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# Fast and Efficient Coin Recognition using 5 Hidden Layers BPNN

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***Abstract:*** Coins have been integral a part of our day to day life. Coins are used nearly every place like in grocery stores, banks, trains, buses etc. Thus it's a basic would like that coins may be recognized, counted, sorted mechanically. For this, it is necessary that coins can be recognized automatically and check whether it's real or fake In this paper we have developed an ANN Fast and Efficient coin recognition using 5 hidden layers Back-Propagation Neural Networks Algorithm for the recognition of Indian Coins of denomination `1, `2, `5 and `10 using Canny Edge Detection. We have taken images from both sides of the coin. So this system is capable of recognizing coins from both sides. Features are extracted from images using techniques of Labeling, Canny Edge Detection, and Image Processing etc. Then, the extracted features are passed as input to a trained Neural Network 84.3% recognition rate has been achieved during the experiments.

***Keywords:*** Canny edge detection, BP neural network, coin recognition, Labeling, Image Processing.

## I. INTRODUCTION

Coins have been integral a part of our day to day life. There is a tendency to use coins in our daily like in banks, supermarkets, grocery stores etc. they need to be the basic a part of our day to day life. Therefore, there's the fundamental want of quick and economical automatic coin recognition system. Coin recognition systems can even be used for the analysis work by the institutes or organizations that modify the coins. There are 3 types are follows:

- The mechanical technique based systems.
- Electromagnetic technique based systems
- Image process-based systems

The mechanical method based systems use parameters like diameter like thickness, diameter or radius, the load of the coin to acknowledge the coins. However, these parameters can't be wont to acknowledge between the various materials of the coins. There are 2 coins original and pretend to have a constant thickness, diameter, and weight however once recognition, it'll treat as original coin, and therefore, these systems are often fooled simply.

Electromagnetic technique based systems between different materials as a result of within these systems the coins square measure passed from degree oscillating coil at a specific frequency and different materials bring different changes in the amplitude and direction of frequency. Therefore, these changes and also the alternative parameters are often wont to differentiate between coins. The Electromagnetic technique based coin recognition systems improve the accuracy of recognition but still. It's going to be fooled by fake coins.

Within the recent years, coin recognition systems supported pictures have additionally acquired the image, however, there's some system is obtainable that square measure detection the faux coins Then these pictures square measure processed by exploitation numerous techniques of image process like edge detection, segmentation, FFT, DCT etc.

In Section I contains the introduction of Fast and Efficient Coin Recognition using 5 hidden layer BPNN and various techniques, Section II contains the related work of Coin Recognition using various techniques, Section III contains the Implementation Details include methodology with flow chart, Section IV contains the architecture and essential steps of Training and Testing Data, Section V describes results and discussion, section VI concludes research work with future directions.

## II. RELATED WORK

In 2015 [1] S. Mohamed Mansoor roomie, R.B. JayanthiRajee "Coin Detection and Recognition using Neural Networks ", 2015 International Conference on the circuit, Power and Computing Technologies, IEEE 2015. In this work, a coin recognition system was proposed to identify the denomination of Indian coins. The given input image should identify coin or non-coin, after that, it is identified as coin means the feature vectors are extracted and denomination of

 

the coin found out with the neural network. The Neural network was trained into the various types of coins. The recognition rate of the proposed algorithm is around 82%.

In the year 2011- Present, the `10 Coin(tail) Outer ring has the lettering "भारत" on left, "INDIA" on right, and the year of mint and mint mark below. At the center is the Lion Capital with the Lettering "सत्यमेव जयते" below it.

`10 Coin (Head) has 10 notches with the '□' sign below it, and the number 10 below the '□' sign.

**Limitations:** This paper is only based on the features of the coins released in 2011-Present.

## III. IMPLEMENTATION DETAILS

Coin recognition process has been divided into six steps. The architecture of Fast and efficient coin recognition using 5 hidden layers BPNN is shown in Fig. 1.

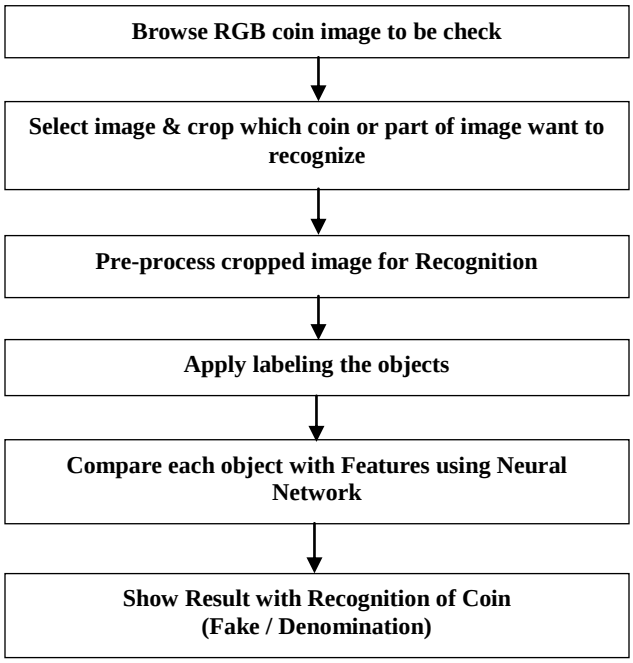


Figure1. Architecture for Fast & efficient coin recognition using five hidden layers BPNN

### 3.1 Browse RGB coin image to be check

This is the first step of coin recognition process. In this step, the RGB coin image is acquired. Indian coins of denominations `10 real and fake both coins were scanned from both sides using the color scanner as shown in Fig. 2.

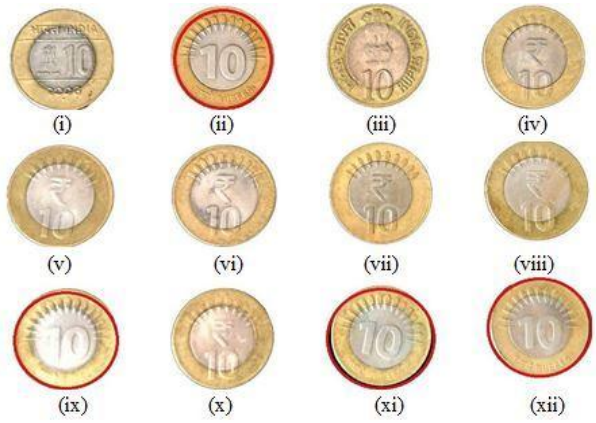


Figure2. Denominations of Indian Coins

(i) Head of Ten coin (1st type, real), (ii) Head of Ten coin (2nd type, fake), (iii) Head of Ten coin (3rd type, real), (iv) Head of Ten coin (4th type, real), (v) Head of Ten coin (5th type, real), (vi) Head of Ten coin (6th type, real), (vii) Tail of Ten coin (7th type, real), (viii) Tail of Ten coin (8th type, real), (ix) Tail of Ten coin (9th type, fake), (x) Tail of Ten coin (10th type, real), (xi) Tail of Ten coin (11th type, fake), (xii) Tail of Ten coin (12th type, fake).

#### 3.1.1 Convert RGB coin image to grayscale

From the primary step, the image we have a tendency to get may be a 24-bit RGB image. Image process of colored pictures takes longer than the grayscale pictures. So, to cut back the time needed for the process of pictures in any steps it's smart to convert the 24-bit RGB image to 8-bit Grayscale image.

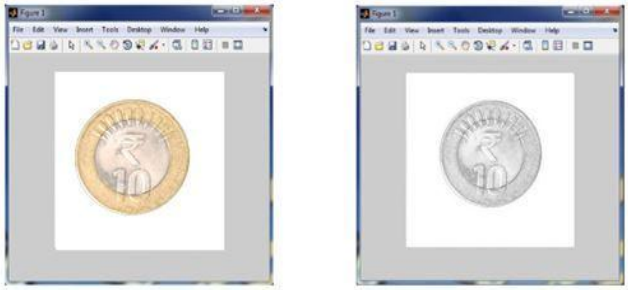

Figure3. Convert RGB to 8-bit Grayscale

#### 3.1.2 Canny Edge Detection

In edge detection, the aim is to mark the points in a picture at that the intensity changes sharply. Sharp changes in image properties mirror necessary events that include: (i) Discontinuities thorough. (ii) Changes in material properties. (iii) Variations in scene illumination. Edge detection is employed within the field of image process and has the extraction. The Canny operator is such associate degree

 

operator utilized in edge detection algorithms. A clear image a similar image once Canny Edge Detection.

➢ The Canny Edge Detection Algorithm

The algorithm runs in 5 separate steps:

1) **Smoothing:** Blurring of the image to remove noise.
2) **Finding gradients:** The edges should be marked where the gradients of the image have large magnitudes.
3) **Non-maximum suppression:** Only local maxima should be marked as edges.
4) **Double thresholding:** Potential edges are determined by thresholding.
5) **Edge tracking by hysteresis:** Final edges are determined by suppressing all edges that are not connected to a very certain (strong) edge.

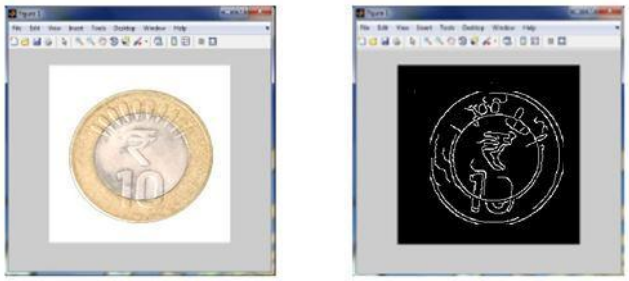

Figure4. Canny Edge Detection

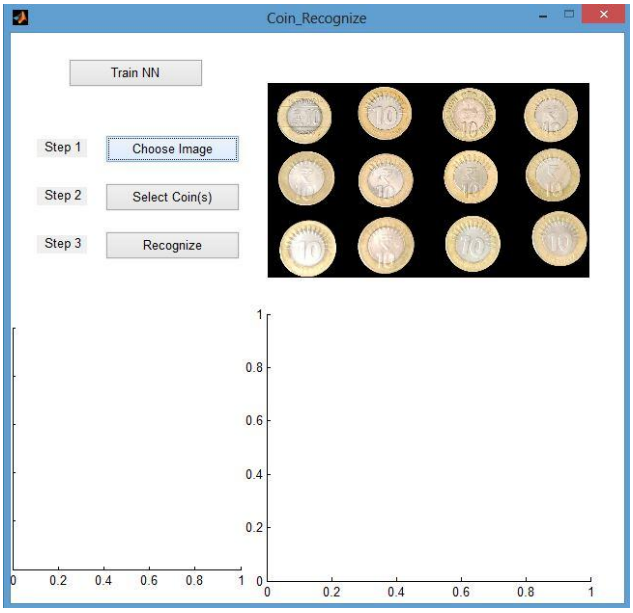


Figure5. Choose Image

### 3.2 Select image & crop which coin or part of image want to recognize

The image is cropped in order that we have a tendency to simply have the coin within the image. Then after cropping, coin image is cut to form it of an equal dimension of 200 × 200.

### 3.3 Pre-process cropped image for recognition

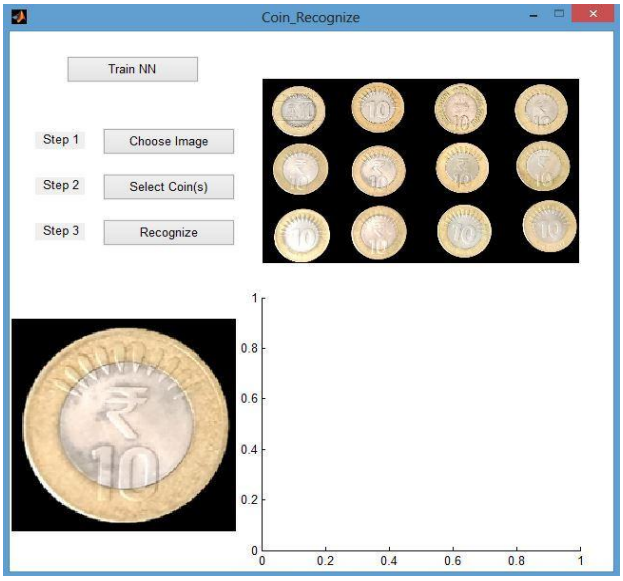


Figure6. Select Image & Crop

### 3.4 Apply labeling apply the objects

The image is labeled using bwlabel which Labels the connected components in 2-D binary images. L = bwlabel (BW, n) returns a matrix L, of the same size as BW, containing labels for the connected objects in BW.

#### 3.4.1 Trained the NN

This trained neural network categories the coin into acceptable class supported that the output is generated. MATLAB provides a Neural Network tool case with the assistance of that Neural Network for pattern recognition will be simply created.

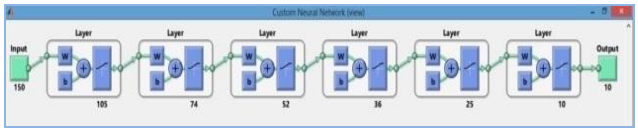

Figure7. Network Diagram for 150 Features

 

### 3.5 Compare each object with Features using Neural Network

Compare test image of extension (.jpg) with coin samples of extension (.bmp) and match the features.

## IV. TRAINING AND TESTING DATA

Five samples of each denomination of Indian coins are scanned from both sides as shown in Fig 2. So, it results in 10 images for each coin. But for `1, `2, `5, `10 two types of coins are used. So for each of these denominations, there are 20 images of which 10 (5 for head and 5 for tail) are of the 1st type and other 10 (5 for head and 5 for tail) are of the second form of that specific denomination. Then after pre-processing once we get pictures of 200×200. Apply Labeling and Edge Detection to the objects and Compare each object with the Features using Neural Networks and Show result with recognition of coin (Fake/ Denomination). This system is capable of recognizing coins from both sides rotated at any degree and detect that the coin is fake or not.

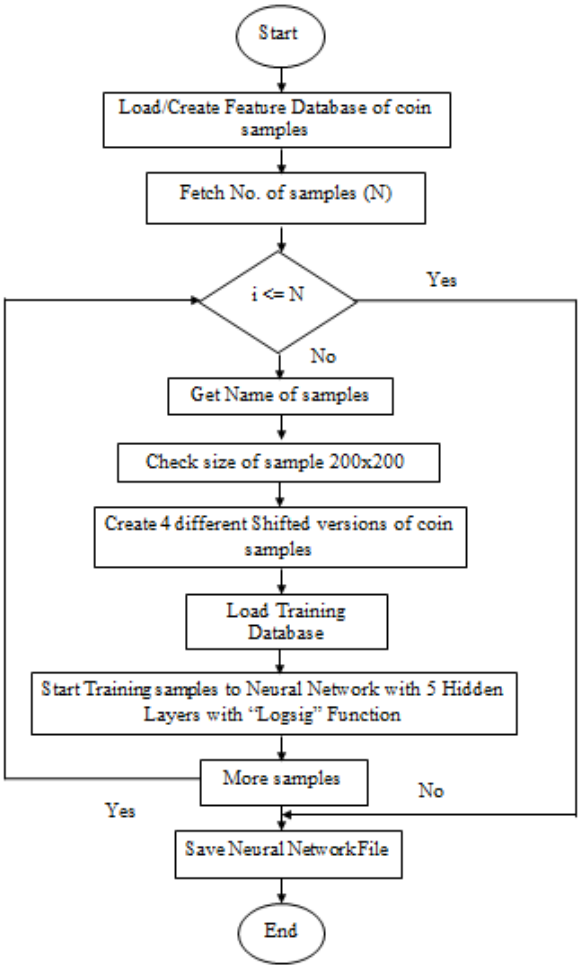


Figure8. Process flow Training NN

## V. RESULTS AND DISCUSSION

### 5.1 Fast and efficient coin recognition using 5 hidden BPNN

In the interface of Fast and Efficient coin recognition using 5 hidden layers, BPNN is shown. During this interface initial of all user got to browse a coin image to be recognized. Then click on the 'Load Image' button to load the image. Then click on 'Recognize' button to begin the popularity method. During which recognition of ten rupee coin is completed.

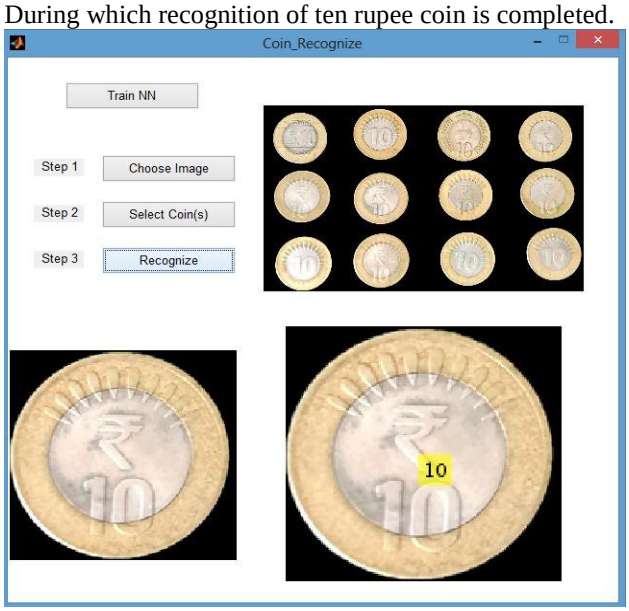


Figure9(a). Recognize real coin

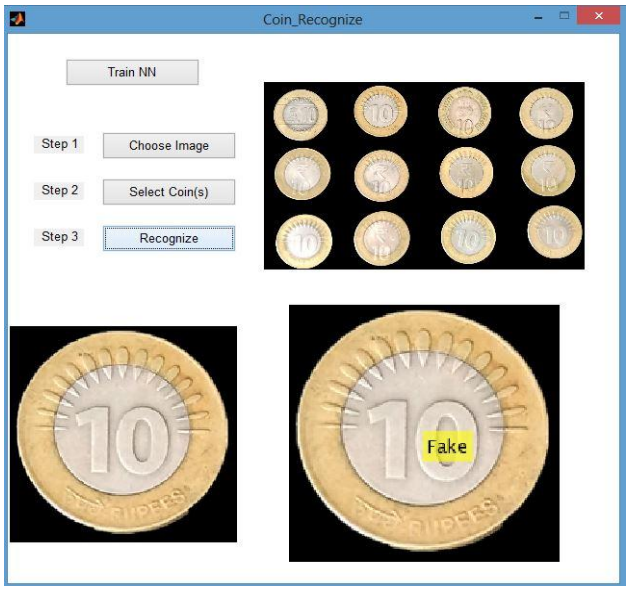


Figure9(b). Recognize Fake coin

Figure9. Fast & efficient coin recognition using 5 hidden layers BPNN

Random samples get selected from n sample images for training, testing, and validation. 90% sample images are used

 

for training, 5% for testing and 5% for validation. Fig. 11 shows the values for MSE (Mean Square Error) and %E for training, testing, and validation.

| | Samples | MSE | %E |
|---|---|---|---|
| Training: | 4536 | 1.65692e-3 | 2.00617e-0 |
| Validation: | 252 | 3.81927e-3 | 3.57142e-0 |
| Testing: | 252 | 6.43451e-3 | 5.55555e-0 |

Figure10. Results for Training, Testing, and Validation of coin_neural_150

Fig.11 shows the confusion matrix for coin_neural_500. In confusion matrix Target classes are the classes to which the coin actually belongs and Output classes are the categories to that the coin truly belongs and Output categories are the categories during which the coins get classified by trained NN. It's clear from the figure that that 84.3% correct recognition has been achieved which is quite encouraging.

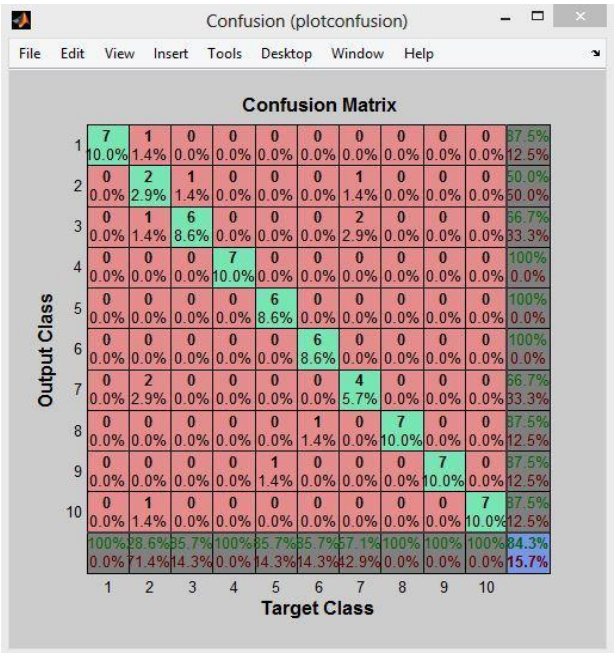


Figure11. Confusion Matrix for coin_neural_150

### 5.2 Comparison

It is clear from the data that the network coin_neural_150 performs better and provides correct recognition of 84.3%.

Table 1 Comparison of Recognition Rate

| Sr. No | Year | Technique used | Dataset of coins used | Recognition Rate (%) |
|---|---|---|---|---|
| 1 | 2015 | Fourier Transform | Indian (modern) | 82 |
| 2 | 2017 | Labeling and Canny Edge Detection | Indian (modern) | 84.3 |

## VI. CONCLUSION AND FUTURE SCOPE

In this thesis a Fast and Efficient coin Recognition using 5 hidden layers BPNN has been developed victimization MATLAB. During this system, first pre-processing of the pictures is completed and so these pre-processed images square measure fed to the trained neural network. The Neural network has been trained, tested and valid victimization N sample images of denominations `1, `2, `5 and `10. In this system images of coins from both sides (Head & Tail) have been used and apply labeling and canny edge detection technique. So, this system is capable of recognizing coins from both sides. The Recognition rate of 84.3% has been achieved. It also detects the fake coins.

Future Scope: The future perspective of the approach is to detect other national currencies and to infuse the presented technique into a mobile application so that it proves to be a greater utility for common people. The application areas that can be beneficial through the proposed approach include fake currency detection while electronic currency exchange and money deposit using ATM.

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Saloni Shrivastava is perusing M.Tech. in Computer science and engineering From Lakshmi Narain College of Technology Bhopal, She has done Bachelor of Engineering in Computer science and engineering from LNCTE College Bhopal in 2015. She published one research in the International Journal.

Dr. Bhupesh Gour is working as Professor in Department of Computer science and Engineering Lakshmi Narain College of Technology Bhopal, He did his Ph.D. He has great research and teaching experience. He has published more than 20 research papers in reputed International Journals including and conferences.

 