shenyang city based on principle component analysis", International Conference on Intelligent Computation Technology and Automation, pp. 912-915.

[14]. Y. He, S. Blandin, L. Wynter, B. Trager (2014), "Analysis and real time prediction of local incident impact on transportation networks*",* IEEE International Conference on Data Mining Workshop*,* pp. 158-166.