Recognition of Counterfeit Indian Paper Currency by Image Processing Techniques

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Abstract

Counterfeit notes are one of the biggest problem occurring in cash transactions. For country like India, it is becoming big hurdle; because of the advances in printing, scanning technologies it is easily possible for a person to print fake notes with use of latest hardware tools. Detecting fake notes manually becomes time-consuming and untidy process hence there is need of automation techniques with which currency recognition process can be efficiently done. This paper is a based on the work which gives solution for fake currency problem. The approach consists of a number of components including image processing, edge detection, image segmentation, feature extraction, comparing images. It becomes very important to select the right features and proper algorithm for this purpose. The basic requirements for an algorithm to be considered as practically implementable are simplicity, less complexity, high speed and efficiency. The main aim is to design an easy but efficient algorithm that would be useful for maximum number of currencies, because all currencies have different security features, making it a tough job to design one algorithm that could be used for recognition of all available currencies. The image processing approach is discussed with MATLAB to detect the features of paper currency which involves changing the nature of an image in order to improve its pictorial information for human interpretation. The result will be whether currency is genuine or counterfeit.

Keywords: *Counterfeit, feature extraction, image processing, MATLAB.*

1. Introduction

As this is the age of automation, almost every task in industries has been automated. Now-a-days there are many things where automation has brought radical changes. Therefore Automatic methods for bank note recognition are required in many applications such as automatic selling-goods and vending machines. Extracting sufficient monetary characteristics from the currency image is essential for accuracy and robustness of the automated system. This is a challenging issue to system designers.

Every year RBI (Reserve bank of India) face the counterfeit currency notes or destroyed notes. Handling of large volume of counterfeit notes imposes additional problems. Therefore, involving machines (independently or as assistance to the human experts) makes notes recognition process simpler and efficient. The only solution that is presently available for common man to detect counterfeit currency is Fake Note Detector Machine. This machine is mostly available only in banks which is not reachable every time by average citizen. All these scenarios need a kind of solution for common people to judge a forged bank note and to refrain our currency from losing its value.

Recognition of counterfeit currency means detection of fake currency from the genuine ones. The methodology of this project will be extracting unique features of the Indian currency note through image processing techniques.

Digital Image Processing is a rapidly evolving field with growing applications in Science and Engineering. It encompasses the processes whose inputs and outputs are images and extract attributes from images including the recognition of individual objects. MATLAB is a high performance language for technical computing. It integrates computation, visualization and programming in an easy to use environment.

Feature extraction is a type of dimensionality reduction that efficiently represents interesting parts of an image as a compact feature vector. This approach is very useful when image sizes are large and reduced feature representation is required to quickly completer tasks such as image matching and retrieval. This overture contains a large number of steps including image acquisition, gray scale conversion, edge detection, image segmentation, feature extraction and comparison of images.

Image acquisition is the creation of digital images, typically from a physical scene. In the proposed work, the image will be acquired by using scanner.The image is then stored in the computer for further processing. Edge detection and image segmentation are the most important tasks performed on the images.

1.1 Edge detection

Edge detection is an image processing technique for finding the boundaries of objects within images. It works by detecting discontinuities in brightness. It is used for image segmentation and data extraction. Edge detection is one of the fundamental steps in image processing, image analysis, image pattern recognition, and computer vision techniques.

1.2 Image Segmentation

Image segmentation is the process of dividing an image into multiple parts. This is typically used to identify objects or other relevant information in digital images. An effective approach to performing image segmentation includes using algorithms, tools, and a comprehensive environment for data analysis, visualization, and algorithm development. Segmentation algorithms generally are based on one of two basic properties of intensity values-

1.2.1 Discontinuity

This approach is to partition an image based on abrupt changes in intensity such as edges in an image.

1.2.2 Similarity

This approach is to partition am image into regions that are similar according to a set of predefined area.

2. Related Work

From the literature, it is revealed that many researchers have done work on the identification of fake currency. Let us explain some of the important references. Recently

in 2017, identification of newly launched 500 and 2000 notes in the Indian market has been performed [1]. A UML activity model is designed to represent the dynamic aspects for identification of fake currency and successfully implemented on newly launched a note of Rs 2000 by an Indian Government.

Another research work conducted a survey [2] by going through different literature, which describes different techniques of fake note identification. This is a MATLAB based system for automatic recognition of security features of Indian currency.

Another study describes an approach in which six characteristics of Indian paper currency are selected for counterfeit detection included identification mark, security thread, watermark, numeral watermark, floral design and micro-lettering [3]. The characteristic extraction is performed on the image of the currency and it is compared with the characteristics of the genuine currency. The decision making is done by calculating the black pixels. This article is aimed to design a low cost system and quick decision making system.

Another study focuses on reading mechanism of Indian currency note number recognition using image processing for the existing ATM machines [4]. The algorithm developed is tested for 1000 rupee notes which provides an accuracy of 86% for serial number extraction of Indian rupee currency note number and takes 0.568079 seconds for its execution.

A new technique is proposed [5] in which images of the paper currency will be acquired through camera by applying UV (ultra violet) backlighting, extra light to the banknote so that the hidden marks of currency are appeared on the image. Then image will be further processed by applying the image processing techniques using LABVIEW tool. Morphological image processing based feature extraction for Indian currency recognition and verification has been done [6].

3. Proposed Work

The proposed system will work on 2000 rupee denomination. The base color of the note is magenta. The note has other designs, geometric patterns aligning with the overall color scheme, both on the obverse and the reverse. The size of the new note is 66mm x 166mm. The system has two images, one is original image of the paper currency and other is the test image on which recognition is to be performed.

The proposed algorithm for the discussed paper currency recognition system is presented as follows-

A. Image of paper currency will be acquired by simple scanner.
B. The image acquired is RGB image and then it will be converted into gray scale.
C. Edge detection of the whole gray scale image will be performed.
D. After detecting edges, the four features of the paper currency will be cropped and segmented.
E. After segmentation, the features of the paper currency will be extracted.
F. The characteristics of test image are compared with the original pre-stored image in the system.
G. If it matches then the currency is genuine otherwise counterfeit.

In the proposed method features of paper currencies are employed that are used by people for differentiating different banknote denominations. Basically, at first instance, people may not pay attention to the details and exact features of banknotes for their recognition, rather they consider the common features of banknotes such as the size, the background color (the basic color), and texture present on the banknotes. In this method, these characteristics will be used to differentiate between different banknote denominations-

Latent Image
Latent image with denominational numeral 2000 can be seen when the banknote is held at 45 degree angle at eye level.

Micro lettering
This feature is exclusive for 2000 rupee note and appears between the vertical band and Mahatma Gandhi portrait. It contains the word 'RBI' and '2000'. This feature can be seen well under a magnifying glass.

Identification Mark
A symbol with intaglio prints which can be felt by touch, helps the visually impaired to identify the denomination. In 2000 denominations the identification mark is a rectangle with Rs 2000 in raised print on the right.

The below diagram shows the step-by step process of this currency recognition system-

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┌─────────────────────────┐
│    Image Acquisition    │
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│   Gray Scale Conversion │
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            │
            ▼
┌─────────────────────────┐
│     Edge Detection      │
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┌─────────────────────────┐
│   Image Segmentation    │
└─────────────────────────┘
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┌─────────────────────────┐
│   Feature Extraction    │
└─────────────────────────┘
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┌─────────────────────────┐
│   Comparison of Images  │
└─────────────────────────┘
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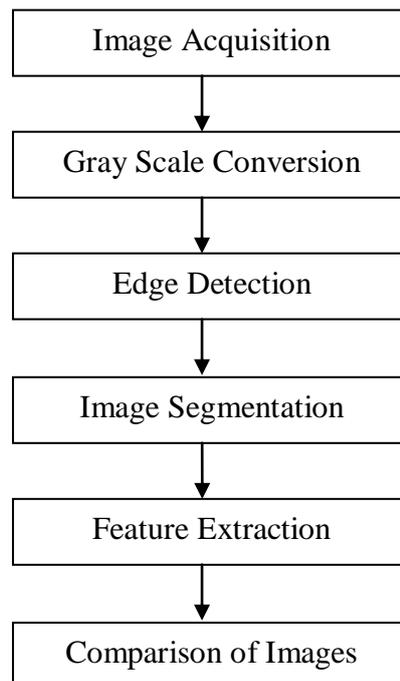
Figure.1 Design Flow of Indian Paper Currency Recognition system

5. Conclusion

This paper discussed a technique for recognition of paper currency of India. The technique uses four characteristics of paper currency including identification mark, security thread, latent image and watermark. The system may extract the hidden features i.e. latent image and watermark of the paper currency. The proposed work is an effort to

suggest an approach for the feature 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. The work will surely very useful for minimizing the counterfeit currency.

References

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