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A PAPER CURRENCY RECOGNITION SYSTEM USING IMAGE PROCESSING TO IMPROVE THE RELIABILITY WITH PCA METHOD

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ABSTRACT

Automatic paper currency recognition always depends on the currency note characteristics of a particular country and the extraction of features directly affects the ability of recognition. Currency has great significance in day to day life and may be because the currency recognition is a great area of interest. We know that, for people, to count different denomination notes in a bunch is a major task as well as its very difficult for people to recognize currencies from different countries. In this paper, we present an image processing technique to extract paper currency denomination based on the local principal component analysis (PCA) method. Here, We try to give an idea to solve such types of problem to help the people.

KEYWORDS: currency recognition, image processing, PCA.

INTRODUCTION

The Indian currency system is prevalent since a long time. Presently the Indian currency system has various currency notes as of Rs. 1,2,5,10,20,50,100,500 and 1000. All denomination notes has its value printed on the note.[2] An image based approach which detects Indian paper currencies (Notes) of different denomination has been proposed in this work.

With the development of present banking services areas, many automatic methods for paper currency recognition become important in many applications such as in automated teller machines and automatic goods seller equipments. The requirements for automatic banknote recognition systems encouraged many researchers to develop corresponding robust and reliable methods. Recognition accuracy and processing speed are generally two important targets in these types of units. In such type of technology of currency recognition focuses to search and extract the visible and hidden marks on paper currency for efficient classification performance. Wither, there are various methods proposed for paper currency recognition. The simplest way is to make use of the visible features of the paper currency, such as, the size and text of the paper. That type of methods has great limitations as currencies of different values may have the same size in some countries, and the visible marks may be contaminated by noise.[3] Junfang Guo proposed a method for paper currency based on the traditional local binary pattern method for feature extraction and template matching is performed in this method.

Omatu proposed a local principal component analysis using (PCA) algo, which is used to remove non-linear dependencies among variables and extract the main principal features of data. In 2012, Chetan B. V. et al. [3] proposed side invariance paper currency recognition method which is two phase approach based on matching an input note image with a database of note image. These are given as :
1. Identifying matching dimension database notes.
2. Secondly, template matching is performed by correlating the edges of input and matching dimension database note images.

METHODLOGY
Image Processing

Image processing is a method to convert an image into digital form and perform some operations on picture or image, in order to obtaining an enhanced image or to extract some useful information from image or picture. This is an important type of signal process in which image is work as an input, like photograph or any video frame and output may be image or characteristics associated with that image. In general Image Processing system includes treating images as two dimensional signals while applying already set signal processing methods to them

There are different kinds of technique for currency recognition that involve pattern, texture or color based. Here, We use digital image processing techniques to find region of interest, after that Machine learning and Pattern Recognition Technique is used for matching the pattern. [2]

The basic steps are described below with a neat diagram.
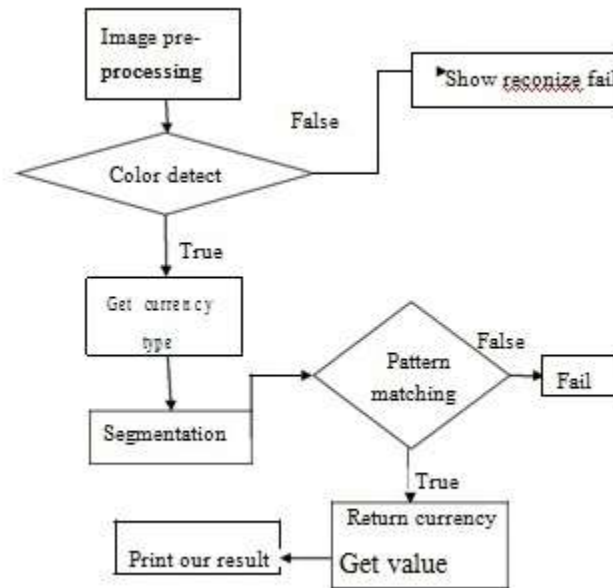
A digital camera or scanner or phone is used for image preprocessing. The starting step of the paper currency recognition system would be image segmentation that means separating the note image from the background. Figure 1 shows an example of segmentation, involved in this work.

Figure 1. Paper currency segmentation result

Dimension Matching

After segmentation of paper currency, the numbers of pixels row-wise and number of column-wise number of pixels in the segmented image are also noted. These pixel counts (row-wise and column-wise) give the dimensions of the paper currency in pixels.

After that match the dimensions of the input note, with the dimensions of all database notes. The matching dimension database notes are noted down. At last, during template matching only these matching dimension database notes are matched with input note for recognition of input note.

Edge Detection

It is the preparatory step of template matching. Edge detection of the database note and input note, which is about to be matched is performed. Figure 2 shows an example for the result of edge detection method which is involved in this work. The edges of input and database notes are coordinate to obtain a correlation coefficient. This coefficient is the matching score obtained by matching input and database notes.

Figure 2. Edge detection result

In this, scanned currency notes are converted into gray scale from file format to pixel values. Converting to gray scale does not reduce the required level of information of currency notes for this instance and colour is not a concern in this research. Then new set of values have been generated from original gray scale pixel values by having a linear combination of the former values. After the transformation, Edge detection is performed to extract the image's identity as what is used to recognize by the system. Edge detection reflects sharp intensity changes in colors of the image. Then this detected edge information is extracted and arranged in a format required by the network.[1]

After that we use the machine learning concept, Since it is supervised learning, network is expected to give expected results when notes with similar or slight differences are presented for classification. Figure 3 shows the different denomination of Indian currency notes.

Fig 3. Different denomination Currency.

Threshold comparison. The matching score obtained from each matching dimension database note is compared with a predefined threshold value. If the matching score is greater than threshold, the particular database note stands matched with the input note. Otherwise, the particular database note stands unmatched.

PCA

The Principal Component Analysis (PCA) is one of the most successful techniques that have been used in image recognition. PCA is a statistical method under the broad title of factor analysis. The main purpose of PCA method is to reduce the large dimensionality of the data space (observed variables) to the smaller intrinsic dimensionality of feature space (independent variables), which are needed to describe the data economically. In this case there is a strong cordination between observed variables. In this paper, to increase the classification reliability we apply a local principal components analysis method for feature extraction of data. The current system is intended for classifying different kinds of paper currency, however, we consider only Indian paper currency. We use a local PCA algorithm for feature extraction which buses a mixture of local linear PCA. The input data is clustered into regions at first and then the PCA is performed on the data which falls within each region.[5]

CONCLUSION

The recognition method of Indian paper currency which describe in this paper is quite simple, efficient and easy to be understand clearly because denomination numerals are used for identification which can be extracted easily from paper currency. These denomination numerals are matched and are found exact match for identification.

This method of currency recognition using image processing will certainly help to identify different denomination of paper currency. This method can be used for counting of different denomination note bunch.

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