Indian Currency Denomination Identification Using Image Processing Technique

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Abstract – It is very difficult to count different denomination notes in a bunch. This paper propose a image processing technique to extract paper currency denomination. The extracted ROI can be used with Pattern Recognition and Neural Networks matching technique. First we acquire the image by simple flat scanner on fix dpi with a particular size, the pixels level is set to obtain image. Some filters are applied to extract denomination value of note. We 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.
Keywords – Image processing, Feature extraction, Neural Networks.

INTRODUCTION

The Indian currency system is prevalent since a long time. The Government of India introduced its first paper money issuing 10 rupees notes in 1861[1]. The Reserve bank of India began note production in 1938, issuing 2,5,10,100 and 1000 rupees notes. Currently the Indian currency system has the denomination of Rs. 1,2,5,10,20,50,100,500 and 1000. Every denomination notes has its value on it.

In this paper we scanned the different denomination notes at 150 dpi with 128x128 pixels. We extract denomination value part from each note. A level is set for all images. By converting compliments , applying different filter i.e. sobel edge filter, average filter, laplacian filter , denomination value is extracted. The pattern recognition and neural network process is applied for matching to identify note value.

METHODLOGY

There are various technique for currency recognition that involve texture, pattern or color based. We use digital image processing techniques to find region of interest, after that Neural Network and Pattern Recognition Technique is used for matching the pattern.
The Steps are as follows –
1. Different denomination notes are scanned at 150 dpi with 128x128 pixels by simple flat scanner.(Fig.1 & 2)
2. ROI is extracted.(Fig.3)
3. Converting image in gray scale and Setting up a level(Fig.4).
4. Denomination value can be obtained by complimenting, applying sobel edge filter, average filter, laplacian filter(Fig.5,6,7,8).

5. After obtaining value numerals, it is matched by using Neural Networks and Pattern Recognition Tool in Matlab for matching(Fig.9).

GRAPHICAL REPRESENTATION

```
┌─────────────────────────────────────────┐
│            Acquiring Image               │
│ Scanning with Simple flat scanner at 150 │
│             dpi with 128x128             │
└─────────────────────────────────────────┘
                    │
                    ▼
┌─────────────────────────────────────────┐
│ Extracting ROI & Converting in Gray Scale│
│                 Format                   │
└─────────────────────────────────────────┘
                    │
                    ▼
┌─────────────────────────────────────────┐
│ Complimenting ,Applying Sobel Edge       │
│ detector, Average Filter, Laplacian      │
│ Filter                                   │
└─────────────────────────────────────────┘
                    │
                    ▼
┌─────────────────────────────────────────┐
│ Applying Neural Networks & Pattern       │
│ Recognition Tool for pattern matching    │
└─────────────────────────────────────────┘
```
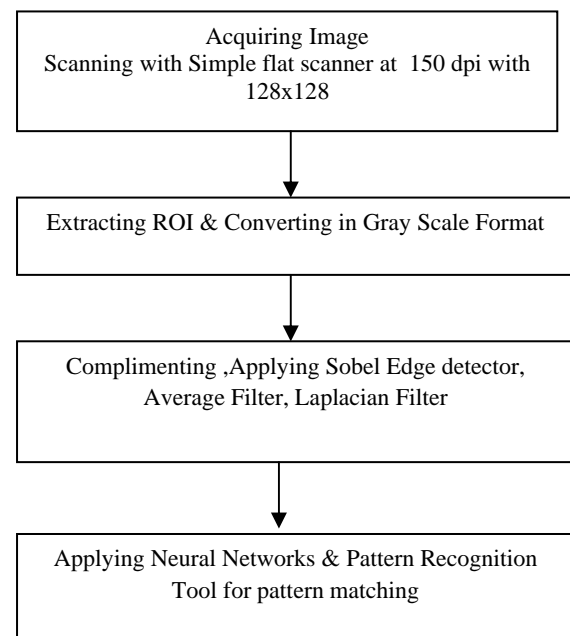

Fig 1. Scanned Copy of Different denomination Indian Paper Currency.

Fig 2. Different denomination Currency.

Fig 3. ROI of Different denomination
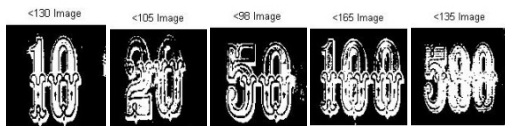Indian Paper Currency.
(150 dpi with 128x128)

Fig 4. Different currency denomination value at
Various pixel levels.

Fig 5. Different currency denomination value with
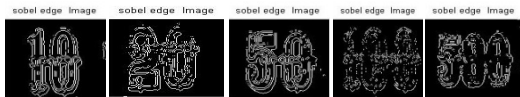Compliment.

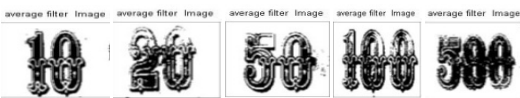Fig 6. Different Currency Denomination Value With
Sobel Edge Filter.

Fig 7. Different Currency Denomination Value With
Average Filter.

Fig 8. Different Currency Denomination Value With
Laplacian Filter.

The pattern recognition and neural networks technique is used for matching image pixels. The   multilayer neural network match each pixel of given sample and provide the exact match.
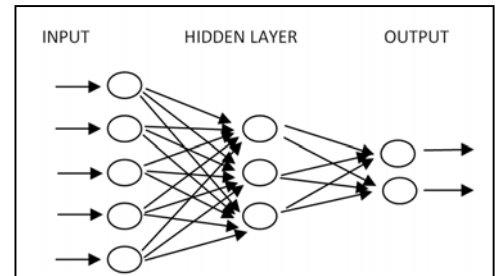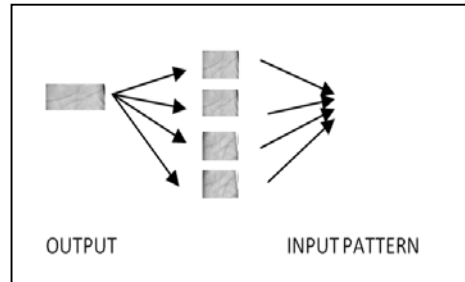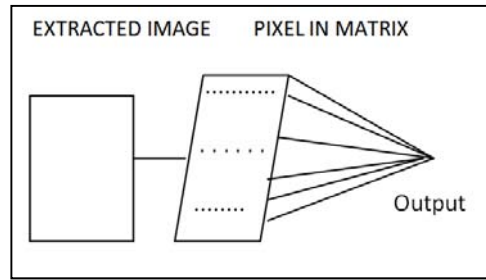

Fig.9 Matching Process Of A Image By Using Multilayer
Neural Networks.

MATLAB CODINGS

```
clear all
close all
a=imread('c:\notesimage\roi\500note150128x128.jpg');
figure(1); imshow(a); title('original Image');
b=rgb2gray(a);
f=(b<135);
figure(2); imshow(f); title('<135 Image');
g=imcomplement(f);
figure(3); imshow(g); title('compliment  Image');

%edge detection
h=edge(g, 'sobel');
figure(4); imshow(h); title('sobel edge  Image');

%special filters
k=fspecial('average');
kk=filter2(k,g);
figure(7); imshow(kk); title('average filter  Image');

l=fspecial('laplacian');
ll=filter2(l,g);
figure(8); imshow(ll); title('laplacian filter  Image');
```

CONCLUSION

This recognition method of Indian paper currency is quite simple, efficient and easy to be realised because denomination numerals are used for identification which can be extracted easily from paper currency. Such numerals are matched and are found exact match for identification. This method of currency recognition will certainly help to identify different denomination of paper currency. This method can be used for counting of different denomination note bunch.

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