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Area Calculation of Coins Using Image Segmentation Techniques

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ABSTRACT: This paper proposes an approach to be followed for the detection of coins from the acquired image containing different coins. The input image is firstly pre-processed so as to perform the function of noise removal. Secondly different Segmentation techniques of image processing such as Thresholding, edge detection, Hough transformation etc. are used for the accurate extraction of the circular boundary of coins. To efficiently detect circular boundary of coin, accurate evaluation of circumference of coin in the input image is required.

KEYWORDS: Segmentation, Edge detection, Hough transformation, etc.

I. INTRODUCTION

The main objective of is to apply computer vision techniques[1] to develop a methodology which should recognize coins in the input image, and extract the circular boundary of coin. That is to have an input image containing coins and calculate the circumference of the coins which are on the image. There are several techniques involved, such as image colour segmentation, edge detection, noise filtering, edge enhancement, Hough transformation and so on. To achieve this there is a significant need to follow a step-step approach for the accurate calculation of area of coins. Section I contains the introduction, Section II contains the proposed methodology, Section III includes results and Section IV involves conclusion with future work.

II. PROPOSED METHODOLOGY

For efficient evaluation of circumference of coin in different input images of coins, accurate segmentation techniques are required. One of the proposed approach is as follows:

Proposed Methodology:

Step 1: Take input image

Step 2: Conversion of input image into gray scale image

Step 3: Segmentation of image

Step 4: Enhancement of edges in segmented image.

Step 5: Detection of edges



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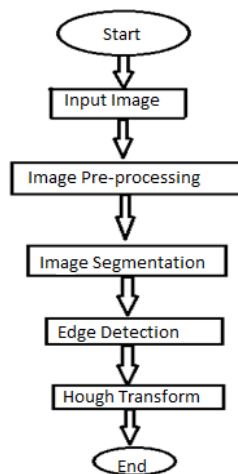


Fig. 1:Step-by-step approach

1. Image Pre-processing

In this step, a camera of good quality is used to capture different images of coins. The input image may contain noise [2] which needs to be removed by making effective use of different filters such as mean filter, median filter, etc to get the pre-processed image which is smooth in nature.

2. Image Segmentation

a) Thresholding

The coins shown on the input image should be classified into groups according to their colours. The output image will contain the group of coins having same colour [3] on the input image. This technique is divided into four steps:

- The color region is selected.
- The “average” colour of the selected region is calculated, which is called mean.
- The measure of similarity between each colour pixels in selected region and the mean is find out, which is called threshold.

b)Edge Enhancement

After thresholding in step a), the image carrying the coins that lie in the same colour group would be treated as a binary image. However, the pixels of the coins on this output image were not connected because not all the pixels of the coin could be found in step a). To improve the accuracy of Hough Transformation, the requirement of clear edges is there. In other words, edge enhancement is required. The steps involved were shown below:

- Noise reduction. The isolated pixels on the image need to be removed in this step.
- Filling of region. The gaps within the coin are filled so as to recover the pixels that are lost in the previous step. Now the edges of the coins should be clear.

3. Edge Detection

In the previous step, the output was an image containing the coins with cleared edges. The next step is to detect the edges of the coins, after applying some morphological algorithm to enhance the edge. Now use of edge detector is

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required to find out the edges of the coins. The Canny edge detector [4] was chosen in this paper as it is the optimum edge detector. It includes the following benefits:

- a) Easy Localization
- b) No multiple responses
- c) Low error rate

4. Hough Transformation

After using canny edge detector, the edges of the coins should be extracted. Now Hough Transform algorithm is used to analyze these edge pixels, so the algorithm's objective is to detect the circles (the shapes of the coins). Firstly, the first derivatives of intensity values in an eye image are calculated to generate an edge map and then the result is thresholded. From the edge map, votes are cast in Hough space [5] for the parameters of circles passing through each edge point.

Once the centers and the radiuses of the circles were found, the area of the coins in the same group could be calculated.

III. SIMULATION RESULTS

The input image containing coins is shown in figure 2 (a). Firstly it is preprocessed using Gaussian filter. Pre-processing is important for the removal of unwanted noise from the input image. The results of image pre-processing is shown below in figure 2(b).

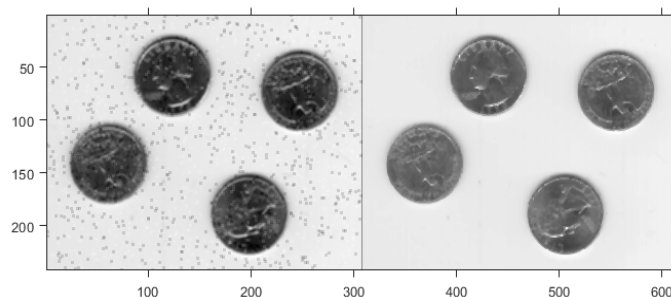


Fig.2(a) Original noisy image (b) Preprocessed image

Thresholding is then applied on the preprocessed image to get a group of pixels having similar colour region. Results of thresholding is shown in figure 3 shown below:

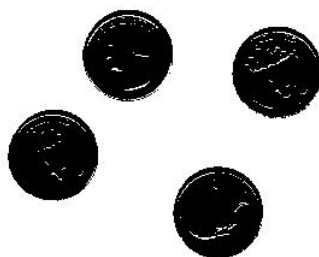


Fig. 3: Results of thresholding applied on the pre-processed image

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After thresholding, edge detection is used to detect sharp boundaries of coins in the image. Canny edge detector identifies is used , the results of which are shown in figure 4 below:



Fig.4:Results of edge detection

Finally the result of Circular Hough transform is shown in figure5.Circular Hough transform identifies the circumference and radius of the coins.

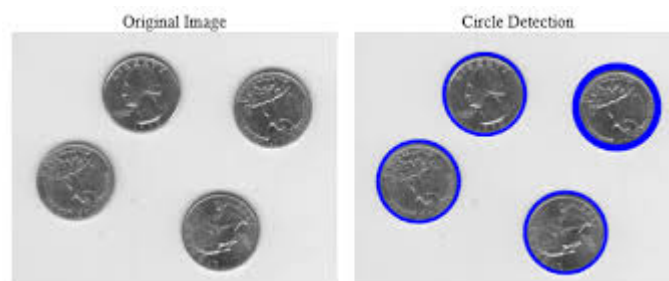


Fig. 5:Results of Circular Hough Transform

IV. CONCLUSION AND FUTURE WORK

The ultimate goal is to extract the outer boundary of coins from the sample input image containing coins of varied sizes. This requires the calculation of circumference of each coin in the input image which in turn needs the radius of coin and that can be obtained through the implementation of various segmentation techniques such as thresholding, edge enhancement, edge detection, Hough transformation, etc. Future works will include modifications of the image processing techniques, such as Neural Networks training using Edge detection that would exclude the process from the dependency over standard light intensity and standard distance between coin and camera during image acquisition so as to add on the accuracy of the process. Also these techniques can be applied in the detection of area of pores in membrane filter, micro-organisms from water and red blood cells from the human body.

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