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Seeking the Roundness of Objects through MATLAB

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Abstract— *In this paper, a method has been incorporated to acquire the knowledge for the identification of the Objects layed on their roundness with the help of tool named GUIDE (Graphical user Interface and development Environment).The noise is shunted out from the image before the Edge Detection Technique which will detect the boundary and henceafter the measurement of roundness is observed.*

Keywords: — MATLAB, GUIDE Tool, Image segmentation and Edge detection.

1. Introduction—Due to the complexity in boundary tracing routine for the boundary detection of objects, we have indulge a tool named guide. Firstly the input image is loaded in the MATLAB and the process of edge Detection is used for the tracing of boundaries, after removing the noise from the image. Thereafter through the passage of certain commands of image processing toolbox of MATLAB the desirable degree of roundness is reached.

1.1 Boundary detection

Boundary detection is an inevitable step in many computer vision tasks. For image analysis and interpretation tasks such as segmentation, object description etc., the boundary mapping plays a part and parcel role that provide worth facts regarding image Fig. 1 shows an image and the associated boundary map as marked by human observers. It can be noted that the map essentially retains gross but important details in the image. It is hence sparse yet rich in information from the point of scene understanding.

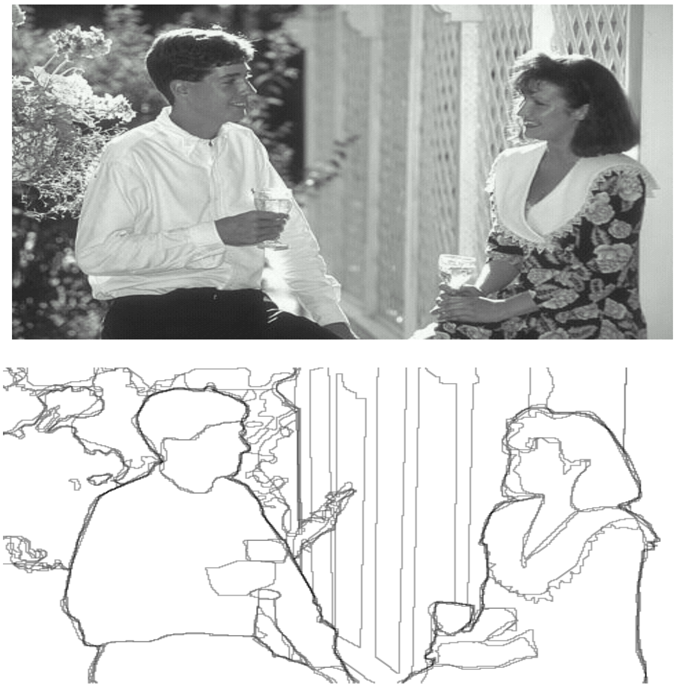

Figure 1.1 (a) Example image (b) Human-marked segment

boundaries. Image shows boundaries marked by 4-8 observers.

1.2 Boundary connection and region merging

After boundary detection, the closed contours are made by the connection of disjoint boundaries that will bring out the number of image regions.

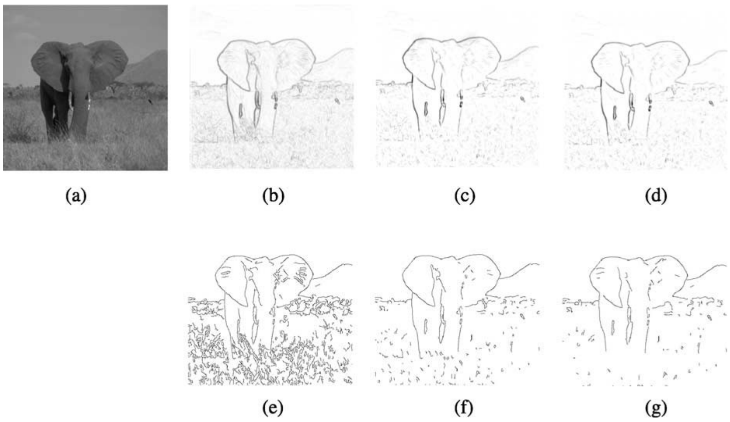

Fig 1. 2(a) Original input image (b) Gradient magnitude matrix (c) Anisotropic and (d) isotropic surround suppressed responses for a ¼ 1:0: (e) Binary map obtained from (b) by non-maxima suppression and hysteresis thresholding (p ¼ 0:1) as in Canny's algorithm. (f), (g) Binary maps extracted from (c) and (d), respectively,

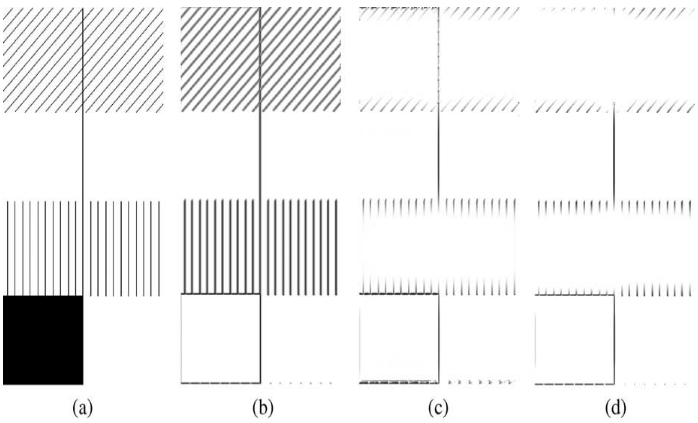

Fig. 1.3 (a) Synthetic input image. (b) The gradient magnitude operator detects all lines and edges independently of the context, i.e., the surroundings in which these lines and edges are embedded. (c) The gradient magnitude operator augmented with anisotropic surround suppression responds selectively to isolated lines and edges, to lines that are surrounded by a grating of a different orientation, and to region boundaries. Interior texture edges are suppressed. (d) The gradient magnitude operator with isotropic surround suppression responds selectively only to isolated lines and edges and also to (texture) region boundaries. Interior texture

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edges and lines embedded in texture of any orientation are suppressed.

1.3 Segmentation

This process simply partition an image into it's constituents parts or objects. The segmentation procedure brings the process a long way towards successful solution of imaging problems that require objects to be identified individually. The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics. The result of image segmentation is a set of segments that collectively cover the entire image, or a set of contours extracted from the image. Each of the pixels in a region is similar with respect to some characteristic or computed property, such as color, intensity, or texture.

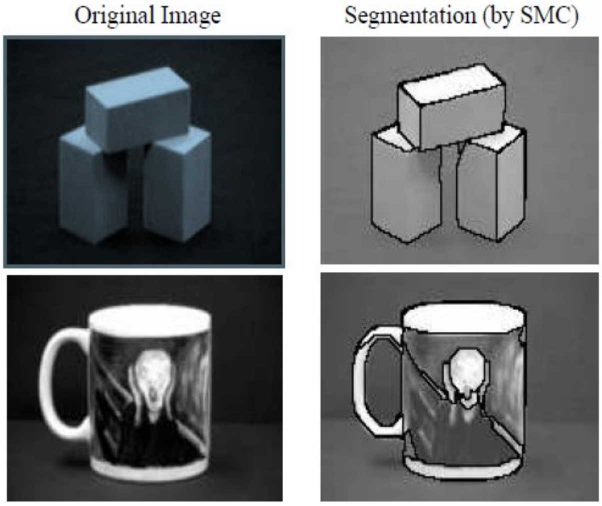


Figure1.4: Realization of Segmentation

2. Proposed Methodology

2.1 Segmentation methods

The number of possible edits is quite large. Well-known video editing programs such as Adobe Premiere or Ulead Media Studio provide more than 100 different and parameterized types of edits. In practice, however, 99% of all edits fall into one of the following three categories:

• Hard cuts • Fades • Dissolves

Four shot boundary detection algorithms will be investigated: the best and most balanced "older" algorithm based on color histogram differences, the recently proposed algorithm based on the edge change ratio, and two algorithms specialized on fades and dissolves exclusively. The matrix in Table 1 summarizes which type of edit is detected by what algorithm.

Feature \ Type of Edit	Hard Cuts	Fades	Dissolve
Color Histogram Differences	x		
Edge Change Ratio	x	x	x
Standard Deviation of Pixel Intensities		x	
Contrast			x

Table 1: Matrix showing which type of edit is detected by what algorithm

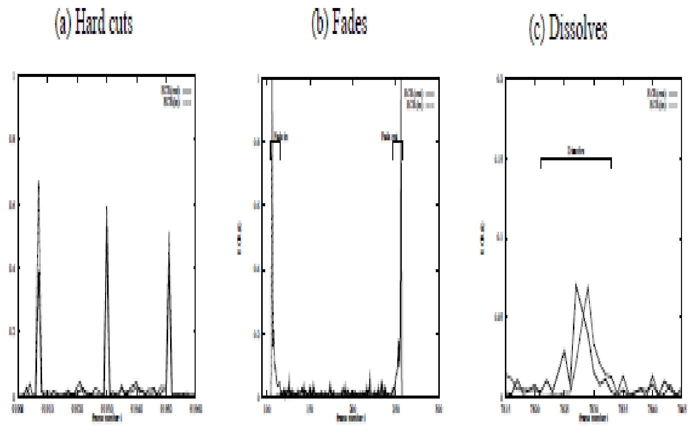


Fig .2.1 ECR patterns hard cuts, fades, dissolves

2.2 Computation model for circular boundary detection.

Real world images are processed in our visual system to produce boundaries. These images are characterized by colour, texture 1 and non-texture (only regular luminance/colour based) regions. Thus, boundaries can arise due to the adjacency of any of these regions in natural images. Some of these that can occur in grey scale images are shown in figure 2: luminance-luminance or LL boundary, texture-luminance or TL boundary, and texture-texture or TT boundary. Our goal is to classify objects based on their roundness using boundaries (a boundary tracing routine).

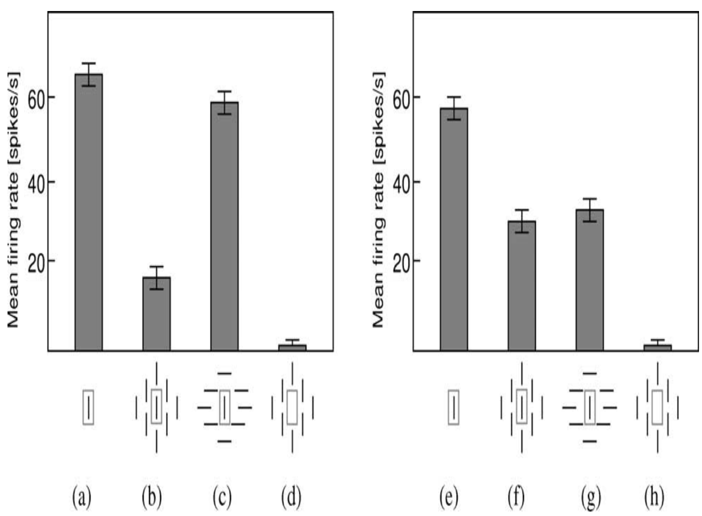


Fig.2.2.Responses of two visual neurons showing anisotropic (left) and isotropic (right) inhibitory behavior, respectively (redrawn from [44], courtesy of H.C.Nothdurft, J. Gallant, D.C. van Essen, and Cambridge University Press). (a),(e) Response to a single bar of optimal size and orientation inside the CRF, delineated by a dotted rectangle. (b),(f) Decreased response is recorded when texture consisting of identical bars with the same orientation is present in the area outside the CRF. (c) For one of the cells (left) the inhibitory effect is small when the orientation of the surrounding bars is orthogonal to that of the optimal stimulus in the CRF (anisotropic surround inhibition). (g) For the other neuron (right), the inhibitory effect does not depend on the relative difference in the orientation between the surrounding bars and optimal stimulus in the CRF (isotropic surround inhibition). (d), (h) In absence of the optimal stimulus, the response of both cells is reduced to the level of spontaneous activity.

The Computational Model may be shown as under:

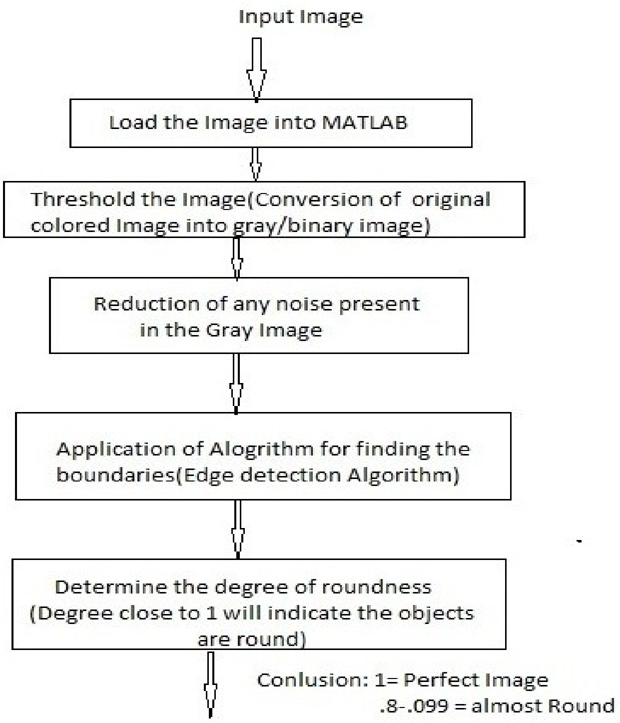
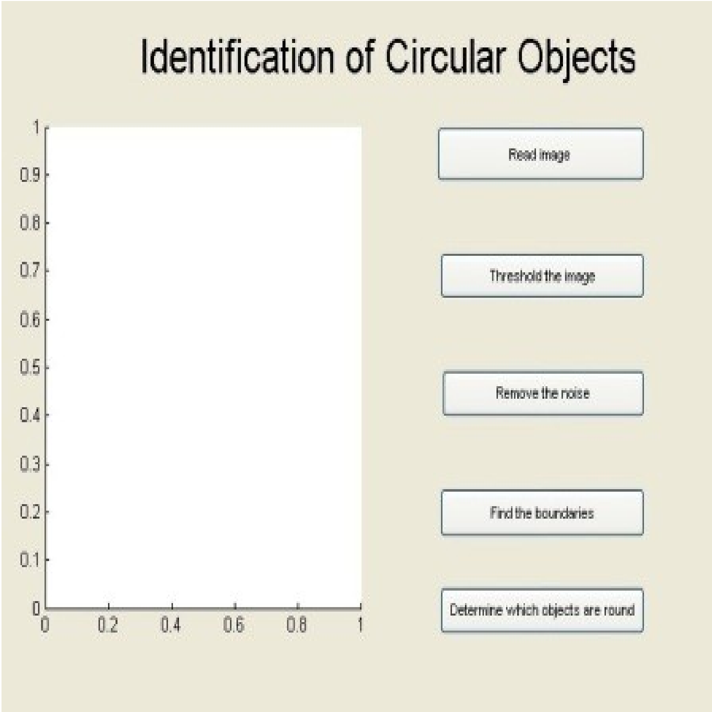


Figure2.3: Computational Model for the proposed scheme

All this has been done using MATLAB Environment. M- Files will be developed for different stages and will be executed in MATLAB and the results will be scrutinized.

GUI using GUIDE:



Sobel edge detection method is used for calculating the image output by calculating the gradient magnitude of each pixel

$$H_x = \begin{bmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{bmatrix}, H_y = \begin{bmatrix} -1 & -2 & -1 \\ 0 & 0 & 0 \\ 1 & 2 & 1 \end{bmatrix} \quad (1)$$

$$I_E(x,y) = \sqrt{I_x^{\,2}(x,y) + I_y^{\,2}(x,y)} \quad (2)$$

$$E_{(r,c)} = \sum_{(x,y)\in B} (IE_P == 1) \quad (3)$$

3. Results & Discussion

The loaded Input image to MATLAB Environment may be shown as:

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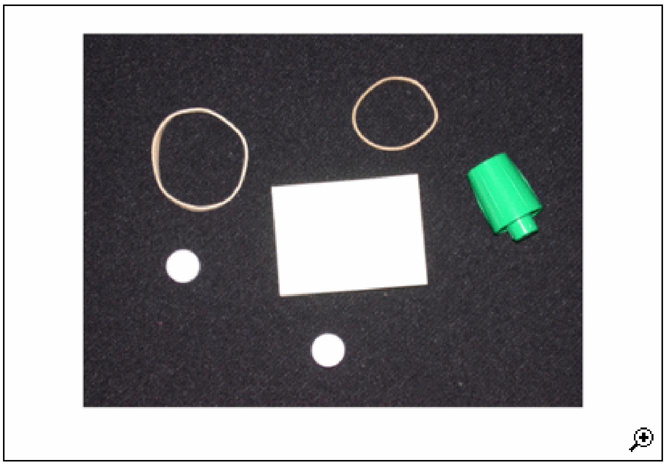
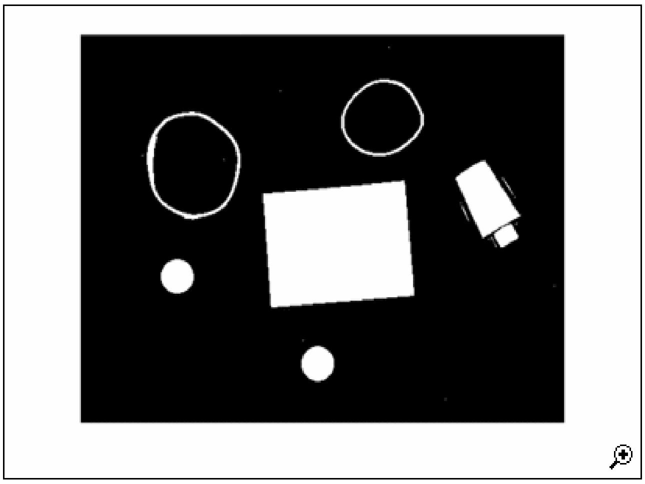
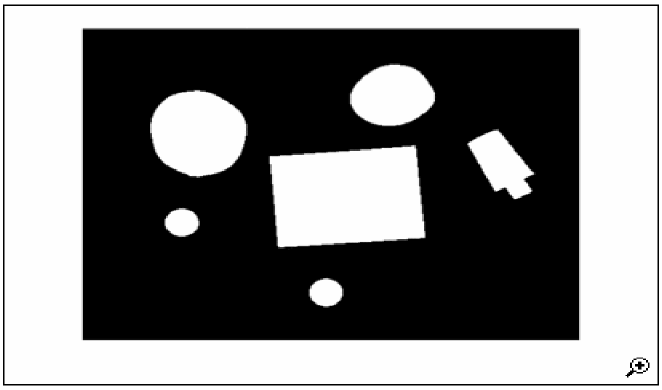


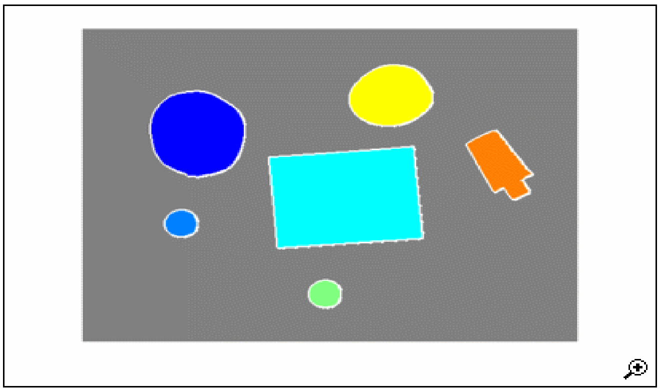
Threshold the Image: Convert the image to black and white in order to prepare for boundary tracing using b/w boundaries.



Noise Removing: Using morphology functions, remove pixels which do not belong to the objects of interest.



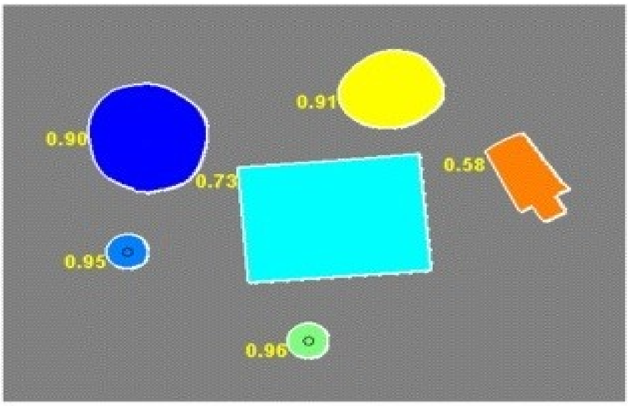
Find the Boundaries: Concentrate only on the exterior boundaries. Option 'no holes' will accelerate the processing by preventing b/w boundaries from searching for inner contours.



Determine which Object is Round: Estimate each object's area and perimeter. Use these results to form a simple metric indicating the roundness of an object:

Metric = 4*pi*area/perimeter^2.

This metric is equal to one only for a circle and it is less than one for any other shape. The discrimination process can be controlled by setting an appropriate threshold. In this example use a threshold of 0.94 so that only the pills will be classified as round.
Determine the degree of roundness (The degree close to 1 will indicate that the objects are round)



4. Conclusion

In this project, it is clear that the degree close to 1 will indicate that the objects are round. Thus semi circular and half circular objects can be found out by this algorithm for any input image. This algorithm can be used in the Development of an Artificial Intelligent system which will identify the objects according to its shape without prior knowledge or storage. Biomedical Application may be the detection of Tumor (May be circular of Rigid) in any part of body using MRI images or DICOM Images.

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