

Counterfeit Currency Detection System

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Abstract: The elevation of color printing technology has increased the rate of fake currency note printing on a very large scale. Years before, 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. This results the issue of fake notes instead of the genuine ones has been increased very largely. India has been unfortunately damned with the problems like corruption and black money. The counterfeit of currency notes is also a big problem to it. This problem 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 genuineness of Indian currency. Verification of currency note is done by the concepts of image processing. The above 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, high performance speed, portability. The result will predict whether the currency is counterfeit.

Keywords: Fake Currency, Currency Mapping, Counterfeit Detection

1. INTRODUCTION

Technology is growing rapidly. Accordingly the banking sector is also getting advance day by day. This brings a intense need of automatic fake currency detection in Automatic Teller Machine and Automatic Goods Seller Machine. Many researchers are encouraged to develop robust and efficient automatic currency detection machine. The technology of currency detection 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 to extract features of the image of the currency note and apply proper algorithm to improve accuracy to recognize the note.

The image of the currency note is captured through a digital camera. The hidden features of the note are highlighted. Now processing on the image is done on 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 a 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 dataset, edge detection, image preprocessing, feature extraction, image, mapping and decision making. Here, the image is captured by a simple digital camera such that all the features are highlighted. Image is then stored for further processing.

1.1. Process of Image preprocessing:

It involves the operations required prior to data analysis and information extraction. Here image resizing is done.

1.2 Process of Image segmentation:

Image segmentation is done to retrieve only the currency part of the image. This basically is removal of background and other unimportant visual information.

1.3 Features Extraction:

After the image segmentation various features are extracted with the help of canny edge Filter and pattern matching of those features with preexisting images.

1.4 Mapping:

Mapping of features with the data available in dataset is done.

2. EXISTING SYSTEMS

Fake money scanner

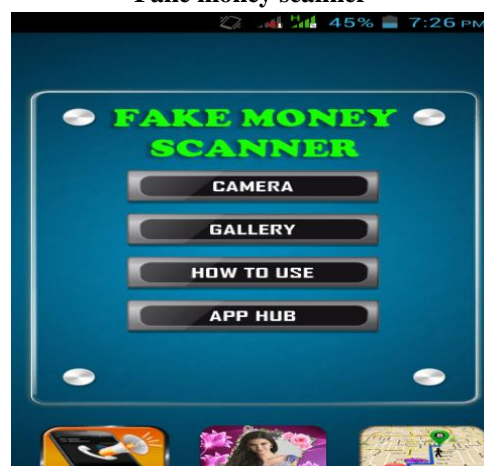


Figure 2.1 Fake Money Scanner App

The Fake Money Scanner App which is available on playstore doesnot provides required output.Though the genuine note has been given as input but the output is false.



Figure2.2 Output of Fake Money Scanner App

In the following application input is been provided as 500Rs.note which is genuine but the following application fails to identify whether the note is real or fake. As a result the output of the application shows that the note is fake which resembles the false output.

Counterfeit Detector Pen:

A counterfeit banknote detection pen is a device used to apply an iodine-based ink to banknotes in an attempt to determine their authenticity. Typically, genuine banknotes are printed on paper based on cotton fibers, and do not contain the starches that react with iodine. While detecting a note, pen contains an **iodine solution** that reacts with the starch in wood-based paper to create a black stain. When the solution is applied to the fiber-based paper used in real notes, no discoloration occurs.

Features:

- Detect notes printed on normal copier paper instead of the fine papers used by genuine authority.
- Effective against notes printed on standard printer or photocopier paper.
- If the note is real, the ink turns yellow.
- If the note is counterfeit, it will turn a dark blue or black.

Limitations:

- Not applicable for starch free papers.
- Effectiveness is much lower.



Figure2.3 Counterfeit Detector Pen

3. BACKGROUND STUDY



Figure 3.1 Features of 500Rs note

1. See Through Register: The see through register is the small floral design on the front (hollow) and back (filled up) on the note in the middle of the note between the vertical band and the watermark window. This floral design can be seen as one when the note is held in the light.

2. Latent Image: The vertical band which is present on the right side of the Mahatma Gandhi's portrait contains a latent image that shows the respective denominational value of the note in numeral. This feature is visible only when the note is held horizontally at the eye level.

3. Denominational Numeral: This is a special security feature. The numeral values of the banknotes are printed in optically variable ink, i.e. color shifting ink. This feature was introduced for Rs.500 and Rs.1000 notes in November 2000. The color of the numerals 500/1000 on the obverse of the note can be seen in blue color when the note is held flat but when it is held at different angles, the color changes to green.

4. Portrait: Portrait of Mahatma Gandhi present at the center of note.

5. Security Thread: The security thread has a width of 3mm and it also has 'Bharat' in Hindi and RBI seal in scripted on

it. The color of security thread changes from green to blue when held at different angles. It is greenish on the reverse side and fluorescent text is visible when the note is held under ultraviolet light. The security thread is alternately visible normally but a long line of thread can be seen when seen in the light.

6. MicroLettering: This feature can be seen between the Mahatma Gandhi watermark and the vertical band. For Rs.5 and Rs.10 notes it has 'RBI' printed on it. This feature can only be seen under a microscope.

7. Watermark: The Mahatma Gandhi series of notes contain the Mahatma Gandhi portrait with light and shade effect and multidirectional lines in the obverse side of a note.

8. Number Panel: It is a feature with numeral growing from small to big on the top left and the bottom right sides of note.

9. Intaglio Printing: The portrait of Mahatma Gandhi(4), the RBI Governor's signature(7), the guarantee and the promise clause, the Ashoka Pillar Emblem at the left are printed in intaglio, i.e. raised prints. This feature can be felt by touch.

10. Identification Mark: This is also another special feature printed in intaglio on the left of the watermark window on all the banknotes except on Rs.10 note. This feature is in different shapes for different notes. The identification mark is vertical rectangle for Rs.20 note, square for Rs.50 note, triangle for Rs.100 note, circle for Rs.500 note, H for Rs.200 note and horizontal rectangle for Rs.2000 note. This feature is for the blind people.

11. Angular Bleed Lines: Seven angular bleed lines on the left and right side in raised print.

4. PROPOSED SYSTEM

Implementation of the Counterfeit currency detection cover following below point

- [1] Currency Number Extraction from the Note.
- [2] Pattern finding for each currency and detection of fake and genuine currency according to the currency number.
- [3] Detection of silver line in middle of the currency note.
- [4] Detection of the fake or Genuine Currency using the Image Color as Every Currency note we have different RGB Value.
- [5] Black List should be maintained using the server. User can click on the update Button so that the user will sync the blacklist and have the latest one.

5. DATA FLOW

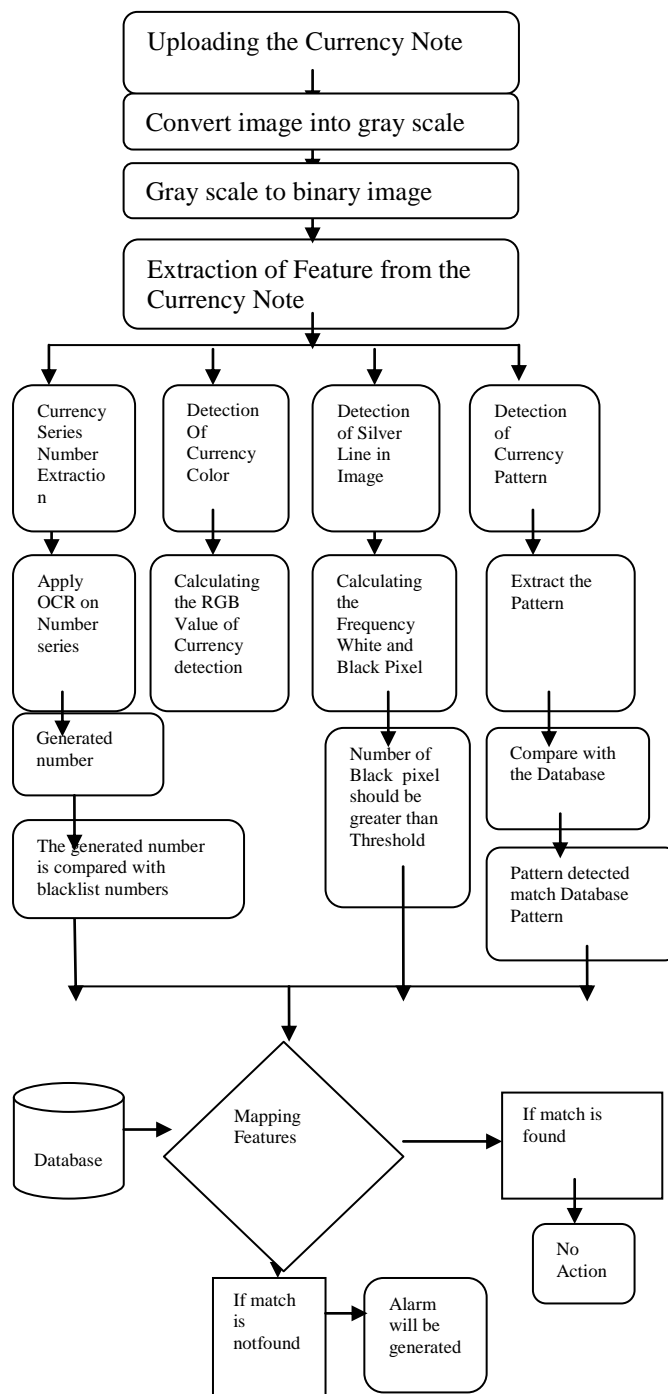


Figure 5.1 Data Flow

6. ALGORITHMS

1. OCR:

The goal of Optical Character Recognition (OCR) is to classify optical patterns (often contained in a digital image) corresponding to alphanumeric or other characters. The process of OCR involves several steps including segmentation, feature extraction, and

classification. Each of these steps is a field unto itself, and is described briefly here in the context of a Matlab implementation of OCR. One example of OCR is shown below. A portion of a scanned image of text, borrowed from the web, is shown along with the corresponding (human recognized) characters from that text. A few examples of OCR applications are listed here. The most common for use OCR is the first item; people often wish to convert text documents to some sort of digital representation.

1. People wish to scan in a document and have the text of that document available in a wordprocessor.
2. Recognizing license plate numbers
3. Post Office needs to recognize zip-code

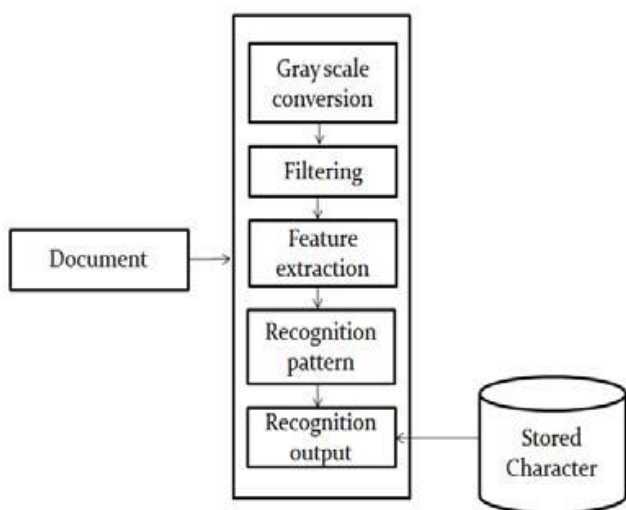


Fig.6.1: Shows general steps used in ocr

Optical character recognition (OCR) is a process of converting a printed document or scanned page into ASCII characters that a computer can recognize. Computer systems equipped with such an OCR system improve the speed of input operation, decrease some possible human errors and enable compact storage, fast retrieval and other file manipulations. The range of applications include postal code recognition, automatic data entry into large administrative systems, banking, automatic cartography and reading devices for blind. Accuracy, flexibility and speed are the main features that characterize a good OCR system. The performance of the systems has been constrained by the dependence on font, size and orientation. The recognition rate in these algorithms depends on the choice of features. Most of the existing algorithms involve extensive processing on the image before the features are extracted that results in increased computational time. In this paper, we discuss a pattern matching based method for character recognition that would effectively reduce the image processing time while maintaining efficiency and versatility. The parallel computational capabilities of neural networks [1, 3, 5] ensures a high speed of recognition which is critical to a

commercial environment. The key factors involved in the implementation are: an optimal selection of features which categorically defines the details of the characters, the number of features and a low image processing time.

The process of converting an image to editable document is separated to several steps; every step is a set of related algorithms which do a piece of OCR job.

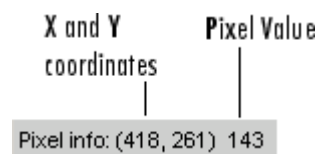
2. IMPIXELINFO:

Impixelinfo creates a Pixel Information tool in the current figure. The Pixel Information tool displays information about the pixel in an image that the pointer is positioned over. The tool can display pixel information for all the images in a figure.

The Pixel Information tool is a uipanel object, positioned in the lower-left corner of the figure. The tool contains the text label Pixel info: followed by the pixel information. Before you move the pointer over the image, the tool contains the default pixel information text (X,Y) Pixel Value. Once you move the pointer over the image, the information displayed varies by image type, as shown in the following table. If you move the pointer off the image, the pixel information tool displays the default pixel information label for that image type.



For example, for grayscale (intensity) images, the pixel information tool displays the x and y coordinates of the pixel and its value, as shown in the following figure.



If you want to display the pixel information without the “Pixel Info” label, use the `impixelinfoval` function.

`impixelinfo(h)` creates a Pixel Information tool in the figure specified by `h`, where `h` is a handle to an image, axes, uipanel, or figure object. Axes, uipanel, or figure objects must contain at least one image object.

`impixelinfo(hparent,himage)` creates a Pixel Information tool in `hparent` that provides information about the pixels in `himage`. `himage` is a handle to an image or an array of image handles. `hparent` is a handle to the figure or uipanel object that contains the pixel information tool.

hpanel = impixelinfo(...) returns a handle to the Pixel Information tool uipanel.

3.SYNCING THE FAKE CURRENCY DATABASE:

The Update Database of Fake currency database are store in Cloud Storage (Google Drive). Which are maintained by the authorized organization. We are downloading the Updated database by Clicking on Sync button in our project So the current database is updated.

Function used For Downloading the Database :

urlwrite :-

urlwrite(URL,filename)

urlwrite(URL,filename,Name,Value)

A. Description

urlwrite(URL,filename) reads web content at the specified URL and saves it to the file specified by filename [filestr,status] = urlwrite(____) stores the file path in variable filestr, and suppresses the display of error messages, using any of the input arguments in the previous syntaxes. When the operation is successful, status is 1. Otherwise, status is 0.

4. ALARM GENERATION:

If the Image is Fake we are alarm the User by Showing the Alert Message on the Screen " Fake Image Detected" and Sending the message to the authorized mail Id.

For Connecting to the mail and Sending the Alert message we are using the

sendmail Function :

Send email message to address list

sendmail(recipients,subject)

sendmail(recipients,subject,message)

sendmail(recipients,subject,message,attachments)

sendmail(recipients,subject) sends email to recipients with the specified subject. For a single recipient, specify recipients as a character vector or a string. For multiple recipients, specify recipients as a cell array of character vectors or a string array. subject must be a character vector or string.

sendmail(recipients,subject,message) includes the specified message. If message is a character vector or a string, sendmail automatically wraps text at 75 characters. To force a line break in the message text,use 10, as shown in the Examples. If message is a cell array of character vectors or a string array, then each element represents a new line of text.

sendmail(recipients,subject,message,attachments) attaches the files listed in the attachments input argument. attachments can be a character vector, cell array of character vectors, or string array.

Point which we have to consider before sending the mail.

The sendmail function does not support HTML-formatted messages. However, you can send HTML files as attachments.

If sendmail cannot determine your email address or outgoing SMTP mail server from your system registry, specify those settings using the setpref function. For example:

```
setpref('Internet','SMTP_Server','my_server.example.com');
```

```
setpref('Internet','E_mail','my_email@example.com');
```

To identify the SMTP server for the call to setpref, check the preferences for your electronic mail application, or consult your email system administrator. If you cannot easily determine the server name, try 'mail', which is a common default, such as:

```
setpref('Internet','SMTP_Server','mail');
```

By default, the sendmail function does not support email servers that require authentication. To support these servers, change your system settings and set preferences for the SMTP user name and password, with commands in the following form:

```
props = java.lang.System.getProperties;
```

```
props.setProperty('mail.smtp.auth','true');
```

```
setpref('Internet','SMTP_Username','myaddress@example.com');
```

```
setpref('Internet','SMTP_Password','mypassword');
```

To override the default character encoding, set the preference for email character encoding as follows:

```
setpref('Internet','E_mail_Charset','encoding');
```

where encoding is a character vector specifying the character encoding, such as 'SJIS'.

RESULT

Mapping of features is been done and detection of currency is been done. If fake note is detected then alarm will be generated and mail will be send to the respected authority.



Figure.Real Note Detected



Figure. Sending of mail to the authorised person.

CONCLUSION

The counterfeit currency detection using image processing was implemented on MATLAB. Features of currency note like serial number, security thread, Identification mark, Mahatma Gandhi portrait, Angular bleed lines 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.

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