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Detecting Irregularities in the Shape of Coloured Bottle

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ABSTRACT

Digital image processing is used for various purposes like image enhancement, compression of images. Uncompressed image needs more storage capacity. So the images are compressed.

In this research paper we aim to detect the irregularities in the shape of bottle. This paper is to review and study of the different methods of object detection. It includes many methods for the shape recognition. This paper discuss the methods like Robert operator, Sobel Operator, Laplacian and Fourier Descriptor. As we have gone through many research papers it was of mostly detecting mangoes, flower, leaf, face, etc but none was for detecting bottle shape recognition. We also compared accuracy and limitations of these methods and from all the methods we found the best result for fourier descriptor for shape recognition.

Keywords: Robert, Sobel, Laplacian, Fourier

I. INTRODUCTION

Owing to the rapid development of digital and information technologies, people now live in a multimedia world. More and more multimedia information is generated and available in digital form. Currently, solutions exist that allow searching for textual information. Many text-based search engines are available on the World Wide Web, and they are among the most visited sites, indicating they foresee a real demand. Classifying information is, however, not possible for visual content, as no generally recognized description of this material exists. Multimedia databases on the market today allow very limited searching for pictures using characteristics like color, texture and information about the shape of objects in the picture.[12]

Solid object recognition and classification has been an area of interest with the increasing environmental and economic concerns. Our work mainly concentrates on identification of bottles and classifying the same into one of several categories, like glass, metal, polystyrene, and low density polyethylene.[7]

Aspects of image processing are that it is convenient to subdivide different image processing algorithms into broad subclasses. There are different algorithms for different tasks and problems, and often we would like to distinguish the nature of the task at hand.

- Image enhancement. This refers to processing an image so that the result is more suitable for a particular application. Example includes:
  - sharpening or de-blurring an out of focus image,
  - highlighting edges,
  - improving image contrast, or brightening an image,
  - removing noise.
- Image restoration. This may be considered as reversing the damage done to an image by a known cause, for example:
  - removing of blur caused by linear motion,
  - removal of optical distortions,
  - removing periodic interference.
- Image segmentation. This involves subdividing an image into constituent parts, or isolating certain aspects of an image:
  - finding lines, circles, or particular shapes in an image,
  - in an aerial photograph, identifying cars, trees, buildings, or roads.[13]

Pattern recognition is also a part of Image Processing. It is defined as the study of how machines can observe the environment, learn to distinguish various patterns of interest from its background, and make reasonable decisions about the categories of the patterns.[8]

Our new algorithm detects the shapes in the following cases when (i) There are distinct objects in the given image. (ii) The objects are touching in the given image. (iii) The objects are overlapping in the given image. (iv)One object is contained in the other in the given image. Then with the help of boundaries concentrate and shape properties, classification of the shapes is done.[9]

The effective recognition algorithm for shape recognition should be less complicated and more accurate. Curvature scale space (CSS), dynamic

programming, shape context, Fourier descriptor, and wavelet descriptor are the example of these approaches.[10]

Image processing is a method to convert an image into digital form and in order to get an enhanced image or to extract some useful information from it. Segmentation plays an important role before all the operations. Major operations are image enhancement and image compression. Image compression removes the waste of storage memory. The object is any colored bottle and a new methodology is applied to identify the bottle shape.

Purpose of Image processing:

- Visualization - Observe the objects that are not visible.
- Image sharpening and restoration - To create a better image.
- Image Recognition

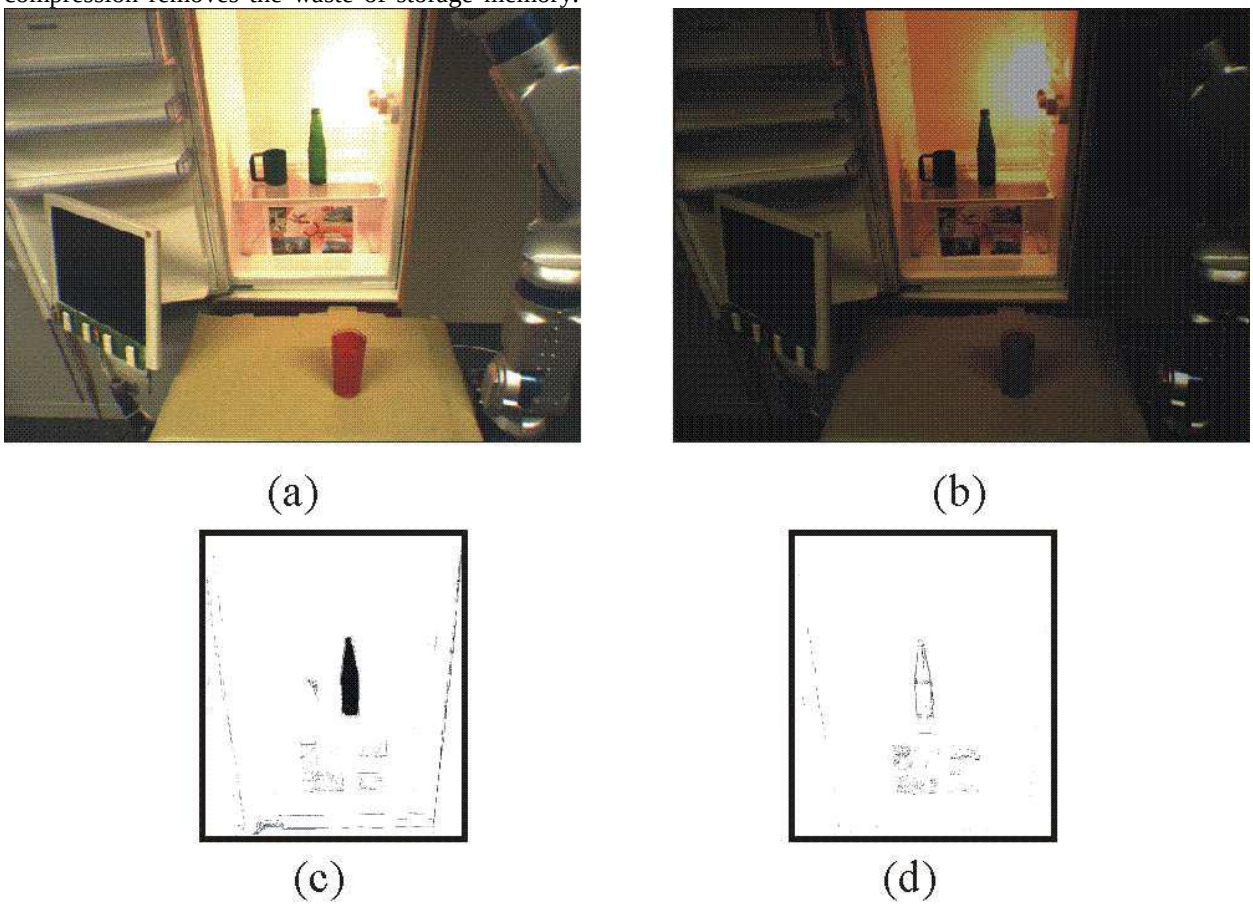


Figure.1.Segmentation of the green bottle object using a reference object thresholding interval. [6]

II. RELATEDWORK

2.1. LiteratureReview

- **2DGEOMETRIC SHAPE ANDCOLOR RECOGNITION USINGDIGITAL IMAGE PROCESSING** research paper has been described about two dimensional shapes of things such as square, circles, triangles and rectangles.[1]It also describes about the color of the thing. Object recognition has two ways:1) Comparing every pixel in the image to the pixels of a number of other images stored in the memory.2) Extracting information from the image, calculating certain metrics based on this information and comparing the values of the semetrics to predetermined values.
- First method takes more memory and time consuming. (E. g. fingerprint, recognition) second method is not time consuming and take less memory. This algorithmis 99% successful on databases images. [2]This algorithmis simple and effective method of recognition of shape.

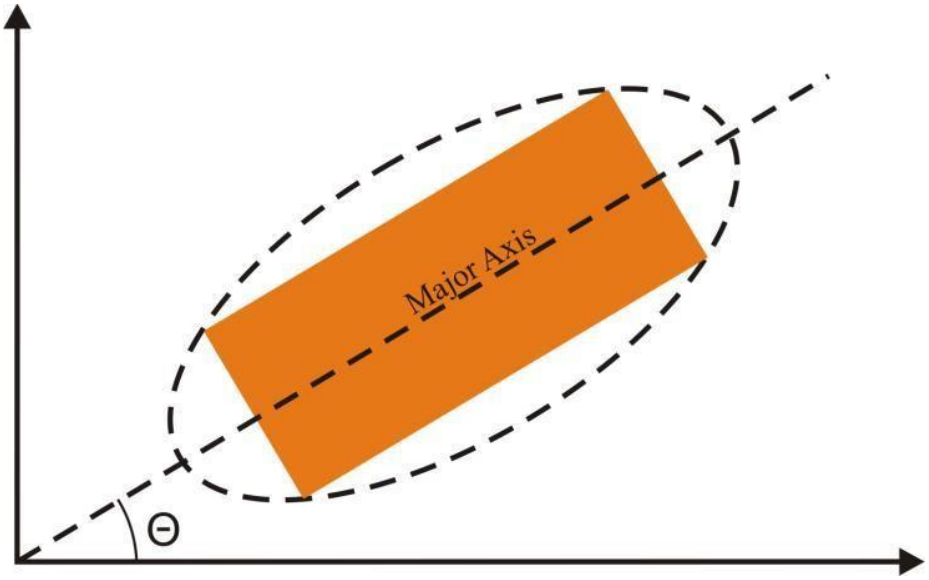


Figure-2.Measurement of inclination of objectwith respect to X-axis. [1]

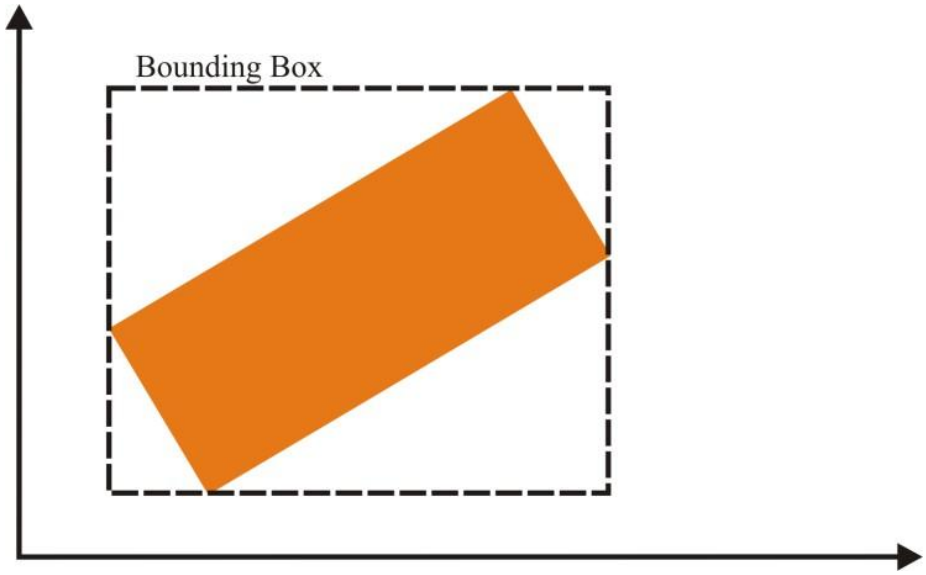
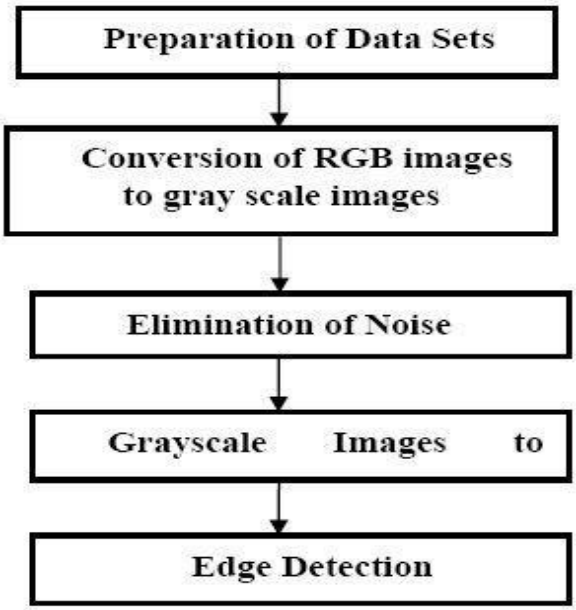


Figure-3.Boundingboxof given object.[2]

- **SHAPE MATCHING AND SHAPE RECOGNITION USINGSHAPE CONTEXT:** Research paper, Solve the correspondence problem between the two shapes. Use the correspondences to estimate analigning transform. Compute the distance between the two shapes as a sum of matching errors between corresponding points, together with a term measuring the magnitude of the aligning transformation.
- Sobel operator is applied to the binary image to recognize the edge of that image before thinning the edges. The feature extraction process is then conducted by using the chain code technique. Digital image processing is the use of the algorithms and procedures for operations such as image enhancement, image compression, image analysis, mapping, geo-referencing, etc. The **Sobeloperator** is use dinimage processing, particularly within edge detection algorithms. The Sobel operator is based on convolving the image with a small, separable, and integer valued filter in horizontal and vertical direction and is the reforerelatively in expensive interms of computations. [2]



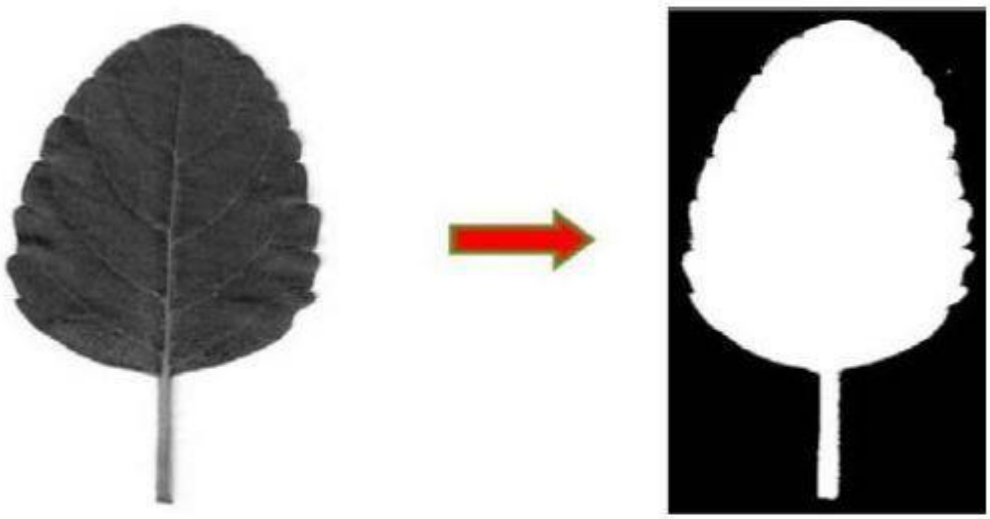


Figure-4..Conversion Gray scaleImages to Binary [2]

Figure-5.Sprite Bottle

Figure-6.Crushed Sprite Bottle

III. MethodsandAlgorithms

3.1. Methods

During Our literature review we study the basic method for the Shape Recognition, all that methodologies are describe bellow:

3.1.1. Robert Operator:

The Robert operator is used in image processing for edge detection. It was one of the first edge detectors and was initially proposed by Lawrence Roberts in 1963. The Robert operator is to approximate the gradient of an image through discrete differentiation which is achieved by

computing the sum of the squares of the differences between diagonally adjacent pixels.
It should have the following properties: the produced edges should be well-defined, the background should contribute as little noise as possible, and the intensity of edges should correspond as close as possible to what a human would perceive.[14]

3.1.2. Sobel Operator:

The Sobel Operator is used in image processing for edge detection and creates an image which emphasizes edges and transitions. It is named after Irwin Sobel in 1968. Technically, it is a discrete differentiation operator, computing an approximation of the gradient of the image intensity function. The Sobel operator is based on convolving the image with a small, separable, and integer valued filter in horizontal and vertical direction and is therefore relatively inexpensive in terms of computations.[14]

3.1.3.Laplacian Operator:

Laplacian Operator is also a derivative operator which is used to find edges in an image. The Laplacian operator is very sensitive to noise. This operation in result produces such images which have grayish edge lines and other discontinuities on a dark background. This produces inward and outward edges in an image. The operator normally takes a single gray level image as input and produces another gray level image as output.[15]

3.1.4. Fourier Descriptor:

A method used in object recognition and image processing to represent the boundary shape of a segment in an image. It is the best method for the shape recognition.

3.2. MethodComparison

All these methods have some feature and limitation which is defineinthe following table:

Table 1: Method Comparison of Shape Recognition

Method Name	**Advantages**	**Disadvantages**
Robert Operator	**1.**Work best with binary images. **2.** It is very quick to compute. **3.** Only four input pixels need to be examined to determine the value of each output pixel, and only subtractions and additions are used in the calculation.	**1.**High sensitivity to noise **2.**Few pixels are used to approximate the gradient
Sobel Operator	**1.**It lies in its simplicity. **2**.Compare to Robert, it is less sensitive to noise. **3**.It can detect edges and their orientations.	**1.**The magnitude of the edges will degrade as the level of noise present in image increases. **2**.The Sobel method cannot produce accurate edge detection with thin and smooth edge.
Laplacian Operator	**1**.Remove blur from images. **2.**Highlight edges.	**1.**Edges form numerous loops(Spaghetti effect). **2.**Complex computation.
Fourier Descriptor	**1.**It overcomes thenoise sensitivity in the shape signature representations. **2.**Easy normalization and information preserving. **3**.Best result then any other methods.	**1.**No redundant information is present in the set {Ak, (Xk}. Therefore, every sequence {Ak, ak, k = 1, 2, . } describes one curve and each curve has only one sequence .

Shape description technique	Commodity	Shape attribute analyzed	Classification accuracy (%); no. classes	Classification technique	On-line throughput	References
Combination of size features	Bell pepper (*Tosa-Hikari D*)	Sharpness, thinness, curvature	95.7; 2	ANN (5-x-2)[a]	vna[b]	Okayama et al. (2006)
Combination of size features (eccentricity)	Grapefruit	'Sheepnosing' (stem-end taper)	96.2; 2 93.8; 2 92.5; 2	Non-parametric Bayesian[c] Recurrent propagation ANN Bayesian	Off-line	Miller (1992)
Combination of size features (eccentricity)	Peach (*CalRed, Summerset, Fairtime*)	Ratio of maximum to minimum dimension	88.3; 2	Simple thresholding	Off-line[d]	Singh and Delwiche (1994)
Combination of size features[k]	Strawberry (*Akihime*)	Conicity	98.6; 3	Simple thresholding	8 cm/s; 1.2 s/fruit	Bato et al. (2000)
Shape signature	Sweet tamarind (*Sitong, Srichompoo*)	Curvature	96.0; 3	Simple thresholding	2 s/fruit	Jarimopas and Jaisin (2008)
Curvature of differential chain coded boundary (8-neighbor)[e]	Carrot	Tip shape (sharp>blunt)	86.0; 5	Bayesian	Off-line	Howarth et al. (1992)
Curvature of chain coded boundary (8-neighbor)	Tomato (*Pik Red*)	Not specified	97.9; 2	Simple thresholding	Off-line	Sarkar and Wolfe (1985)
FDs (33)	Apple (*Fuji*)	Conicity, elongation	78.3; 4	Decision tree	Off-line	Xiaobo et al. (2008)
FDs (6)	Apple (*Golden Delicious*)	Conicity, elongation, cross section circularity	96.0; 3	QDA	Off-line	Leemans et al. (1997)
FDs	Hazelnut (*Tonda di Giffoni, Tonda Romana, Mortarella, San Giovanni*)	Discrimination between 2 round cultivars and between 2 oblong cultivars	96.3; 2[f]	PLSDA	Off-line	Menesatti et al. (2008)
FDs (16)	Pear (*Huanghua*)	Sphericity[g]	90.0; 4	ANN (16-22-4)	Off-line	Ying et al. (2003)
FDs (9)[h]	Potato (*Monona, Le Chipper*)	Curvature, conicity	73.3; 2 68.1; 2	ANN (9-7-2) Fisher LDA	Off-line	Deck et al. (1995)
FDs (10)	Potato	Curvature, elongation, conicity, etc.	89.2; 4	Simple thresholding applied on heuristic separator S[i]		Tao et al. (1995)
FDs (30)	Potato (6 cultivars)	Curvature, elongation, conicity, etc.	100.0; 2	LDA	10 fruits/(s-lane)	Noordam et al. (2000)
FDs (6)	Starfruit	Number of ridges	100.0; 3	Simple thresholding	Off-line	Abdullah et al. (2006)
FDs (10) + combination of size features (compactness, symmetry, etc.)	Mandarin segments	Wholeness of segments	92.3[j]; 3	Non-linear DA	50 segments/s	Blasco et al. (2009)
WDs	Citrus		89.8; 3	ANN (7-4-3)	Off-line	Gui et al. (2005)
WDs	Papaya	Curvature	98.0; 2	LDA	Off-line	Riyadi et al. (2008)
Medial axis + "paired gradients "	Bell pepper	Asymmetry and abnormal concavities	88.6; 2	LDA	Off-line	Wolfe and Swaminathan (1987)
Geometric moments (3rd order)	Apple (*Golden Delicious*)	Asymmetry	92.3; 2	Simple thresholding	Off-line	Heinemann et al. (1995)
Geometric moments (2nd order)	Mushroom (Common white *Agaricus bisporus*)	Roundness	78.0; 2	Simple thresholding	Off-line	Heinemann et al. (1994)
Zernike moments	Apple		88.3[k]; 3	SVM	Off-line	Gui and Zhou (2010)
Dense matching (level Set)	Apple (*Jonagold*)	Not specified	87.9; 3	Motion estimation	Off-line	Gui et al. (2009)
Gradient search	Bell pepper		75.0; 2 75.0; 2	Z distribution tail comparisons *k*-NN	Off-line	Shearer et al. (1989)

Figure-7.Comparision of methods

IV. CONCLUSION

This research paper includes summary review of literature studies related to detecting irregularities in the shape of coloured bottle. It is not possible to consider a single method for all type of images, norc an all method sperform well for aparticular type of image. Hence, we concluded to further detect shape using four ier-descripto rsolution consists of multiple methods for threshold problem.

- Object behind objectis not detected. Problem occurs during identification of object when any obstacles come before the object. If the position of camera is not proper and object in image is not captured properly then it cannot be identified. Result accuracy depends upon environment, so if there is bad-light problem noise is increased so object cannot be clearly visible.

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