Survey on Fake Coin and Currency Detection

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ABSTRACT
This paper makes an attempt to represent the survey on the fake coin and currency detection. Fake notes in the Republic of India are flowing into the system. Now, the identification of fake notes is becoming a very important topic for the researchers. The focus of the currency identification system is on fake currency recognition. The Currency Identity System is important today, it must be accurate. Progressive approach to identifying paper money relies on several steps, together with edge detection, feature extraction, image segmentation, image acquisition, grayscale conversion, and comparison of pictures. This survey paper discusses how to look for fake coins and notes. This paper provides an overview of India's Currency Identification Methods to determine if the malware has been activated. When some pre-training and training techniques are implemented, the validity of the Currency Identity System can be improved.

Keywords *- Currency circulation, Edge Detection, Fake currency Identification, Feature Extraction, Image Processing*

1. INTRODUCTION

Modernization of the financial system is the cornerstone of the protection of economic prosperity and the maintenance of social harmony. The Reserve Bank of India is the only fully-fledged bank in India. But some people tend to create counterfeit currency. India's 100, 500, and 2000 counterfeit currency seem to have flooded the system, and there is no meaningful way to deal with them for ordinary people. The common people are the victims of these currencies. 2000 and 500 are the highest available currency and the maximum fake is done in them. For many years, the currency, sterling silver has spread to society and there is no balance between social harmony and society. Numerous agreements have been made in this regard. Reserve Bank is the only bank that has the sole power to issue bills in India. Reserve banks, like other central banks around the world, occasionally change the design of the bills. In general, anti-fraud measures are included, including good bills, which allow specialists, not to fake. On grinding or parallel-grooved, the edges are used to indicate that no precious metal is scraped. Reserve banks use many fraudulent techniques. Fake or counterfeit cards are the biggest issue of money transactions. For a country like India, it is becoming a major obstacle. Due to the advanced scanning technology, it is easy for people to print fake records using the latest hardware. The detection of fake handwritten records becomes a costly and unsatisfactory process that requires an automatic technique that can process the currency identification process efficiently.

2. LITERATURE SURVEY

The effective recognition of the blind banners is used based on the components. This article should mark the daily sign with ultraviolet light. The employer employs the account of the equipment and tries to determine if the ocean's identities, identities and other notes are appropriate for their denomination and authentication. This increases the labor force. On the other hand, if the bank staff uses the system, the results may be correct. Traffic Blur affects system performance, so the true speed of marking marks is reduced. The problem can be summarized as follows: i) Problems with motion blur (ii) Ambiguities that are placed by the imager iii) Technology to download less efficient features. This technique is proposed by Yinglienian [1].

The techniques for detecting fake currency methods based on bit rate reduction techniques. This article introduces a new approach using cost-saving techniques to extract the most important data from the images of fake bills by applying edge detection algorithms. The proposed technique is in the original image distribution, with the gray gradient 256 in its binary image equal 8. This is useful when analyzing the importance of attributes defined by each image of the original image. Higher-bit bits are evaluated for the blue dollar bill image by applying the Canny Edge Finder algorithm. Then the result is compared to real money and other available techniques that are used to detect fake notes. This methodology is proposed by Mohammad H. Alshayeji [2].

This technique describes an electronic-based blind-based Enhancement System. This paper is designed primarily to support them and make it easier for them to use the currency. Here we offer Android based apps to recognize the currencies from different countries, as well as their denominations for the blind. Image processing techniques such as download features and matching are used to determine the currency. The software runs on the low-end smartphone. We provide voice mail as an input to launch apps and capture images. Then the image is captured and compared to the test image. If the features of both pictures are matched, the audio output is given to the user about the currency name and the country in which it belongs. Otherwise, an error message is provided as a result. This technique is proposed by Nayana Susan Jose and Sherman Siby [3].

This article describes the automatic paper recognition system. This can be useful in banking systems and other commercial areas. This paper describes the recognition of paper currency using digital imaging techniques. Three Indian paper features were chosen to look for counterfeit goods, including identity certificates, security threats and sketches. Download features are made on the image of the currency and are compared with real currency characteristics. The gradient level Sobel operators are used for character extraction. Recognizing accurate paper currency and high speed processes are important for the banking system. This approach has the advantages of simplicity and high speed. This methodology is proposed by Mirza and Nanda [4].

3. METHODOLOGY

3.1 Artificial Neural Network

Artificial neural network Neural Networks, with their remarkable ability to derive meaning from complicated or imprecise data, can be used to extract patterns and detect trends that are too complex to be noticed by either humans or other computer techniques. A trained neural network can be thought of as an "expert" in the category of information it has been given to analyze. This “expert” can then be used to provide projections given new situations of interest and answer "what if" questions. Other advantages include:

- Adaptive learning: An ability to learn how to do tasks based on the data given for training or initial experience.
- Self-Organization: An ANN can create its own organization or representation of the information it receives during learning time.
- Real Time Operation: ANN computations may be carried out in parallel, and special hardware devices are being designed and manufactured which take advantage of this capability.
- Fault Tolerance via Redundant Information Coding: Partial destruction of a network leads to the corresponding degradation of performance. However, some network capabilities may be retained even with major network damage.
- Using Multiple Hidden Layers: Multilayer perceptrons using a back propagation algorithm are the standard algorithm for any supervised learning pattern recognition process and the subject of ongoing research in computational neuroscience and parallel distributed processing. They are useful in research in terms of their ability to solve problems stochastically, which often allows one to get approximate solutions for extremely complex problems like fitness approximation. This method has low computational complexity. This is the big advantage of this approach. But it has one disadvantage that is its [1] accuracy is rather low.

3.2 Local Spatial Feature

The fake coin detection method uses the local features of the image for feature extraction. The method is invariant to rotation and translation and also the recognition is being done with the single neutral image as train image. Normalized Local standard deviation filter is used for extracting the spatial intensity changes in the image. The key feature of this approach is that it uses single gallery image per coin for the recognition purpose and produces high recognition accuracy. Using background extraction of the coin and the decomposition of an image into concentric circles increases its invariant property against rotation and translation [2].

3.3 Hough Transform

Hough Transform is usually used in detection programs to detect shapes. Here in the proposed system, we want to apply it to coins of circle shape so the Circular Hough Transform (CHT) is used. The Hough transform is specific to a circle of given radius and the result of the transform gives a likelihood of each pixel being the center of a circle with the given radius. In Circular Hough Transform there exist two spaces, geometric space, and accumulator or (Hough space). Each point in the geometric space on the original circle

edges generates a circle in the accumulator space. The circles in accumulator space intersect together at (a, b) that correspond to the center (x, y) in the geometric space. Notice that (a, b) is a group of pixels that are likely to be the center of the circle. This method is very fast and has less memory capacity. But the performance of this method [3] is very poor in case of low-resolution images.

3.4 Morphological Operation Approach

Morphological recognition algorithm based fake coin recognition capture the image by the camera and converted into a grayscale image for pre-processing. After conversion, image complemented, binary conversion is applied to the image. After conversion, the method for detecting the edge of the cup was performed and passed the discovery in the expansion process. After filtering and expanding, the area is chosen where the maximum number of pennies is and the coins are recognized by the image in the form of the box. Block analysis is used for coins for Indian coin discovery. It provides the clear edges of the coins to improve accuracy for coin detection. This is the great plus of this method. The major drawback of this approach [4] is, this scheme only considers static data files and do not explicitly study the problem of data error localization.

3.5 Rotational Invariant Approach

Rotation invariance approach, it is not necessary to place the coin at a specific angle. Image Segmentation helps to reduce the amount of data required for processing. This system takes less time for processing and gives the best results rotation invariance approach, it is not necessary to place the coin at a specific angle. Image Segmentation helps to reduce the amount of data required for processing. This system takes less time for processing and gives the best results. This algorithm using rotation invariance approach it is not necessary to place the coin at a specific angle. Also, it [5] helps to reduce the amount of data required for processing.

3.6 Edge Detection and Enhancement

The thresholded (binary) image has irregularities that will be removed with Morphological closing and filling plus area thresholding. The morphologically close image is done by using a disk structuring element to preserve the circular nature of the object. The filling is done to fill in holes in the image that are a set of background pixels that cannot be reached by filling in the background from the edge of the image. Finally, area Thresholding is applied also to remove the small objects which containing fewer than 1000 pixels from the binary image. Recognition time of this method is very less. So this is the advantage of this approach. But it did not use the vertical locations of coin candidates for identifying fake coin because the changes in positioning and respiration between the two views were not considered in this scheme. This approach [6] reduces the accuracy.

3.7 Image Subtraction

Having procured both the object and the test image, two subsequent checks are performed narrowing down the recognition process. Coarse Subtraction: The test image is given one full rotation in steps of the fixed angular distance of say 30º. At each instance of rotation, image subtraction is carried between the rotated test image and the input object image. The two images basically are a 2-d array consisting of gray values. Subtracting these array yields gray values begetting the third image.

Subtracted Image (r, c) = Object (r, c) – test image (r, c) (1)

This approach [7] works well with fewer samples and learning result is more robust. But the limitation of this approach is the choice of kernel and extensive memory requirements.

3.8 Harris-Hessian Algorithm

Harris-Hessian detector is based on a Harris-Hessian algorithm and it extracted features from the original image of the coin and usually, interest points are used as the feature points. This method is robust to noisy data. This is the merit of this approach. But this approach [8] need to determine the value of the kernel and distance-based learning is not clear.

3.9 Otsu Algorithm

The method is done by the user to get the image from the computer or camera used. Once the image is selected, the RGB image of the coin is scanned on both sides. When the selected RGB image is converted to Grayscale. If the image is selected initially, it is gray, so it does not have to be converted. If the image size is small, RGB images can be used for recognition and recognition, and if the size of the image is large, you need to change it. Once you have completed both steps, you need to crop the image to have a pictured image. When the crop is done, the next step is to divide the image into different segments depending on the total amount of pennies in the picture. This is done using a known algorithm known as Otsu Algorithm. This algorithm is a method of pragmatization based on histograms and is known as command on tags. When analyzing the image, it is first divided, then the

corresponding low method is applied. To obtain overlapping images in one image, morphing operations can be used. The result is high and unaltered radius. Lack of threshold variability sample leads poor performance. This is the disadvantage of this approach [9].

3.10 Thresholding

Thresholding is applied to the input image to separate foreground from the background through hue and saturation values to create a threshold image that could possibly include overlapping or clutter. To apply thresholding [10], first, determine the hue of the background by using the histogram, and then find the first index of the max value of nonzero elements. Second, apply saturation thresholding. After that, determine threshold factor a value that rates the likelihood of being in the background[10].

3.11 Component-Based Model

The component-based model has four main advantages over the global model: 1) the class-specific information is not evenly distributed on the banknote. Some regions cover more obvious class-specific features, while other regions are relatively similar across different classes. It will be more effective to use those more class-specific components in the recognition of banknotes. 2) A component-based model is able to focus on local and stable parts, which very much less than the pattern of an entire banknote under the geometric and photometric changes. 3) Local image features that are generated from components are much less than that from the entire image. This helps to speed up the matching process and reduce memory requirement. 4) A component-based model is more robust in handling partial occlusions. It is empirically impossible to take account of all conditions which cover the spectrum of possible variations that can result from occlusions. In the component-based model, individual components are detected by their corresponding detectors. Partial occlusions only affect the outputs of a portion of component detectors. As long as a certain amount of components are detected, the whole banknote is still able to be recognized. It has low computational complexity. But it [11] is affected by Motion Blur problem.

3.12 Backpropagation Neural Network

The Backpropagation algorithm was proposed by Rumelhart, Hinton, and Williams in 1986. The Backpropagation algorithm works as a feed-forward neural network but it propagates back the error to previous layers so that weights can be updated in all layers. In the first step, the input is presented to the network and weights are initialized to some random values, and the activation function is applied. The output is checked with the targets, if it is not same as targets then it propagates an error back to all previous layers and weights are updated on all layers. Three-layer feed forward Backpropagation Neural Network with sigmoid activation function is trained with the learning parameters. The author concluded that efficient feature extraction technique will improve the accuracy of identification against the forged currency. This approach [12] are not robust for all currency notes.

3.13 Multi Neural Network

Multilayer Perception is a new technique to recognize paper currency. The recognition of paper currency has been successfully attempted to be recognized from both sides. It uses two classifications, the Euclidean circle weighing at the right weight and the nervous system. The requested technique is based on the download of certain specifications of the paper currency. In addition to finding and extracting features, the technique also includes various preprocessing steps. Various factors like the image size, edge detection, the Euler number and the correlation coefficient play important role in the recognition process. This method uses two classifiers, the weighted Euclidean. But image quality is produced by this approach [13] is very low and the system does not work properly.

3.14 Negative Correlation Learning

The Negative Correlation Learning was to produce different individual NN in the ensemble, so that entire ensemble learns the input pattern completely. ENN is a learning paradigm where a collection of a finite number of neural networks is trained for the same task. The input vectors are applied simultaneously in all the ensembles. The negative correlation learning is to produce the diversity of the individual networks using a penalty term. It can be easily implemented and it can provide high classification performances. The major drawback of this approach [14] is computation complexity.

TABLE 1: Comparison of existing methods

Methods	Description
Artificial Neural Network	This method is used to separate the fake and real currency.
Local Spatial Features	This approach extracts the feature which uniquely identifies the fake currency.

Heuristic Approach, Hough Transform	This technique is used in this paper to find the shapes of the currency.
Morphological Operation	It is used for each coin separately to detect Indian coins.
Artificial neural network	This method is used to separate the fake and real coin.
Rotational Invariance Approach	This approach is used to recognize the coin and note in any direction.
Edge detection, Cropping, threshold detection	This approach is applied to the input image to separate foreground from the background through huge and saturation values to create a thresholded image.
Statistical Approach	This approach is used to drive the statistical feature from the given input image.
Image Subtraction	Image subtraction is carried between the rotated test image and the input object image to find the fake note and coin.
Otsu's Algorithm, Hough Transform	It divides the image into various segments depends on the total number of the coins present in an image.
Component-based framework	This approach is used to speed up the matching process and reduce memory requirement
Radius Basis Function	A radial basis function (RBF) is a real-valued function whose value depends only on the distance from the original currency and the fake currency.
Three-layer backpropagation	In this paper, a three-layer back-propagation neural network (BPNN) is employed for fake coin detection by using a concentration based feature construction (CFC) approach.
Negatively Correlated Neural Network Ensemble	This approach is used to produce different individual weights of fake currency.
Multilayer Perceptrons	It extracts the feature value in a multilayer to increase performance.
Feed-forward Backpropagation Neural Network (BPN)	In this approach, the output of the first layer is given as the input of the next layer.

4. CONCLUSION

This paper discusses various coins and currency identification methods based on image processing. Table 1 compares the work of some researchers, which is useful for short study. Many methods have been proposed till now for the coin and currency recognition, but still, very less work has been done for better accuracy. The comparative experiments show that each of these approaches improves accuracy, smaller feature dimension and faster feature extraction time than the previous approaches. This survey has conducted a study through various literature describing different techniques to determine fake coins and currencies. From this survey, it is clear that the accuracy of the fake coin and currency identification can be improved by applying some efficient pre-processing and feature extraction techniques.

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