

A Novel Approach for Identification of Indian Currency using Super Resolution Method

Anjana P, Apoorva P

Abstract: India is a country where it consists of different types of coins and currencies. Each currency has its own denomination and using that we can identify currency easily. There are many techniques for identification, classification, recognition of currencies which may also consist of fake currencies detection. Using digital image processing methods all these can be done. In this paper it goes with a new method called super resolution which will help to increase the clarity of a currency. I.e. Low - resolution image will get converted into a high-resolution image. MATLAB is the platform used here.

Index Terms: High-resolution image, Image processing, Low-resolution image.

I. INTRODUCTION

As we know coins and currencies are a part of our daily life. In that some currencies and coins may be of counterfeit, so identification is an important one. So to detect or identifying the genuine ones and classifying them according to the standards can be done using image processing techniques is what says here. As we can say whole worship places are the second most coins and currencies used place in India [1]. So automatic identification of currencies using image processing techniques will be helpful in those places. Here proposes new feature named super resolution in order to identify an Indian currency with its denominations. And it consists of the image processing steps like image acquisition, gray-scale conversion, feature extraction and identification of image. This proposed system will be useful in identifying an unclarified image of a currency and its denomination. In this proposed framework we are finding another way to deal with recognize monetary standards utilizing a picture based system super-resolution. It will pre-process the pictures and arrange the prepared arrangement of information and it will distinguish monetary forms. This paper proposes a convenient method for Indian currency identification system. The proposed methodology distinguishes category by extricating highlights like multiple colors and the text in the currency. Super-resolution is a novel methodology in this field. As we probably aware currencies and monetary standards are a piece of our life. In that a few currencies might be of fake and in monetary forms some might be of phony or wrecked. So to recognize or distinguishing the real ones and grouping them as indicated by the norms should be possible utilizing picture preparing systems is the thing that says here. MATLAB is the tool used for it. Every country in this world will always face a problem regarding their

currency notes i.e. counterfeit currencies which remains always as a challenging factor towards the country [9]. So its identification and detection will be an important one. When the input image of the currency is a blurred one or its resolution is of a less one this proposed system will help to get it as a high clarity one. So the identification of currency denomination becomes easy.

II. RELATED WORK

Rajasekaran.C *et al.* (2018)[1], in this paper they proposed a convenient method of automatic coin and currency identifier which can be placed in temples i.e. the digital hundies, and at first it finds the denomination of currencies and then counts the total. After that it displays on an LCD screen. The image processing consist of the algorithms oriented FAST and Rotated BRIEF for the feature extraction purpose. The result of matched number of features in input images provides high accuracy. It proposes a method of coin and currency which fall into the counted automatically. The coin and currency sorting and counting are carried out accurately. Vipin Kumar Jain *et al.* (2013) [2] mentioned a new image processing method which will acquire the image and then it will extract the ROI. That image will then converted into grayscale and by applying some filters and by applying the neural networks for pattern recognition the denomination value will get identified. The pattern recognition and neural networks matcher technique is used to match or find currency value of each one. Various techniques involved in currency recognition consists of texture, pattern and color recognition. As it concludes with ease of currency recognition with denomination numerals which can be used for currency identification which can be extracted easily from paper currency. N.Panah *et al.* (2017) [3], in their paper they discussed about the Iranian banknotes detection by applying RGB color model and histogram normalization algorithm. This process will identify the denomination of the currency by using the templates. And also it will remove the noise in the image. So this paper concludes with identifying the value of currency using the image processing methods. And it will do the extraction of interconnected components and at last it will separate the value of currencies. It provides high accuracy in determining the detection and determining the value". "Shaikh Ajj Amirsab *et al.* (2017) [4], in this review paper authors deals with the fake currency recognition in an automated manner. Using image processing techniques like SVM, neural network feature extraction etc. And the tool mainly used is MATLAB.

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Fake notes identified by using image processing steps like grayscale conversion, edge detection of the input image and by doing segmentation the characteristics of the image get extracted. And it checks the match with the pre stored images and it get identified. Mirza, R *et al* (2012) [5], currency verification is done here through by characteristic extraction using image processing methods. They converts the currency into grayscale and after that, it processes the image by segmentation and it will verify the matching currencies based on the dataset. MATLAB is the platform used in this paper. Abburu, *et al.* (2017) [6]. In this ongoing paper likewise passes on a mechanized money acknowledgment framework utilizing picture preparing methodology. The proposed technique can be utilized for perceiving both the nation and starting point just as the group or estimation of a given banknote. Just paper monetary standards have been considered. This technique works by first recognizing the nation of inception utilizing certain predefined zones of intrigue, and after that separating the division esteem utilizing qualities, for example, size, shading, or content on the note, contingent upon how much the notes inside a similar nation contrast. They have thought about 20 of the most exchanged monetary standards, just as their groups. As a matter of first importance they distinguished the nation of inception after that category estimation of the cash. In the following pre - handling stage the picture get changed over into a parallel picture utilizing versatile thresholding. At that point in the following stage the nation of birthplace is recognized utilizing two different ways. Recognizing void districts and utilizing format coordinating. This paper concludes with a valid accuracy". "Yadav *et al.* (2014) [7], this paper is based on the two characteristics of Indian currency that are the identification mark and serial number. The process begins from image acquisition and end at comparison of features. The features are extracted using edge based segmentation by sobel operator and works well in the whole process with less computation time. As the other paper shows accuracy this paper also leads with a high accuracy. Bunke, H. *et al.* (2011) [8], in pattern recognition graphs plays an important role as its powerful and popular representation. As the paper also discusses about the recent developments in graph based pattern recognition. Where the graph based pattern recognition has advantages it has drawback also. In contrast to vectors, most of the basic mathematical operations required for many standard pattern recognition algorithms, including classification and clustering, do not exist for graphs. This article mainly describes a novel approach to graph embedding using dissimilarities. The datasets given in the article and the results which obtained conveys that one should consider embedding or kernelization as a potentially useful alternative to traditional approaches to graph-based document analysis".

"Yadav *et al.* (2014)[9], in this paper they are telling about the manual testing of all notes in transactions is very time consuming and untidy process and also there is a chance of tearing while handing notes. 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. Automatic method for detection of fake currency note is very important in every country. In this paper they have made fake currency note detection technique using MATLAB and feature extraction with HSV color space and other applications of image processing. This paper conveys a MATLAB based system for automatic recognition of security features of Indian currency. The low cost system, using effective and efficient image processing techniques and algorithms, provide accurate and reliable results at good throughput as shown by experimental results. The developed algorithm works for Indian denomination 100, 500, 1000. Mulmule-Shirkhedkar *et al.* (2015) [10], in this paper, they propose to remove the surface highlights of money note pictures. To extricate the highlights, first the Discrete Wavelet Transform (DWT) specifically Daubechies 1 (DB1) is used on a money note and the rough coefficient network of the changed picture is gotten. A lot of coefficient measurable minutes are then separated from the estimated productive network. The removed highlights are put away in an element vector. The separated highlights can be utilized for acknowledgment, order and recovery of money notes. In this paper, a proficient methodology is proposed to remove the highlights of Iranian and United Arab Emirates money notes. The estimated coefficient network is acquired in the wake of applying DWT for every cash note. From the rough coefficient network, a lot of productive measurable component minutes are extricated to speak to the surface element of a money note. This paper also provides an extension to its related future work".

III. EXISTING SYSTEM

From the decade of evolution, trading has become one of the fundamentals for the existence in the society as far as we know. Thus it has become the key factor for efficiently utilizing the resources thereby strengthening to progress and survive. So for that human beings developed money as a medium and it consists of plenty of coins and currencies. In that counterfeiting of currencies makes a lot of issues while transaction. For detecting the currencies as well as identifying the denominations of the currencies using image processing is a great way. In previous papers and all the authors introduced various methods to identify, classify and to verify whether the currency is fake or not using the image processing algorithms like feature extraction, pattern recognition, neural networks, FAST, SIFT and LBP etc... Other than these algorithms here proposes a new technique which will help in identifying the currency as well as its genuine nature. The pattern recognition and neural networks matcher technique is used to match or find currency value of each one.

IV. PROPOSED METHODS

The proposed method is a novel approach which will help to identify the currency values by uploading the images. Which are acquired from the mobile camera as well as some specific datasets. Here the super resolution method goes with an algorithm which is given below. It starts with uploading a currency image into the system and then it goes with the gray scale conversion of the given image. At last it will identify the denomination of the currency as well as whether the given image is of a fake one or genuine one. The given algorithm tries to explain the working procedure of the technique which is used here.

The SI unit for magnetic field strength H is A/m. However, if you wish to use units of T, either refer to magnetic flux density B or magnetic field strength symbolized as $\mu_0 H$. Use the center dot to separate compound units, e.g., "A·m²."

A. Algorithm

Step 1: Read an input currency image.

Step 2: The acquired image will get converted into grayscale.

Step 3: After that the super-resolution method will be applied.

Step 4: Watershed segmentation method is used to segment the image.

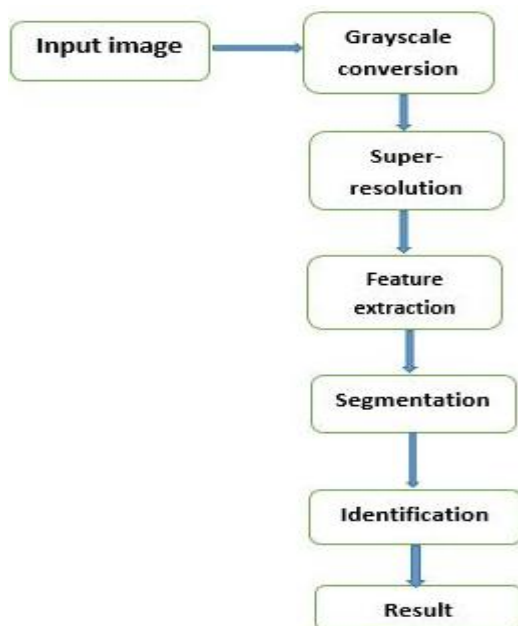
Step 5: When segmentation of the image is done, feature extraction will be processed. And it's done by using the OCR method to extract the text in the currency.

Step 6: After all these the currency denomination will get identified and displayed.

Step 7: After identification of the currency image it will also verify that the image is a fake one or genuine one.

Step 8: Stop

B. System Architecture



1.1 CURRENCY IDENTIFICATION USING IMAGE PROCESSING

Various methods for identifying the physical currency

are yet to be discovered. The initial basic step and yet the oldest techniques using fibers, watermark and security thread for securing documents are the most effective thereby it is very difficult to replicate this methods at the same time they are not always suggested in this process. So using image processing techniques it will be a convenient way to identify or to verify currency images. There are many algorithms are applicable and in earlier works it has proven that identification of currency images using Digital image processing methods will be accurate.

1.2 SUPER- RESOLUTION METHOD

This method is a novel approach in image processing where it zooms out the clarity of an input image. It converts a low resolution image into a high resolution image. Thereby it enhances the clarity of the given image. If the image is of a blurred one or its resolution is of lower one this algorithm helps in enhancing the image. Indian currency images are the dataset used here. And it consists of 10, 20, 50, 100, 500, 2000 rupees paper note images. After applying the algorithm it will identify the denomination of the currency as well as it will try to identify whether the note is of genuine or not.

Module 1

Read an Input Image

The first step is of reading an input image. The image will be uploaded from the stored dataset. The dataset consists of Indian currency images like 10, 20, 50, 100, 500, and 2000 rupees. And then it will go through the further processes.

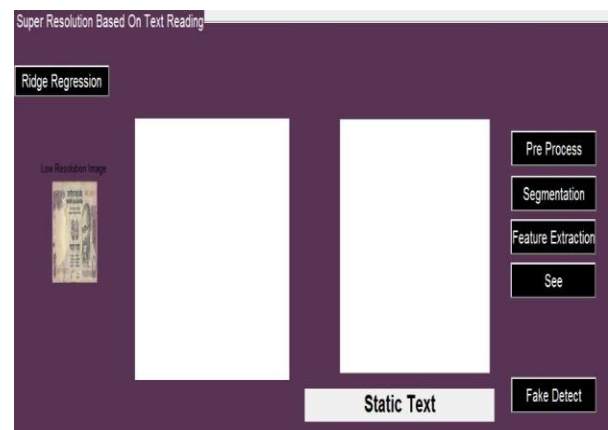


Fig 1. Input image

Module 2

Image Conversion

The acquired image will be converted into the form of grayscale. The uploaded image will be an RGB color model image and it will be converted to the grayscale form.



Fig. 2 Grayscale conversion

Module 3

Applying Super-Resolution Algorithm

The algorithm will be applied to increase the resolution of the input image from the trained dataset. It will enhance the clarity of the blurred image or a low resolution picture of currency. Applying the novel super-resolution algorithm the currency denomination can be easily identified and the result will be more accurate than the other methods.



Fig. 3 after applying super-resolution

Module 4

Segmentation

It is the next step where it will provide the segmentation process. Watershed segmentation method is used here. The main objective of watershed segmentation algorithm is to find the “watershed lines” in an image in order to separate the distinct region.



Fig. 4 Watershed segmentation

Module 5

Feature Extraction

Feature extraction is the next step. This step will process by extracting the characters on the currency image. I.e. it will check whether it matches with the template and the characters. By using the OCR method. OCR (optical character Recognition) is the method of recognizing printed or composed content characters by a PC. This includes photo scanning of the content character-by-character. And it will try to match with the trained dataset



Fig.5 Feature extraction

Module 6

Identification

After processing feature extraction, the currency value will be identified. The identification will be based on the text and color of the currency.



Fig.6 Identified Currency

V. RESULT

Table 1.1 Security parameters classification as Stage1, Stage2, and Stage3.

Stage 1	Stage 2	Stage 3
Substrate Fidelity	Micro-text	Magnetic Ink
Print Fidelity	UV Glowing	Screen Traps
Color Fidelity		Manufacture
Acoustic Fidelity		Materials Interaction
Serial Number		Complicated Patterns
Holograms		Complicated Design
Watermark		Fluorescence
Security Thread		Texture Analysis
Security Fiber		
Planchets		
Tactile Fidelity		
Color-shifting Ink		
Clear Window		
Matching Sides		
Latent Image		



This table provides the list of contents in a currency. For the verification of currency all these parameters can be taken. The authenticity of currency is always lies on its security parameters. Fake currency notes will create many issues in every country. To verify the authenticity of currency individually, it will be inspected for fidelity of specific characteristic features as shown in table 1.1.

Most of the ways to determine the detection of the currency is confidential and has been authorized to only classified authorities. Thus to detect them specialized individuals are must be trained As much of the crucial information required to determine authenticity of currencies remains secret, forensic analysis often requires specialist trained individuals. Obviously, analysis is therefore reliant on the availability of highly pursued after individuals. Such scrutiny is an ad-hoc process and subject to human mistake. Earlier works introduced different methods on verifying the credentials of a currency. And shown high accuracy as well.



Fig.7 Fake Note Identification



Fig.8 Fake Note Identified Based On Color

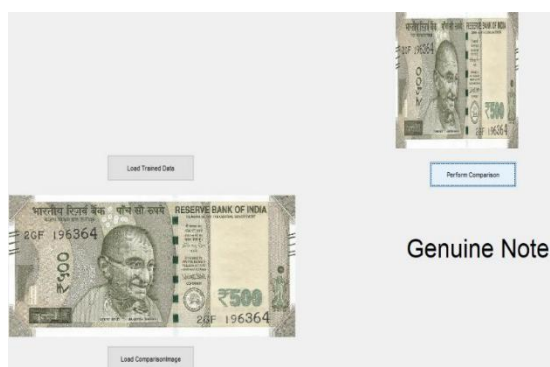


Fig. 9 Genuine Note Identified



Fig.10 Genuine Note

An excellent style manual and source of information for science writers is [9].

VI. FUTURE WORK

Future work will find inside and out analysis of the present technique utilized by this proposed arrangement, it is necessitated that a 99% precision rate be accomplished, such investigation will concentrate on the preparation, and testing size of the example set, this will be made conceivable where by over a more drawn out span of time, a more extensive cluster of currency images will be obtained for testing purposes. Along these lines, the parameters used to computationally portray the acquired images will be refined, further examination of the shading descriptors, and surface descriptors will be investigated.

VII. CONCLUSION

This project work leads to a conclusion that using the novel approach super-resolution it helps to identify the currency denomination by enhancing the low resolution image into a high resolution image. The trained dataset consists of Indian currencies like 10, 20, 50, 100, 500 and 2000. And the images obtained by using mobile camera also. So it provides maximum possible accuracy on identifying the currency as well as on verifying whether the obtained currency image is of a fake one or not. By extracting the multiple colors in the currency images it will verify that the image is of a fake one or genuine one.

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