I J C T A, 9(14) 2016, pp. 6485-6489

A Novel Currency and Denomination Recognition System

[*]S. Girija*[1], A. Nithyakalyani[1], S. Ushasukhanya[1], T. Y. J. Naga Malleswari[1], Gautam[1] and Prashant Khaitan[1]

ABSTRACT

Currency Recognition is implemented to reduce human power to recognize the currency and the monetary value of the currency. The basic idea is to utilize image processing and feature extraction for analyzing the various features from respective currency. The existing works focus on either the recognition of a particular currency or its denominations based on a single feature. This paper focuses on recognizing currency as well as its denominations using several features that are specific for a particular currency thereby increasing the efficiency of recognition.

Keywords: Image Processing, Currency Recognition, Feature extraction, Region of Interest

INTRODUCTION

There are various types of currencies all over the world. All currencies around the world look entirely different from each other. For instance, the size of the currency is different; the color might be different, or the features present are different. The staffs who work at these offices where currency exchange is done have to distinguish between different types of currency and it is not an easy job. The project proposes an image processing technique for paper currency recognition. The extracted Region of Interest (ROI) can be used with pattern recognition matching techniques [2].

The Image Processing approach is used to detect the distinct features of paper currency. Image Processing involves changing the quality of an image to improve its pictorial information for human interpretation. There are various techniques for currency recognition based on texture, pattern or color based. Extracting discriminant characteristics from the currency image is essential for accuracy and robustness of the automated system [4]. Two images are considered in the proposed system; one is an original image to be identified, and other is the test image on which verification is to be performed [2].

After studying various currencies and considering their availability, we have chosen three currencies to work on for this project. The chosen currencies are Indian Rupee (INR), Euro (EUR) and US Dollar (USD).

PROPOSED SYSTEM

The proposed currency recognition system design is described in figure 1. The steps involve image acquisition of currency to be recognized using a Scanner or a camera and storing it in the database followed by Histogram equalization to compare the scanned image with the testing sample currencies and identify the currencies. It is then followed by smoothing techniques to change the nature of the image to prepare the image for further processing. From the result, boundaries and ROI (Region of Interest) are extracted and saved to match the desired features.

Department of Computer Science Engineering, SRM University, Chennai
[1]*{girija.s,ushasukhanya.s, nithyakalyani.a, nagamalleswari.t }@ktr.srmuniv.ac.in*
Department of Computer Science Engineering, SRM University, Chennai
[2]*{93cgautam,pkprashantkhaitan}@gmail.com*

(A) Proposed Algorithm

The following sequence of steps represents the various stages of acquiring the test and training samples and processing the currency image.

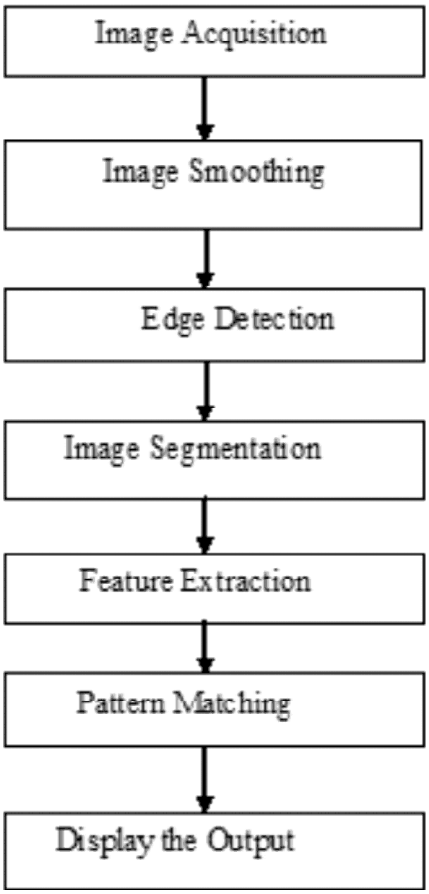

Figure 1: Architecture of currency Recognition system

(B) Currency Features

There are different distinct features present in every currency. Each note has a unique identification mark. The proposed algorithms extract these features from the currency and use them to identify the currency. Various features of different currencies on different denominations like INR, USD, and EURO, are presented below.

(Distinct features in 100 Rupee note) (Distinct features in 500 Rupee note)

Figure 2: Distinct features in Indian Rupee (INR)

(Distinct features in 100 dollar note) (Distinct features in 5 dollar note)

Figure 3: Distinct features in US Dollar (USD)

(Distinct features in 10 Euro note) (Distinct features in 100 Euro note)

Figure 4: Distinct features in Euro (EUR)

WORKFLOW

The aim of proposed algorithm is to develop an algorithm which can be easily applied to some currencies and has good efficiencies and high speed.

A. Obtaining the image: An image can be obtained using a number of different equipment such as a camera or a scanner. The image of the scanned currency is stored in the database.

B. Histogram image: Histogram is a graph to represent an exposure of each pixel in an image. The left side of a graph represents shadows and blacks. The right side of the graph represents highlights and brighter areas in an image. When the exposure is more, the peaks in histogram will be high. The chart goes from 0 to 255, 0 represents black and 255 represents white.

A histogram plot of the scanned, as well as the test image, shows the similarity between the images. In figure 6, the x-axis represents the tonal distribution of the currencies and y-axis, the number of pixels in that particular tone.

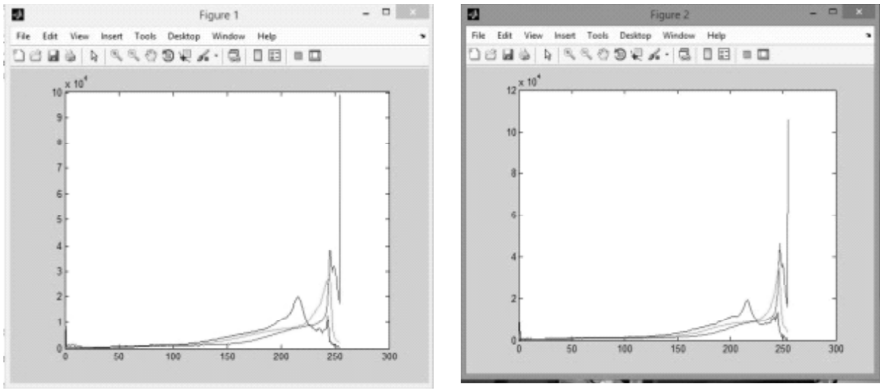

Figure 5: Histogram plot for scanned and test image

C. Image Smoothing: While performing image processing some noise may appear in the image.Thus, image processing is needed to remove the unwanted portions from the image for further processing.Smoothing algorithms are applied to reduce noise and prepare an image for further processing such as segmentation. These operations involve blurring gray-scale conversions, thresholding, noise removing using filters and color blurring [2]. Following are the conversions involved in Image smoothing:

1. *Gray Scale conversion*: In photography and computing, a gray-scale digital image is an image in which value of each pixel is single sample, that it is, it carries only intensity information. Images of this sort, also known as black-and-while, are composed exclusively of shades of gray, varying from black at the weakest intensity to white at the strongest.
2. *Binary Scale Conversions*: A binary image is a digital image that has only two possible values for each pixel. Black and white are the two colours used for the binary image. Binary conversion is used for proper segmentation of the image.

This paper deals with gray scale conversion of an image since the tonal distribution of the various regions of the currency can be used to identify the intensity of the pixel values across all regions.

D. Image Segmentation: A digital image is partitioned into multiple segments (sets of pixels, also known as superpixels) for better analysis. The goal of segmentation is to simplify and change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain characteristics. As a result, segmentation subdivides the image into its constituent regions or objects [5].

The result of image segmentation is a set of segments that collectively cover the entire image or a set of contours extracted from the image (see edge detection).

E. Edge Detection: Edge detection is an image processing technique for finding the boundaries of objects within images.

It works by detecting discontinuities in brightness. Edge detection is used for image segmentation and data extraction in areas such as image processing, computer vision, and machine vision.A set of mathematical functions is used to identify points in a digital image at which the image brightness changes sharply or, more formally, has discontinuities. Here, we spot the various ROI of the currency based on the features of a particular currency and its denominations.

F. Pattern Matching: The correlation coefficient is a number representing the similarity between two images in relation to their respective pixel intensity. corr2 (A, B) computes the correlation coefficient between A and B, where A and B are matrices or vectors of the same size. Here A and B are the images used in the comparison. For every pixel location in both images, the difference between the intensity value at that pixel and the mean intensity of the whole image, denoted as a letter with a straight-line over it is computed.

EXPERIMENTAL RESULTS

The figure represents the GUI for selecting the currency followed by Feature Extraction from the selected currency. The features are unique for different currencies (INR, USD EURO). These features are used as an input for finding the denomination. For example, in INR different shapes like circle, triangles are used to discriminate between the various denominations.

The experimental results show a better efficiency for all denominations of the currencies considered. The currency recognition system.

CONCLUSION

We have developed an interactive system that performs Currency recognition using Histogram Equalization and feature extraction using MATLAB. We have worked on currencies and have found that it works efficiently on these currencies provided the notes are in good condition, and lighting is sufficient.

The designed module successfully recognizes the currency and also identifies the denomination of the currency.

FUTURE WORK

The proposed project successfully identifies the type and denomination of three currencies – Indian Rupee (INR), US Dollar (USD) and Euro (EUR). Based on this work the future prospects can be done for the addition of more currencies to the database as we deal with three difference currencies with various denominations. Another important area to be covered would be fake currency recognition.

CONFLICT OF INTEREST

None declared.

REFERENCES

[1] Hanish Aggarwal, Padam Kumar "Indian Currency Note Denomination Recognition in Color Images", *International Journal on Advanced Computer Engineering and Communication Technology Vol-1 Issue:1: ISSN 2278 – 5140.*

[2] Chinmay Bhurke, Meghana Sirdeshmukh, Prof. Mrs. M.S.Kanitkar on "Currency Recognition Using Image Processing", *International Journal of Innovative Research in Computer and Communication Engineering, Vol-3, Issue 5, May 2015.*

[3] Vipin Venugopal , Deborah Thomas, Arya Prasadon "Indian Currency Recognizer and Counter System", *Internation Journal of Innovative Technology and Exploring Engineering", ISSN: 2278-3045, Vol-4, Issue 5, October 2014*

[4] Binod Prasad Yadav, C.S.Patil, R.R.Karhe, P.H.Patil on "An Automatic Recognition of fake Indian Paper Currency note using MATLAB", *International Journal of Engineering Science and Innovative Technology, Vol-3, Issue-4, July 2014.*

[5] Kishen Chakraborty, Jordan Basumatary, Debasmita Dasgupta, Jagadish Chandra Kalita, Subra Mukharjee on "Recent Developments in Paper Currency Recognition System", *International Journal of Research in Engineering and Technology, eISSN: 2319-1163 | pISSN: 2321-7308.*

[6] Binod Prasad Yadav, C.S.Patil, R.R.Karhe, P.H.Patil on "Indian Currency Recognition and Verification System using Image Processing", *International Journal of Advanced Research in Computer Science and Software Engineering", Vol-4, Issue-12, December 2014, ISSN: 2277 128X.*

[7] Rubina Mirza, Vinti Nanda, "Paper Currency Verification System based on Characteristic Extraction using Image Processing, *IJEAT, Vol-1, Issue-3, pp. 68-71. February 2012.*

[8] Amol A. Shirsath, S.D.Bharkhad, "Survey of Currency Recognition System using Image Processing", *IJCER, Vol-3, Issue-7, pp. 36-40, July 2013.*

[9] Nurlaila Binti Haman, "Currency Recognition and Converter System".

[10] Ms. Trupti Pathrabe, Mrs. Swapnili Karmore, "A novel approach of embedded system for Indian paper currency recognition", International Journal of Computer Trends and Technology- May to June Issue 2011, 152-156.