

Currency Recognition And Fake Note Detection

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Abstract

Counterfeit currency is a burning question throughout the world. The counterfeiters are becoming harder to track down because of their rapid adaptation with highly advanced technology. One of the most effective methods to stop counterfeiting can be the outspread use of various counterfeit detection tools/software that are easily available and are efficient in terms of cost, reliability and accuracy. The aim of this project is to recognize Indian currency notes using a image obtained from a webcam in real-time. This java based application will help recognize a bank-note based on its denomination on an application window. The application will be build using Java. The method will be based on image based preprocessing followed by a classification of note. The application will be trained with samples of note denomination in Indian currency before testing.

Keywords: Fake Currency, Image Pre-processing, Feature Extraction, Text to speech.

1. Introduction

Modernization of the financial system is a milestone in protecting the economic prosperity, and maintaining social harmony. The Reserve Bank of India is the only one which has the full authority to issue bank notes in India. But some unsocial group of people is prone to make these fake currencies. Fake Indian Currency of 100, 500 and 1000 seems to have flooded the system and there is no proper way to deal with them for a common person. From few years, along with the original currency, Fake Currency is also circulating in the society and unbalancing the social harmony of the society. Many of the transaction are also carried out with it. With the advancement of the modern banking services, automatic methods for paper currency detection has become important in most of the applications such as in automated teller machines and automatic goods seller machines. Images are processed by using various techniques of image processing and further various features are extracted from the images. The approach consists of a number of components including image processing, image segmentation, characteristic extraction, comparing images. The basic thing of approach is that we

extract the features on the basis of which we are going to classify the fake note.

2. Problem Statement

The paper currencies are the center of target to counterfeiters. Counterfeit detection is mainly executed based on the Chemical or Physical properties of paper currencies. The counterfeiters nowadays, can evade the chemical property & physical feature based counterfeit paper currency detection system due to technological advancement. Moreover, the unavailability, high cost, poor accuracy and lack of user-friendliness leads these fake detection tools to a least acceptance situation among the end-users. That is why, feature based counterfeit detection system is now the focus of active research. In the proposed work, the methodology of image processing based extraction of the existing features of notes will be depicted in detail to demonstrate the feasibility of software assisted counterfeit currency detection system.

3. Proposed System

The proposed system is to design a robust prototype that can perform efficient and reliable recognition of the Indian currency notes applicable for Visually Impaired People (VIP). The problem identifications of the proposed study are as follows: Presence of noise while capturing the image of currency note and mitigating them. Computing extent of the threshold to be used for color matching for different type of denomination under challenging physical condition of notes (skewed, variable illumination, etc). In this system we are going to extract the following features through which we can detect fake and genuine notes, they are:-

- See through Register
- Security Thread
- Identification mark
- Serial Number
- Optically Variable Ink

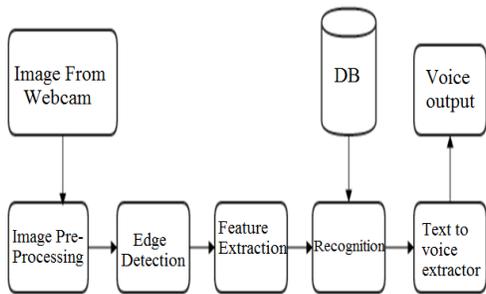


Fig. 1 System block diagram

4. Methodology

Image processing based currency recognition technique consists of few basic steps like image acquisition, its pre-processing and finally recognition of the currency. Image processing generally involves three steps:

1. Import an image with an optical scanner or directly through digital photography.
2. Manipulate or analyze the image in some way.
3. Output the result. The result might be the image altered in some way or it might be a report based on analysis of the image. The Flowchart of the steps involved in methodology is as follows:

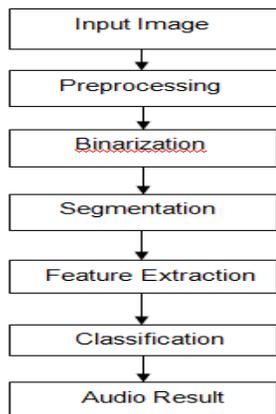


Fig. 2 Work flow diagram

4.1 Image Acquisition

(Input Image) Image acquisition is the action of retrieving an image from some source, usually it is a hardware-based

source, as in this paper the hardware source is a webcam. Performing image acquisition is always the first step in the image processing workflow sequence because, without an image, no processing is possible. The image that is acquired is completely unprocessed. Once the image is obtained various methods of pre-processing are applied to perform the desired task and if the image obtained is not satisfactory then the desired task may not be achievable.

4.2 Image Pre-processing

The goal of image pre-processing is to suppress undesired distortions or improve the quality of some image features that are important for further analysis. It includes:-

4.2.1 Image adjusting:-

The image we got from scanner or digital camera is too big. So calculations are going to be a bigger one. In order to reduce these calculations we need to reducing the size of an image. Image Adjusting is done with the help of image interpolation technique which is required for tasks such as zooming, rotating, shrinking of an image and for geometric corrections. Bilinear and bucolic are the two different types of image interpolation techniques. The first one uses the concept in which the distance weighted average of the four nearest pixel values is calculated to estimate a new pixel value. Let (x, y) denotes coordinates of the location where we want to assign an intensity value and $Z(x, y)$ denote the intensity value, so to evaluate the intensity value we use equation,

$$Z(x,y) = ax+ by + cxy + d \tag{1}$$

Where four coefficients can be obtained from the four equations from the four unknown and can be written using four nearest neighbours of point.

4.2.2 Image smoothening:-

When we capture image through digital camera or scan image through scanner, some noise will appear on the image. The removal of this noise is an important step in the image processing. In an image processing, smoothing of a data set by suppressing noise means, to create an approximating function that attempts to capture important patterns in the data. In smoothing, the data points of a signal are modified so that individual points are reduced, and points lower than the adjacent points are increased leading to a smoother signal. There are two important ways

in which smoothing that can aid in data analysis by being able to extract more features from the image data. The algorithm used for smoothing is non linear algorithm which is called as median filter as described below.

4.2.3 Median filter :-

A median filter is similar to mean filter which considers each pixel in the image and at the same time looks at its neighbouring pixels to decide whether or not it is the representative of its surroundings. The pixel value is replaced with the median of the neighbouring pixel values instead of replacing with the mean of the neighbouring pixel values.

Calculation of median is done by first sorting all the pixel values from the surrounding neighbourhood in an ascending order and then replacing the pixel being considered with the middle pixel value.

4.3 Image Binarization

Image binarization is performed in the pre-processing stage of different document image processing related applications such as optical character recognition (OCR) and document image retrieval. A gray - scale document image is converted into a binary document image and accordingly it facilitates the various tasks such as document skew estimation and document layout analysis.

4.5 Image Segmentation

[1] It determines region boundaries in an image. It can explore many different approaches to an image segmentation & thresholding. Optimal Global Thresholding:

A threshold is said to be globally optimal if the number of misclassified pixels is minimum

- Histogram is bimodal (object and background)
- Ground truth is known OR the histograms of the object and the background are known

4.6 Feature Extraction

[2]In any currency recognition system, feature extraction is one of the most challenging tasks. Here, the aim is to analyze and identify the unique and distinguishing features of each denomination under various challenging conditions such as old notes, worn out notes, also under different

illumination and background. Some of the features of Indian paper currency are stated as below:-

- Identification marks
- Intaglio Printing
- Latent Image
- Security thread
- Optically Variable Ink

4.7 Classification and Result

Image classification analyzes the numerical properties of scanned image features and organizes data into categories. Algorithms used for classification typically employ two phases of classification:

1. Training.
2. Testing.

In the initial training phase, characteristic properties of scanned image features are separated and, based on these training class is created. The main important component of the classification process is the training class. The procedure of classification is as follows:-

1. Definition of Classification class
2. Selection of features
3. Sampling of training data
4. Estimation of universal statistic.
5. Classification.

Multi-level slice classifier, Minimum distance classifier, Maximum likelihood classifier are most popularly used technique for classification. On the basis of classification the currency is examined whether it is fake or original.

4.8 Text to Speech

Text-to-speech (TTS) is a type of speech synthesis application that is used to create a spoken sound version of the text in a computer document, such as a help file or a Web page. TTS can enable the reading of computer display information for the visually challenged person, or may simply be used to augment the reading of a text message.[7]

5. Conclusion

This paper discussed a technique for verifying paper currency of India. The proposed work is an effort to suggest an approach for the characteristic extraction of Indian paper currency. Approach suggested from the beginning of image acquisition to converting it to gray scale image and up to the word segmentation has been

stated. This work will surely be very useful for minimizing the counterfeit currency.

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