Currency Recognition System Using Image Processing

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Abstract- *Paper currency recognition depends on the currency note characteristics of a particular country. And the features extraction directly affects the recognition ability. Paper currency recognition is one of the important applications of pattern recognition. This paper aims to do a survey of work done in this area. this paper explored systems for automated currency recognition using image processing techniques. The digital image processing plays a very important part in achieving Currency recognition.*

Keywords- Currency, Image processing, features extraction, classification.

I. INTRODUCTION

Currency is the coins and paper notes which is issued by the government for circulating within an economy. Paper currency is a common form of medium used for transactions. Automated banking system is achieved through this financial self-service like ATM counter and Coin – dispensers where the currencies are handled by the machines. In such situations the machine will use the currency recognizer to classify the bank notes. The characteristics of currency note vary from country to country. The recognition of currency depends on the characteristics of currency note of a particular country. These problems include direct and parallel implementation of matching and searching algorithm, feature extraction from complex datasets, forecasting, and prediction in a rapidly varying environment, image processing.

Currencies are used all over the world to exchange goods and services. Coin currencies are difficult to transfer, so usage of paper currency increases rapidly. This induces the people to make the copy of original currencies. In early days, there is no system to identify the fake currency notes, so availability of fake notes increases day by day. Each country has their own currencies. They are different in size, shape, color, and pattern. During counting all notes by mandatory testing, it is difficult to count the different denomination and identifying counterfeit notes. In banking and other money transaction services needs a currency recognition system to overcome this problem. Today, automated teller machine, automatic good seller machine etc. are widely used in shops and bank counters.

According to the survey conducted by the CIA [7], there are around 180+ currencies presently circulating in the world. Each of these currencies differs greatly in features such as size, color and texture. Unlike the olden times, the trade and commerce between countries has increased in all sorts of levels. The need for acquiring knowledge about all the currencies by the banks has been extremely important. However, for any human teller to recognize each note correctly is something that is not feasible. Thus, the need for an efficient automated system that helps in recognizing notes is pivotal for the future.

II. LITERATURE REVIEW

1. **Paper 1:** An Extensive Study on Currency Recognition System Using Image Processing**.**

Authors:Georgie V Rajan, 2 Dincy M Panicker, 3 Nisha Elizabeth Chacko, 4 Jayalekshmi Mohan 5 Kavitha V.K

Discussion:—The paper discussed the need for currency recognition system and its relevance due to the advent of technology and machinery used to counterfeit the banknotes. There are many features to identify an authentic currency note physically. Although it may not be practical to accurately identify a counterfeit from an authentic currency note for a person. Several special features are included for strong security against counterfeit in the paper currency which only an intelligent machine can identify. We make use of this special visual properties and patterns to identify the original currency from a counterfeit. A system is applicable globally for the authentication of paper currency. Institutions like banks spend for expensive hardware and for their installation to resolve this issue of currency recognition. Image processing techniques are exploited for a better cost-effective and highly efficient currency recognition system. Although image analysis is not sufficient for authentication, it makes the process easier and faster than the existing system and has easy availability

Observation: An innovative model for currency recognition system using digital image processing has been discussed to improve efficiency by producing more accurate results and increase success rates. Various image processing methodologies have been adopted to design and build an

efficient recognition system. ORB feature extraction technique is faster compared to SURF. But SURF produces more accurate results. In this system, accuracy is more important than a millionth of a second. By using digital image processing, analysis of paper currency is more efficient on the basis of cost and time consuming other than existing system.
Year:2018

2. Paper 2

Authors: Vedasamhitha Abburu, Saumya Gupta, S. R. Rimitha, Manjunath Mulimani, Shashidhar G. Koolagudi

Discussion: —In this paper, the authors propose a system for automated currency recognition using image processing techniques. The proposed method can be used for recognizing both the country or origin as well as the denomination or value of a given banknote. Only paper currencies have been considered. This method works by first identifying the country of origin using certain predefined areas of interest, and then extracting the denomination value using characteristics such as size, color, or text on the note, depending on how much the notes within the same country differ. We have considered 20 of the most traded currencies, as well as their denominations. Our system is able to accurately and quickly identify test notes.

Observation: a system is designed that can accurately identifies both the country of origin and the denomination of a given banknote. Our system currently supports twenty of the most common currencies, but can easily be extended to more countries based on the method we have previously described. When compared with the crude algorithm of pixel by pixel comparison, our algorithm is considerably more accurate, and takes less time. We have thus learned that our proposed algorithm is able to identify currency and denomination in an average of 5.3 seconds, which is a considerable improvement over the crude algorithm. However, our proposed system only considers a limited number of currencies. There are 180+ currencies that can be included in the system, and we have chosen to only do for 20 of the most common ones. Also, the system should be effective in identifying notes that are mutilated. Our system is not effective under this consideration. This can be worked on in the future.
Year:2017

3. Paper3:Comparative Study on Currency Recognition System Using Image Processing

Authors: S. Surya1, G. Thailambal2

Discussion: in the present age, currency is the main role as medium of exchange where government of many countries introduces as banknotes and coins that is. Indian rupees, dollar, Yuan, dinar etc. in different appearance such as picture of our leaders, different color, size, serial numbers, watermarks. At same time people handled difficult to recognize currencies from different countries. The purpose of the paper is to help people solve these difficulties by comparing with another methodology. However, currency recognition system that are based on image analysis entirely are not sufficient. Our system is based on image processing and makes the process easy and user friendly to recognize all kind of banknotes. In this paper we have use Indian currency i.e. Rupees

Observation: A lot of images of currency notes were taken from their front as well as back in different positions with the help of a camera. The designed algorithm was then applied on these acquired images of Indian currency notes to find the denomination of the currency note. After we follow the above-mentioned design steps of the proposed recognition scheme, the currency note in the image gets recognized.
Year:2014

4. Paper 4:Design and Implementation of Paper Currency Recognition with Counterfeit Detection

Authors: Shaana Murthy, Jayanta Kuru Mathur, B Roji Reddy

Discussion: Advancement of technology over the recent past has led to an increase in circulation of counterfeit notes in today's economy. To combat this issue, it is essential that there exists an efficient mechanism to detect fake banknotes. The main problem with current systems is the trade-off between speed and complexity. This paper proposes a system that can classify and subsequently verify Indian paper currency using fundamental image processing techniques. It uses the comparison between the input banknote and the calculated reference values for different parameters of original banknotes in a similar environment. This system maintains its simplicity while still having high accuracy of 100% for classification and 90% for validity verification

Observation: Counterfeit currency recognition systems have become an important part of the banking sector. The proposed methods to classify denomination and identify counterfeit notes have high accuracy of 100% and 90% respectively, while still maintaining low system complexity. As systems to take pictures of both the obverse and reverse of the note already exist, using them in conjunction with the proposed algorithm allows for the time taken for computation to be low. As the techniques used have the advantage of low processing

time, low intricacy and reliability, it is suitable for real time applications.
Year:2016

5. Paper 5: Currency Recognition on Mobile Phones

Authors: Suriya Singh, Shushman Choudhury2, Kumar Vishal, C.V. Jawahar1

Discussion: In this paper, the authors present an application for recognizing currency bills using computer vision techniques, that can run on a low-end smartphone. The application runs on the device without the need for any remote server. It is intended for robust, practical use by the visually impaired. Though we use the paper bills of Indian National Rupee (|) as a working example, our method is generic and scalable to multiple domains including those beyond the currency bills. Our solution uses a visual Bag of Words (BOW) based method for recognition. To enable robust recognition in a cluttered environment, we first segment the bill from the background using an algorithm based on iterative graph cuts. We formulate the recognition problem as an instance retrieval task. This is an example of fine-grained instance retrieval that can run on mobile devices. We evaluate the performance on a set of images captured in diverse natural environments, and report an accuracy of 96.7% on 2584 images.

Observation: The authors succeeded in their aim to develop a system that can be used to recognize currency for a visually impaired user. We have ported the system to a mobile environment, working around difficulties like limited processing power and memory, while still achieving high accuracy and low reporting time. Currency retrieval and thereafter recognition is an example of fine-grained retrieval of instances which are highly similar. This requires segmentation for removal of clutter. Through our experiments, it has been established that segmentation is helpful for the retrieval process as it reduces the chance of reporting erroneously as well as the overall processing time, and also that the instance retrieval method ensures results swiftly. The methods used work well on noisy images captured from a mobile phone. We expect our system to easily adapt to other currencies of the world as well as a collection of various currencies simultaneously while keeping a similar level of accuracy and speed.
Year:2014

6. Paper 6: Myanmar Paper Currency Recognition Using GLCM and k-NN

Authors: Khan Nyein Nyein Hlaing and Anilkumar Kothalil Gopalakrishnan

Discussion: Paper currency recognition depends on the currency note characteristics of a particular country. And the features extraction directly affects the recognition ability. Paper currency recognition is one of the important applications of pattern recognition. This paper aims to present a model for automatic classification of currency notes using k-Nearest Neighbour (k-NN) classifier that is the most important and simplest method in pattern recognition. The proposed model is based on textural feature such as Grey Level Co-occurrence Matrix (GLCM). The recognition system is composed of four parts. The skew correction of rotated image is first. The captured image is second pre-processing and the third part is extracting its features by using GLCM. The last one is recognition, in which the core is k-Nearest Neighbour classifier. Experimental results are presented on a dataset of 500 images consisting of 5 classes of currency notes which are 100 Kyat, 200 Kyat, 500 Kyat, 1000 Kyat, and 5000 Kyat notes. It is shown that a good performance can be achieved using k-NN classifier algorithm. The recognition system presented in this paper indicates that the proposed approach is one of the most effective strategies of identifying currency pattern to read its face value

Observation: In this paper, we have proposed grey Level Co-occurrence Matrix (GLCM) for feature extraction and k-NN classifier for recognition. The algorithm makes use of the partial texture difference of Myanmar paper currency. Also, we have created our own dataset of Myanmar currencies of 5 classes of 500 currency images. The experimental results have shown that the method can identify the currency amount and can satisfy the Myanmar currency recognition real-time demand. Although either Myanmar digit or Myanmar word texture image is recognized, Myanmar paper currency amount is correctly shown. So, it is easy to count currency quickly for the staffs that work in the financial organizations and overcome from his/ her serious problems, especially wrong classification. But MPCR system cannot check the valid currency that is used in real world. The recognition system is perfect system if the system can check the valid currency. Thus, additional research will be needed.
Year:2016

7. Paper 7: An intelligent paper currency recognition system

Authors: Muhammad Sarfraz

Discussion: Paper currency recognition (PCR) is an important area of pattern recognition. A system for the recognition of paper currency is one kind of intelligent system which is a

very important need of the current automation systems in the modern world of today. It has various potential applications including electronic banking, currency monitoring systems, money exchange machines, etc. This paper proposes an automatic paper currency recognition system for paper currency. A method of recognizing paper currencies has been introduced. This is based on interesting features and correlation between images. It uses Radial Basis Function Network for classification. The method uses the case of Saudi Arabian paper currency as a model. The method is quite reasonable in terms of accuracy. The system deals with 110 images, 10 of which are tilted with an angle less than 15o. The rest of the currency images consist of mixed including noisy and normal images 50 each. It uses fourth series (1984–2007) of currency issued by Saudi Arabian Monetary Agency (SAMA) as a model currency under consideration. The system produces accuracy of recognition as 95.37%, 91.65%, and 87.5%, for the Normal Non-Tilted Images, Noisy Non-Tilted Images, and Tilted Images respectively. The overall Average Recognition Rate for the data of 110 images is computed as 91.51%. The proposed algorithm is fully automatic and requires no human intervention. The proposed technique produces quite satisfactory results in terms of recognition and efficiency

Observation: Paper Currency Recognition is an important application of Pattern Recognition. Many studies were made to recognize paper currencies using Neural Networks. In this paper, another method of recognizing currencies has been introduced, which is based on correlation between images. The method uses Radial Basis Function Network. The method is quite reasonable in terms of accuracy. However, there is a room to improve the processing time. The proposed algorithm is fully automatic and requires no human intervention. The author is also thinking to apply the proposed feature methodology for another model of classification. It might improve the accuracy and efficiency process. This work is in progress as a subsequent work together with the issue of considering multiple currencies with one system
Year:2015

8. **Paper 8:**Image Based Currency Recognition System

Authors:B. Varalakshmi, D. Gowthami and N. Mounika

Discussion: The people may not recognize the original currencies from different countries. So, to solve this difficulty to the people, the system called "Image based currency recognition system" is helpful. However, the currency recognition system based on image analysis is entirely not sufficient. But the proposed concept which is based on image processing will makes the process automatic and also robust.

Observation: This paper proposes an algorithm for recognizing the currency using image processing. The proposed algorithm uses the primary color and a part of currency in hsv components by fixing the saturation and value threshold levels for recognition. In future the on basis of image acquisition, multiple parameters including correlation matrix, edge detection operators, color check etc were also considered.
Year:2017

9. **Paper 9:**Fake currency detection using image processing

Authors: Tushar Agasti, Gajanan Burand, Pratik Wade and P Chitra

Discussion: The advancement of color printing technology has increased the rate of fake currency note printing and duplicating the notes on a very large scale. Few years back, the printing could be done in a print house, but now anyone can print a currency note with maximum accuracy using a simple laser printer. As a result, the issue of fake notes instead of the genuine ones has been increased very largely. India has been unfortunately cursed with the problems like corruption and black money. And counterfeit of currency notes is also a big problem to it.

This leads to design of a system that detects the fake currency note in a less time and in a more efficient manner. The proposed system gives an approach to verify the Indian currency notes. Verification of currency note is done by the concepts of image processing. This article describes extraction of various features of Indian currency notes. MATLAB software is used to extract the features of the note. The proposed system has got advantages like simplicity and high-performance speed. The result will predict whether the currency note is fake or not.

Observation: The fake currency detection using image processing was implemented on MATLAB. Features of currency note like serial number, security thread, Identification mark, Mahatma Gandhi portrait were extracted. The process starts from image acquisition to calculation of intensity of each extracted feature. The system is capable of extracting features even if the note has scribbles on it. The algorithm processed here works suitably for the newly introduced 500 and 2000 denomination. Hardware implementation of the proposed system can also be done using suitable processor so that to increase the speed of detection. An automatic railway ticket booking system can also be proposed which includes currency detection as one of its part.
Year:2017

**10. Paper 10:** Currency recognition system using image processing

Authors: Prof. Sagar S. Raj Bhosale, Devang S. Gujarathi, Sushil V. Nikam, Prathmesh P. Gogte, Nilesh M. Bahiram

Discussion: The Reserve Bank is the one which issue bank notes in India. Reserve Bank, changes the design of bank notes from time to time. Reserve bank uses several techniques to detect fake currency. Common people face many problems for the fake currency circulation and also difficult to detect fake currency, suppose that a common people went to a bank to deposit money in bank but only to see that some of the notes are fake, in this case he has to take the blame. As banks will not help that person. Some of the effects that fake currency has on society include a reduction in the value of real money; and inflation due to more fake currency getting circulated in the society or market which disturbs our economy and growth - an some illegal authorities an artificial increase in the money supply, a decrease in the acceptability of paper money and losses. Our aim is to help common man to recognize currency for originality. Proposed system is based on image processing and makes the process automatic and robust. Shape information are used in our algorithm. Original Note Detection Systems are present in banks but are very costly. We are developing an image processing algorithm which will extract the currency features and compare it with features of original note image. This system is cheaper and can provide accuracy on the basics of visual contents of note. So, as an output, people will get information provided the note image is original or duplicate

Observation: In this technique, the authentication of currency is described by applying image processing. Basically, some features are extracted including various domination parts of note (like identification marks of the currency). The features are extracted using image-based segmentation using template matching and works well in the whole process with less computation time. The complete methodology works for 100, 500 and 1000 currency notes. The method is very simple and easy to implement. This technique is very adaptive to implement in real time world. The process begins from image acquisition and end at comparison of features. This project will be helpful to those people who don't have any knowledge about currency, so basically this project will be developed by taking common man issues of currency related problem
Year:2017

III. PROPOSED METHOD
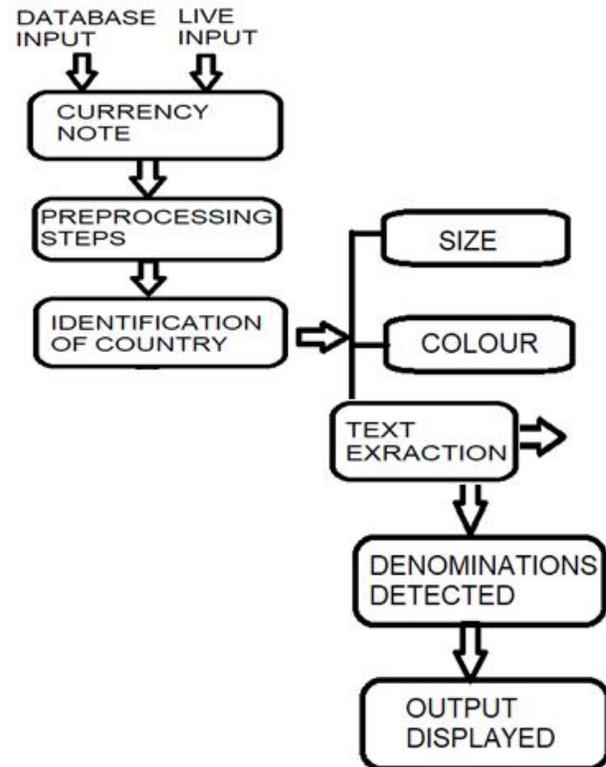
Make the currency recognition an easy task. We propose an automated system for currency recognition using various Image processing techniques and algorithms. Our system should be able to accurately and quickly identify test notes This system helps to identify the currency which have blur or damage features, because the currency with damage or blur feature is difficult to recognize. The process of currency recognitionhelps to extract the visible and also the hidden features on the currency.

IV. CONCLUSION

This Paper presented literature survey of existing works done in this area of currency recognition.

We propose a system which makes use of Neural Network and machine learning algorithmstoperform the task. To make a dataset of different currency notes. Then the to divide the images into training and testing data set. Next is to train the images using algorithms. To test the images using machine learning. To detect currency for both database and live images/

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