

FAKE CURRENCY DETECTION USING K-NN TECHNIQUE

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Abstract: Fake notes in India are being flooded into the system. At present fake note recognition becomes the major issue for the researchers. The main focus of this standard paper currency identification system is on recognizing fake currencies. The currency identification system is a must and it is essential that it should be very accurate. The paper currency identification depends upon a number of steps, including edge detection, feature extraction, image segmentation, image acquisition, grayscale conversion, and comparison of images. In this paper, we have seen that different type of literature survey which describes different techniques of fake currency identification. The paper also proposes a review on Fake Indian Currency identification techniques to detect mal practicing. It concludes that, when we apply some efficient pre-processing and feature extraction techniques, we can still improve the accuracy of currency identification system. Fake Currency Detection is the biggest problem faced by many countries including India. Though Banks and other large organizations have installed Automatic machines to detect fake currency notes, it is really difficult for an average person to distinguish between the two. Counterfeiting of money is as old as money itself, and is sufficiently prevalent throughout history that it has been called the world's second oldest profession. This has led to the increase of corruption in our country's growth. Some of the methods to detect fake currency are water marking, optically variable ink, security thread, latent image, techniques like counterfeit detection pen and using MATLAB..

Keywords: counterfeit currency, detection, segmentation, image processing

INTRODUCTION

Technology is growing very fast in these days. Similarly the banking sector is also improving day by day. Many researchers have been encouraged to develop robust and efficient automatic currency identification machine. Automatic machine which can be used to detect banknotes are now widely used in dispensers of modern products like candies, soft drinks bottle to bus or railway tickets. The technology of currency recognition system basically aims for identifying and extracting visible and invisible features of currency notes. Until now, many techniques have been proposed to identify the currency note. But the best way is to use the visible features of the note. For example, color and size. But this way is not helpful if the note is dirty or torn. If a note is dirty, its color characteristic are changed widely. So it is important that how we extract the features of the image of the currency note and apply proper algorithm to improve accuracy to recognize the note. We apply here a simple algorithm which works properly. The image of the currency note is captured through a digital camera. The hidden features of the note are highlighted in the ultraviolet light. Now, processing on the image is done that acquired image using concepts like image segmentation, edge information of image and characteristics feature extraction. MATLAB is the perfect tool for computational work, and analysis. Feature extraction of images is challenging task in digital image processing. It

involves extraction of invisible and visible features of Indian currency notes. This approach consists of different steps like image acquisition, edge detection, gray scale conversion, feature extraction, image segmentation and decision making. Acquisition of image is process of creating digital images, from a physical scene. Here, the image is captured by a simple digital camera such that all the features are highlighted. Image is then stored for further processing. The possible solutions are to use either chemical properties of the currency or to use its physical appearance. In this project we proposed a novel structurally efficient approach for the detection and identification of duplication in currency notes using the Dual Tree Complex Wavelet Transform(DTCW). The matching scores of all fake detection modules are fused together to identify the fake portions in the note and to make the decision of fake notes.

LITERATURE SURVEY

In paper[1], Fake notes are increasing everywhere in this modern technology. At present fake note recognition become the major problem. The main aim is to recognise the fake notes from the original notes. The currency identification system should be necessary and it is essential. There are so many steps including in this process is edge detection, feature extraction, image segmentation, image acquisition, grayscale conversion, pre processing and comparison of

images. In this paper, there are different types of literature survey which describes different techniques of identifying fake currency notes. This paper also proposes a review on Fake Currency identification techniques to detect counterfeit notes. By applying some efficient pre-processing and feature extraction techniques, there are chances to still improve the accuracy of currency identification system.

In paper[2], Presented the advancement of color printing technology, has increased the fake currency note printing rate and duplicate notes on a high scale. In previous days, the printing could be done in a print house, but now anyone can print counterfeit notes by using simple laser printer. As a result the issue of fake notes instead of the original notes has been increased very largely. India unfortunately cursed with the problems like corruption and black money. And counterfeit of currency notes is also a major problem. The proposed system gives an approach to verify the fake notes. Verification of currency note is done by using image processing. This article describes feature extraction of Indian currency notes. MATLAB software is used to extract the note features. The proposed system has advantages like simplicity and high performance speed. The result will predict whether the currency note is fake or not.

In paper[3], Currency duplication is now a common occurrence due to the advancement of printing and scanning technology. Many note detection systems are present in banks but they are very costly. In this paper, we are proposing an accurate and consistent technique for fake banknote recognition. We are developing an image processing algorithm which will extract different currency features and compare it with features of original note image. As an output, information about whether the note image is original or duplicate is given. Three main features of paper currencies has been implemented which are micro-printing, water-mark, and ultraviolet lines using OCR (Optical Character recognition), Face Recognition and Canny Edge & Hough transformation algorithm of Matlab. We apply these techniques in order to find an algorithm which will easily be applicable and will be efficient in terms of cost, reliability and accuracy. Along with 1000taka note has been tested for checking authenticity hence making our techniques more appropriate for users.

In paper [4]. The currency will be verified by image processing techniques. In this article, six characteristic features are extracted. The approach consists of a number of components including image processing, edge detection, image segmentation, characteristic extraction, comparing images. The characteristics extraction is performed on the image of the currency and it is compared with the characteristics of the genuine currency.

The Sobel operator with gradient magnitude is used for characteristic extraction. Paper currency recognition with good accuracy and high processing speed has great importance for banking system. [Sobel operator or Sobel filter is used in image processing and computer vision, particularly within edge detection algorithms where it creates an image emphasising edges.

In paper [5], The extracted region of interest (ROI) can be used with Pattern Recognition and Neural Networks matching technique. First they acquire the image by simple flat scanner on fix dpi with a particular size, the pixels level is set to obtain image. Few filters are applied to extract denomination value of note. They use different pixel levels in different denomination notes. The Pattern Recognition and Neural Networks matcher technique is used to match or find currency value/denomination of paper currency.

In paper[6], Nowadays, advanced technology has played an important task in circulation of anti-counterfeit notes economy. It is essential that requires an efficient solution to detect fake banknotes. This paper proposes an approach for recognition of paper currency based fundamental image processing using deep learning for feature extraction and recognition. Deep neural network techniques have dramatically become the state of the art in image processing. The high capacity of traditional techniques on currency image dataset has been impeded because of varieties of the appearance of the banknotes. This paper focuses recognition face value and anti-counterfeit based on bank note appearance.

PROPOSED METHOD

The system will work on two images, one is original image of the paper currency and other is the test image on which

verification is to be performed. The proposed algorithm for the discussed paper currency verification system is presented as follows-

A. Image of paper currency will be acquired by simple scanner in .jpg extension.

B. The image processing will be implemented on this image.

C. The various characteristics of the paper currency will be cropped and segmented.

D. After segmentation, the characteristics of the paper currency will be extracted.

E. The extracted characteristic of test image then undergoes classification.

F. On the basis of classification the result is generated.

In the proposed method characteristics 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 characteristics of banknotes for their recognition, rather they consider the common characteristics of banknotes such as the size, the background color (the basic color), and texture present on the banknotes. So we are implementing some different way or typical features of currency detection.

ADVANTAGES OF PROPOSED METHOD

1. High accurate
2. Very simple
3. Requires less hardware
4. Low processing time
5. Consumes low power

K-NN TECHNIQUE

K nearest neighbour algorithm is very simple. It **works** based on minimum distance from the query instance to the training samples to determine the K-nearest neighbours. The data for KNN algorithm consist of several multivariate attributes name that will be used to classify images. K nearest neighbours is a simple algorithm that stores all available cases and classifies new cases based on a similarity measure (e.g., distance functions). KNN has been used in statistical estimation and pattern recognition.

The KNN algorithm is a robust and versatile classifier that is often used as a benchmark for more complex classifiers such as Artificial Neural Networks (ANN) and Support Vector Machines (SVM). Despite its simplicity, KNN can outperform more powerful classifiers and is used in a variety of applications such as economic forecasting, data compression and genetics. For example, KNN was leveraged of functional genomics for the assignment of genes based on their expression profiles.

METHODOLOGY

The system proposed here work here on the image of currency note under ultraviolet light acquired by a digital camera. The algorithm which is applied here is as follows

- a) Acquisition of image of currency note under ultraviolet light by simple digital camera or scanner.
- b) Image acquired is RGB image and now is converted to grayscale image.
- c) Edge detection of whole gray scale image.
- d) Now characteristics features of the paper currency will be cropped and segmented.
- e) After segmentation, characteristics of currency note are extracted.
- f) Intensity of each feature is calculated.
- g) If the condition is satisfied, then the currency

note is said as original otherwise fake.

A. In this method, characteristics of currencies are employed which are used by common people for differentiating for different banknote denomination. The characteristics that can be used to check the authentication of currency note are

1. **See through Register** : The small floral design printed both on the front (hollow) and back (filled up) of the note in the middle of the vertical band next to the Watermark has an accurate back to back registration. The design will appear as floral design when seen against the light.

2. **Water marking** : The Mahatma Gandhi Series of banknotes contain the Mahatma Gandhi watermark with a light and shade effect and multi-directional lines in the watermark window.

3. **Fluorescence** : Number panels of the notes are printed in fluorescent ink. The notes also have optical fibres. Both can be seen when the notes are exposed to ultra-violet lamp.

4. **Security Thread** : The Rs.500 and Rs.100 notes have a security thread with similar visible features and inscription

Bharat (in Hindi), and RBI. When held against the light, the security thread on Rs.1000, Rs.500 and Rs.100 can be seen as one continuous line. The Rs.5, Rs.10, Rs.20 and Rs.50 notes contain a readable, fully embedded windowed security thread with the inscription "Bharat" (in Hindi), and RBI. The security thread appears to the left of the Mahatma's portrait

5. **Intaglio Printing** : The portrait of Mahatma Gandhi, the Reserve Bank seal, guarantee and promise clause, Ashoka Pillar Emblem on the left, RBI Governor's signature are printed in intaglio i.e. in raised prints, which can be felt by touch, in Rs.20, Rs.50, Rs.100, Rs.500 and Rs.1000 notes.

6. **Latent image** : On the obverse side of Rs.1000, Rs.500, Rs.100, Rs.50 and Rs.20 notes, a vertical band on the right side of the Mahatma Gandhi's portrait contains a latent image showing the respective denominational value in numeral. The latent image is visible only when the note is held horizontally at eye level.

7. **Micro lettering** : This feature appears between the vertical band and Mahatma Gandhi portrait. It always contains the word "RBI" in Rs.5 and Rs.10. The notes of Rs.20 and above also contain the denominational value of the notes in micro letters. This feature can be seen well under a magnifying glass.

8. **Identification Mark** : Each note has a unique mark of it. A special feature in intaglio has been introduced on the left of the watermark window on all notes except Rs.10/- note. This feature is in different shapes for various denominations (Rs. 20- Vertical Rectangle, Rs.50- Square, Rs.100- Triangle, Rs.500- Circle, and Rs.1000- Diamond)

and helps the visually impaired to identify the denomination

B. Digital Image Processing Method To Detect Fake Currency.

The design flow of fake currency detection system includes eight stages: Image acquisition, pre processing, gray scale conversion, edge detection, image segmentation, feature extraction, comparison and output. This system is works on two images, one is test currency image on which authentication is to performed and other is the original currency image.

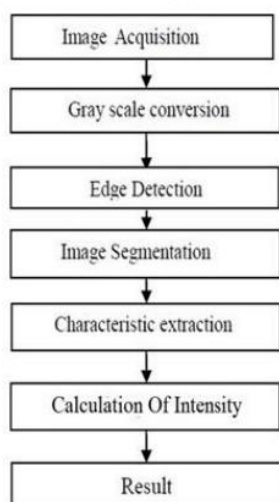


Figure 1. Flow diagram of process.

1. Image Acquisition : There are various ways to acquire image such as with the help of camera or scanner. Acquired image should retain all the features..

2. Pre-Processing : Pre-processing of image are those operations that are normally required prior to the main data analysis and extraction of information. The aim of image pre-processing is to suppress undesired distortions or enhance some image features that are important for further processing or analysis. It includes

2.1 Image Adjusting : When we get the image from a scanner, the size of the image is so big. In order to reduce the calculation, we decrease them size of image. Image Adjusting is done with the help of image interpolation. Interpolation is the technique mostly used for tasks such as zooming, rotating, shrinking, and for geometric corrections.

2.2 Image smoothening : When using a camera or a scanner and perform image transfers, some noise will appear on the image. Image noise is the random variation of brightness in images.

Removing the noise is an important step when image processing is being performed. However noise may affect segmentation and pattern

matching. When performing smoothing process on a pixel, the neighbour of the pixel is used to do some transforming. After that a new value of the pixel is created. The neighbour of the pixel is consisting with some other pixels and they build up a matrix, the size of the matrix is odd number, the target pixel is located on the middle of the matrix. Convolution is used to perform image smoothing. Also image smoothening can be done with the help of median filter which more effective than convolution when goal is to simultaneously reduce the noise preserving edges. Median a pixel via the median pixel of all the neighbourhoods .

3. Gray-scale conversion: The image acquired is in RGB color. It is converted into gray scale because it carries only the intensity information which is easy to process instead of processing three components R(Red), G(Green), B(Blue).

4. Edge detection : Edge detection is a fundamental tool in image processing and computer vision, particularly in the areas of feature detection and feature extraction, which aim at identifying points in a digital image at which the image brightness changes sharply or more formally has discontinuities. Edge detection is one of the fundamental steps in image processing, image analysis, image pattern recognition, and computer vision techniques.

5. Image segmentation : The image into its constituent regions or objects. The level to which sub division is carried depends on the problem being solved. Segmentation algorithm for monochrome images generally are based on one of the two basic properties of image intensity values

- Discontinuity
- Similarity.

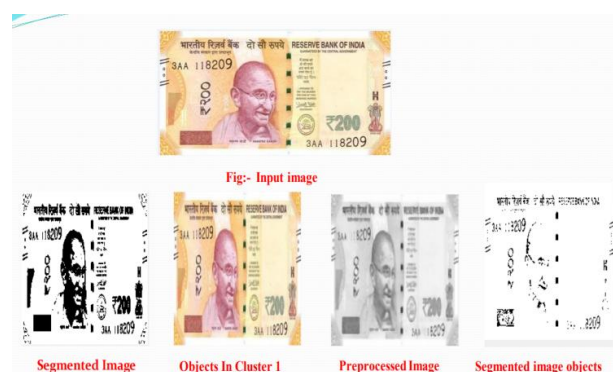
In the first category, the approach is to partition an image based on abrupt changes in intensity such as edges in an image. The approach in the second category is based on partitioning an image into regions that are similar according to a set of predefined criteria.

6. Feature Extraction: In pattern recognition and in image processing, feature extraction is the special form dimensionality reduction. It is the method of capturing the visual content of images for indexing and retrieval. When the input data to an algorithm is too large to be processed and it is suspected to be notoriously redundant (much data but not much information).

FUTURE SCOPE : In Future, Mobile app can be developed which would be useful for normal as well as visually impaired persons, the same system can developed for the remaining Indian currency notes and other country's currency notes. Also, the app interface can be further modified as per the

user requirements.

RESULTS



```
Command Window
New to MATLAB? See resources for Getting Started.

Contrast=0.206596
Correlation=0.097740
Energy=0.769797
Homogeneity=0.937270
Mean=0.000565
Standard_Deviation=0.089804
Entropy=3.325174
RMS=3.325174
Variance=0.008065
Smoothness=1.129979
Kurtosis=7.846277
Skewness=0.235362
Currency Note is Not Valid
It is a Fake Note
>>
```

fig :- Fake Currency Result

```
Command Window
New to MATLAB? See resources for Getting Started.

Contrast=0.213021
Correlation=0.090935
Energy=0.769276
Homogeneity=0.936560
Mean=0.000387
Standard_Deviation=0.089805
Entropy=3.345767
RMS=3.345767
Variance=0.008065
Smoothness=1.202012
Kurtosis=0.064884
Skewness=0.224508
Detected Currency is Two Hundred Rupees
Currency Note is Valid
It is a valid currency note
>>
```

Fig:- Original Currency Result

CONCLUSION : A technique for verifying India

paper currency. The approach gives an efficient method of fake currency detection based on physical appearance. The work will surely be very useful for minimizing the counterfeit currency. Through this application, we are able to see the missing parameters which the fake note doesn't have as compared to the original notes. Original Currency being detected using Image Processing Technique.

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