COIN DETECTION AND RECOGNITION USING NEURAL NETWORKS

Neural Network
Mini Project Report

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COIN DETECTION AND RECOGNITION USING NEURAL NETWORKS

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ABSTRACT:

Coins are important part of our life. We use coins in places like stores, banks, buses, trains etc. So, it becomes a basic need that coins can be sorted, counted automatically. For this, there is necessary that the coins can be recognized automatically. Automated Coin Recognition System for the Indian Coins which is Rs. 1, 2, 5 and 10 with the rotation invariance. We have taken image of coin. So, this system is capable to recognizing coins. Features are taken from the images using techniques as a Thresholding, canny edge detection, character recognition etc

KEYWORDS:

Image Processing, binary image (Image thresholding), Image filling, Region Propping, Automated Coin Recognition and counting

INTRODUCTION

Image Processing Based Coin Recognition System Classification:

1) Mechanical method-based systems,
2) Electromagnetic method-based systems and
3) Image processing-based systems.

The mechanical method-based systems use parameters like radius/diameter, thickness, weight and magnetism of the coin for differentiate between the given coins. But these parameters cannot be used for differentiate between the different materials of the coins. It means if we provide two coins one original and other fake which have the same radius/diameter, thickness, weight and magnetism but with different materials of mechanical method based coin recognition system then it will treat both the given coins as original coin so these systems can be fooled easily by hackers.

Now, for the electromagnetic method based systems can differentiate between different materials because in these systems the coins are passed through an oscillating coil at a certain frequency range and different materials bring different changes in the amplitude and frequency. So these changes and the other parameters like radius/diameter, thickness, weight and magnetism can be used to differentiate between the coins. The electromagnetic method based system of coin recognition systems improves the accuracy of Recognition but still they can be fooled by some of game coins.In the recent of years coin recognition systems based on images have also come into the picture

RELATED WORK

Yamini Yadav ,Apoorvi Sood In his paper the aim for coin recognition system is to classify high volumes of coins with high accuracy within a short time gap. This paper presents the comparison between various types of coin recognition systems in terms of their accuracy which has been proposed by various researchers based on image processing, image recognition method.

The accuracy rate delivered by R.Bremananth et al was 92.43%, Adnan Khashman system et al was 96.3%, Hussein R.Al-Zoubi system et al was 97%,

Shatrughan Modi et al was 97.74%, Deepika Mehta was 40% to 50%. Sandeep Kaur *et*, International Journal of Computer Science and Mobile Computing, Vol.no.3 Issue.9 of September- 2014, pg.no.259-262

Suchika Malik, Parveen Bajaj, Mukhwinder kaur are this paper presents reliable coin recognition system based on polar Fast Fourier Transform system. There are basic need to automate the counting and sorting of the coins. For this machine need to recognize the coins very fast and accurately as for further processing depends on this recognition. However the currently available algorithm to focus basically on recognition of the modern coins. In this paper they have developed ANN (Artificial Neural Network) based on automated coin recognition system for the recognition of modern coins. Then, these extracted features are going to passed as input to the trained neural network of 98.798% recognition rate has been achieved during the experiment.

Sonali A Mahajan, Chitra M.Gaikwad in his this paper is to detect denominations of Indian coins. Counting all coins manually, collected in large amount such as the coins collected at Indian temples is very difficult. The method proposed in this used reduction of technique that is the input image is reduced by database image repeatedly by the rotating it with a fixed angle at every time. Denomination of the coin is verified by comparing the coin from both sides. Thus, this method proposed here is rotation invariance and also by using two-way scanning and comparison of the coin, method determine the denomination clearly even if the database is having different coins with the same radius.

Chandan singh, Amandeep kaur in his paper described polar harmonic transforms are orthogonal rotation invariant transforms which provide many numerically stable features. The kernel functions of the PHTs are consisting of the sinusoidal functions that are inherently of computation intensive. They develop a fast approach for their computation using recursion and also 8-way symmetry /antisymmetry property of the kernel functions.

PROPOSED METHOD

The proposed method is used to identify coin or non coin and then find the denomination of Indian coins A camera is placed inside the coin drop box. The image of head side of a dropped coin are acquired at constant illumination and fixed distance with rotation invarience. A reference database is maintained withthe image of the coins of different variety and various denominations. First We have to find coin or non coin.The rotation invariance feature is represented by the absolute value of Fourier coefficients of polar image of the coin on circles with different radii. Then coins can be distinguished by feeding those features into a multi-layered BP neural network.

Image Acquisition

The acquisition of image to operate the vending machine using different denomination of coins. A camera is fixed inside the vending machine to capture the coin image. Illumination is provided for image acquisition by fixing a light source. The light source is hinged into the vending machine in a proper position to have reduced reflection on coin.

Segmentation

The captured image contains the details of the inserted coin along with unwanted details. Therefore, a process is needed to segment the portion of the coin from the captured image. The captured image is subtracted from the background image to obtain the difference image (*diff (x, y)*) which is represented in equation (2.2.1).

diff (x, y) = b(x, y) c(x, y) ------ 2.2.1

Edge Detection

Edges charecterize boundaries and are therefore a problem of fundamental importance in image processing .The Canny edge detection algorithm is known to many as the optimal edge detector. The canny edge detector first smooths the image to eliminate and noise.

Hough Transform

This method used to find the circle in the image. The general Hough transform can be used on any kind of shape, although the complexity of the transformation increase with the number of parameters needed to describing the shape. Hough transform can be described as a transformation of a point in the x,y-plane to the parameter space. A

straight line passing through the points in x,y-plan be described by:

$$Y = ax + b \text{ ----- (2.4.1)}$$

Polar Transform

The coin image is converted from Cartesian coordinates to logarithmic polar coordinates. The image transform from Cartesian to logarithmic polar coordinates is introduced. Suppose the coin image can be denoted as f(x,y) under the Cartesian coordinates and as $f(r, \theta)$ under the logarithmic coordinates. The coordinates transform from f(x,y) to $f(r, \theta)$ can be defined as:

$$r = \sqrt{(x - x_c)^2 + (y - y_c)^2} \text{ ---- (2.5.1)}$$

$$\theta = \arctan\left(\frac{y - y_c}{x - x_c}\right) \text{ --------(2.5.2)}$$

By applying polar transform to the hough transform of image,one output will be obtained. From that we will decide coin or non coin.If the image is coin denomination of the coin will be found out.

Feature Extraction

If the Image is coin means the denomination of the coin founded out by this procedure. Feature vectors as the input for the neural network. Polar transform is applied to original image. Then the fourier transform applied to the output of the polar transform .Then the feature vectors will be obtaine.

Fourier Transform

The Fourier Transform is an important image processing tool which is used to decompose an image into its sine and cosine componentsThe Fourier Transform is used in a wide range of applications, such as image analysis, image filtering, image reconstruction and image compression.

PROPOSED ALGORITHM

The following steps are taken in the proposed coin recognition system:

Step 1: Develop RGB code for loading database of coin image in MATLAB

Step 2: Convert RGB image to gray scale image using MATLAB

Step 3: Applied image thresholding on gray image for convert in binary image in MATLAB

Step 4: Reduce the noise by image filling in MATLAB

Step 5: Find area and centroid of coin image using 'regionprops' command in MATLAB

Step 6: Coin recognition and counting using area and centroid in Matlab

Step 7: Separate each coin from image and store it

PSEUDO CODE

1: Read the coin image for creating data base

2: Convert RGB to gray scale image using 'rgb2gray' command

3: Convert gray image to binary image using 'im2bw' command (Thresholding)

4: Use 'imfill' command in MATLAB for removing noise from image

5: Use 'regionprops' command in MATLAB for determines area and centroid for coin image

6: According to area and centroid, built code for count and identification of coin

7: According to centroid and area, separate the each coin

8: End

The model consist of :-

1)Input count=32040
2)Output count=7
3)Layer size=32040 20 7
4)Bias=1.0
5)Momentum=0.6
6)Learning rate=0.5
7)Max epoch count=100
8)Error threshold=0.00001
9)Batch size=169
10)Activation type=sigmoid

SIMULATION RESULTS

Load the RGB image in the MATLAB is the first step of coin recognition system process. In this step the RGB coin image is captured/ acquired. Indian coins of denominations Rs.1, 2, 5 and 0.5 were captured together. This image captured using good mega pixel camera with black background, so we can easily proceed further. This captured image is height fixed so we have same area if the location of coin changes. This image shown in fig 1.

From the above step the image we got the 24-bit RGB coin image. Image processing of colour images can takes more time than the gray scale images. So, for reduction the time required for processing of images in further steps it is good to convert the 24-bit RGB image into the 8-bit Greyscale image. This shown in fig 2.

From the second step, we get gray scale image of the coin. Now, I am going to convert this gray scale image to binary image in MATLAB for next process. By this binary image, we can easily calculate the area and centroid of each and every coin. This shown in fig3.

After converting binary image, we have some doted parts in this image as noise. After using imfill command, we have cleared image. So by this we got noise free coin image, so we have no problem now for noise and can easily calculate the area and centroid. This shown in fig 4.

We got noise free image from the fourth step. Now, we use regionprops command for finding Area and centroid of each and every coin of given image from the MATLAB. By this step, we have area and centroid of each and every coin of image.

From the above step five, we get Area and centroid of coin main image. Using this, I am going to build algorithm for counting and identifying the coin in image. Using this algorithm, we can get the coin image showing its value This shown in fig 5 how it displays.

Now from above step, we have fully identified and counted image. Now further process is separate the each and every coin from image with its value. Thus, all coins are separated from each other. We will exactly show each and every separated coin. For this separating purpose, we can use Imcrop command in MATLAB. In imcrop command, first of all we will find the centroid and area of the coin. According to the area and centroid, we set crop margined and store this cropped image to relative folders.

Fig 1.Loading Image

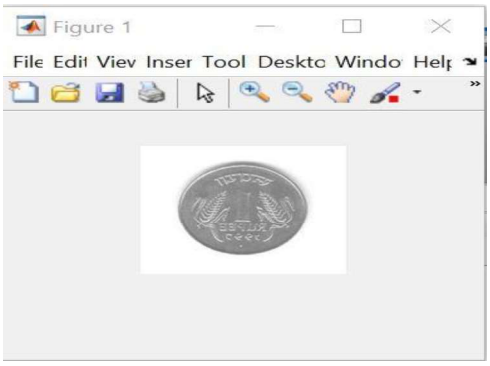

Fig 2.Gray Image

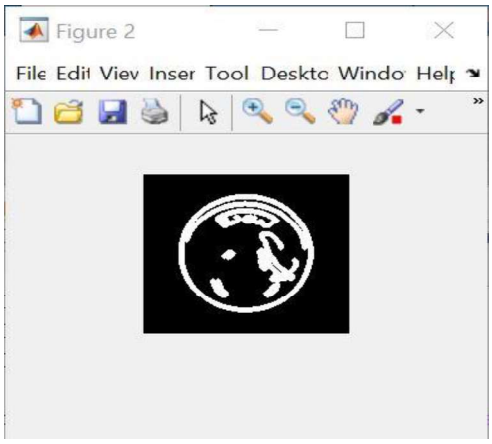

Fig 3.Binary Image

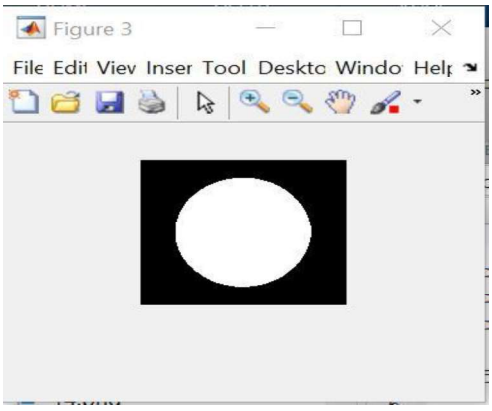

Fig 4.Reduced Noise Image

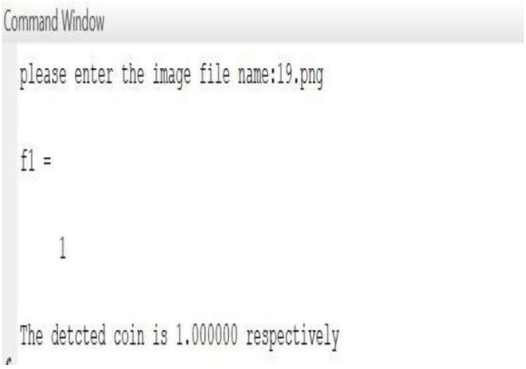

Fig 5.Coin Identification

CONCLUSION AND FUTURE WORK

In This paper, presents various systems developed and existing techniques of coin recognition based on image processing method. In this paper, basically provider of various methods of recognition of the coins and get the best accuracy. It was shown that the described project contributes to the image based coin recognition and classifications. We presented an overview of the work-packages and project partners. Thereby, coins from more than 31 countries can be recognised and separated from it. Further research will be carried out to improve the recognition result and also speed. And important thing is that, the Recognition time is very less.

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