Indian Institute of Information Technology Allahabad
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Image and Video Processing Course 2021

Progress Report on

Detection Of Fake Currency using Image Processing Techniques

as part of C3 assessment

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1. Abstract

The growth in the number of fake notes in the system have been tremendous over the past few years. The counterfeiters have kept developing new ways to get as close to the real paper currency as possible. This puts the common masses under grave danger of being robbed of their hard earned money. To overcome this issue, various researchers have tried to come up with different procedures to detect fake notes

So, here we implemented a program detecting fake currency using image processing techniques. We applied various image processing techniques on some features of the currency that is used to differentiate itself from counterfeit currency. Keywords: Currency Recognition, Image Processing.

2. Introduction

Digital image processing is the use of computer algorithms to perform image processing on digital images. As a subcategory or field of digital signal processing, digital image processing has many advantages over analog image processing. It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the build-up of noise and signal distortion during processing.

The problem of counterfeit currency is a huge issue that's been growing in recent years. Coloured printing of notes is a common procedure to make counterfeit currency. Various methods have been introduced to detect the existence of counterfeit notes. Manually examining these notes is a tedious method and requires a lot of effort and time. Thus, we need an automated method for detection of counterfeit currency that provides high accuracy and quicker results. Therefore, We try to differentiate counterfeit currency from real ones using image processing techniques.

3. Methodology

The algorithm which is applied here is as follows -

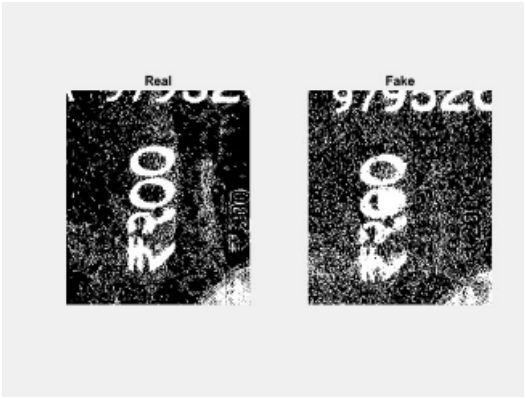
- Images of paper currency will be acquired by a simple scanner or digital camera.
- The image acquired is an RGB image and Decompose image into HSV and analyse.
- Threshold the saturation and value planes to create a binary image.
- Do some minor changes like closing to remove possible noise.
- Then characteristics of the paper currency will be cropped manually depending upon the dimensions of image and segmented.
- After segmentation, we will perform post processing by performing morphological operations closing and opening with structuring of elements to make vertical straight lines in the image.
- The number of vertical lines in both images (connected components) are counted and compared.
- If the difference in the counts is above a certain limit, then the currency being compared is fake.

Here, we convert the image from RGB to HSV first because it is better for object detection.When we obtain the image RGB, color space describes colors in terms of the amount of red, green, and blue present but if we decompose it to HSV color space which describes colors in terms of the Hue, Saturation, and Value and it will give more color description. Then, In thresholding, we convert an image from color into a binary image, i.e., one that is simply black and white. We use thresholding to select areas of interest in an image like Emblem, Security Threads,Symbols of the note while ignoring the parts of the currency. And now we use segmentation to assign a label to every pixel in an image such that pixels with the same label share certain characteristics.Then we perform post processing using morphological closing and opening operations to structure the elements to make the vertical straight line in the image. Then we count the number of vertical lines in both the real and fake image and compared.

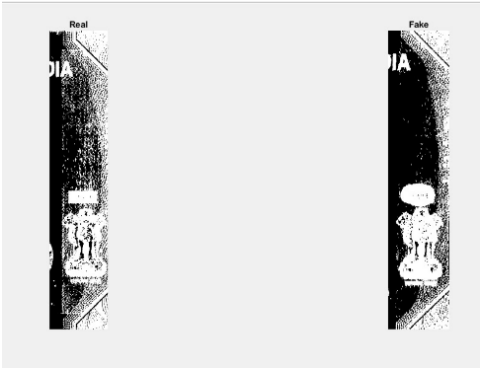
In this method, characteristics of currencies are employed which are used by common people for differentiating for different banknote denominations. The characteristics that can be used to check the authentication of currency note are -

➢ **RBI symbol**

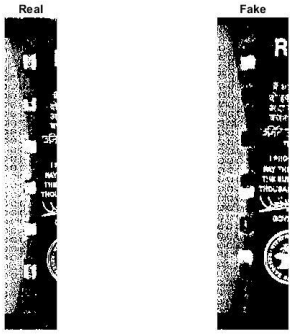
➢ **Currency Denomination**



➢ **Emblem**



➢ **Security Strips**



The above images are processed images to compare the number of vertical lines (connected components) of real and fake note images respectively.
Next we count the number of lines/strips. If the difference between that number is high then we conclude that the note is fake.
We used matlab for implementing our program as it has higher level functions specifically for image processing that are easy to implement in a few lines of code.
In the program code the following steps were performed sequentially for each target characteristics of currency note images.
Steps:

a) Read Images
b) Pre-analysis
c) Segmentation
d) Post-process
e) Area open the image
f) Count number of vertical lines

4. Dataset being used

The images of real currency notes are first scanned and stored. Then printed these images so that we could obtain fake notes (common practice).
Again we scanned these printed notes and stored them as fake note image samples.

5. Results and Discussion

Program was run using 2000 note images and the following results were obtained.

- For RBI symbol
  - The total number of black lines for the real note is: 147
  - The total number of black lines for the fake note is: 238
- For Currency Denomination
  - The total number of black lines for the real note is: 72
  - The total number of black lines for the fake note is: 647
- For Emblem
  - The total number of black lines for the real note is: 421
  - The total number of black lines for the fake note is: 204
- For Security strips
  - The total number of black lines for the real note is: 120
  - The total number of black lines for the fake note is: 132

From the results, it can be observed that there are huge differences between the number of the vertical lines obtained from real and fake images for corresponding characteristics.

6. Conclusion

In this project we implemented a program for fake currency detection using image processing techniques. We see that the many features under consideration had very high differences when real and fake images were compared. But the differences between two real notes had less differences observed. We tried to implement the project using different algorithms for noise removal, edge detection, etc to improve the accuracy of detection. Final results are analysed. We did not try to improve anything in our project.

8. Reference

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THANK YOU