SHAPE BASED EDGE DETECTION USING FUZZY C-MEANS CLUSTERING ALGORITHM

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Abstract— **The working principle of shape is a common task in the field of image processing. Edge detection is one of the most commonly used operations in image analysis based on shape. An edge is the boundary between an object and the background in the image, and indicates the boundary between overlapping objects. This paper presents a Sobel edge detection to extract shape feature from the given image. Histogram equalization is also implemented for the given images. The proposed method has been implemented with Fuzzy C-Means Clustering Algorithm which provides better performance. Total median value is calculated for both given image and edge detection images.**

Keywords— **Sobel edge detection, Fuzzy C-Means Clustering algorithm, Histogram Equalization.**

I. INTRODUCTION

An edge is a position where there is a rapid significant change in the brightness of an image. Shape representation and description is a not an easy task. This is because when a 3-D object is projected against 2-D image plane, the object information of 1- Dimensional is lost. So the shapes extracted from the image will moderately represents the projected object [3].There are many shape representation and explanation techniques in the literature. Marr and Nishihara and Braddy have systematically discussed about shape representation and evaluation of shape. The information about shape is extracted using histogram of edge detected image. The information about edge in the image is obtained by using the Sobel edge detection and median is calculated. We have many different techniques available for edge detection technique.

In this Histogram equalization technique is used. Histogram method typically increases contrast of many images. Histogram equalization provides accurate frequent intensity values. To apply this Sobel edge detection and Histogram, we have to convert our image to a Grey scale image. Still the color values of the image are lost but that makes our edge detection more resourceful. Fuzzy C-means clustering algorithm is implemented for edge detected image and the result is obtained. And finally Median is calculated for both edge detected image and the original image. The Median values are calculated for both original image and edge detected image and compared with each image.

II. METHODOLOGY

Shape is the most imperative for recognizing the objects. There are various types of edge detection methods based on shape.In this proposed method; we have to convert original image into Gray scale image.

III. SHAPE FEATURE EXTRACTION

Generally, in digital images the original image is changed into gray level image. In this shape is used as feature, edge detection will be the first process to extract that feature. In this paper, the sobel edge detector is used to determine the edge of the object. After the edge has been detected the important step is Histogram Equalization is implemented.

A. Sobel Edge Detection

The Sobel edge detector is a gradient oriented method and it deals with first order derivatives and calculates the first derivatives of the image separately for the X and Y axes [1].

The derivatives are not accurate due to image discontinuous. To approximate those, the following kernels are used for convolution.

-1	0	1
-2	0	2
1	0	1

Horizontal

-1	-2	-1
0	0	0
-1	-2	-1

Vertical

IV. HISTOGRAM EQUALIZATION

It is a technique to increase the contrast in an image, to stretch the intensity variety. Histogram modeling methods provide a difficult method for contrast of an image by changing that image so that its intensity histogram has a preferred shape. Diverse contrast stretching, histogram operators might utilize non-linear and non-monotonic transmit functions to plot map between pixel intensity values in the original image and output images [7]. Histogram equalization employs monotonic, non-linear mapping transmits functions

which re-assigns the intensity values of pixels in the original image, such that the output image contains a uniform distribution of intensities.

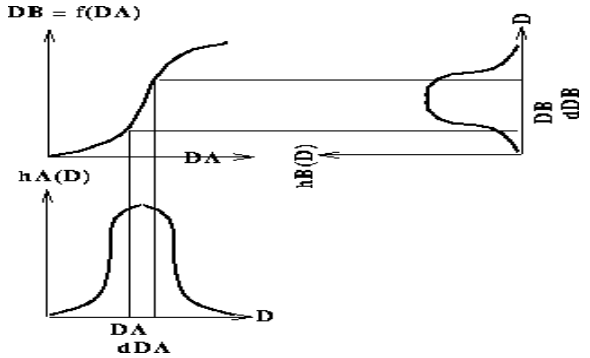


Fig.1 Histogram Transformation functions.

Histogram technique is based on continuous functions. If the image has a continuous intensity and the transformation function *f* which plots an original image A (x, y) on output image B(x, y) is based on continuous interval level. Finally it will implicit a single-valued and monotonically rising makes us to define the inverse law $D_A=f^{-1}(D_B)$.Pixel in the original image with densities in the region is D_A to D_A+dD_A which assume an output pixel density value from the range D_B to D_B+dD_B. The surface areas $h_A(D_A)dD_A$ and $h_B(D_B)\,dD_B$ will be equal to

$$h_B(D_B) = h_A(D_A) \div d(D_A)$$

$$d(x)=df(x)/dx$$

If h is considered as a continuous probability density function *p* relating the distribution of the intensity levels:

$$p_B(D_B) = p_A(D_A) \div d(D_A)$$

In histogram equalization, the output probability densities of intensity levels in the original image is D_M.The transmit function for this result is:

$$d(D_A) = D_M * p_A(D_A)$$

$$f(D_A)=D_M\int_0^{DA} p_A(u)du=D_M*F_A(D_A)$$

$F_A(D_A)$ is the cumulative probability distribution of the original image.

The transmit function is

$$f(D_A)=\max(0,\text{round}[D_M*n_k/N^2)]-1)$$

N = number of image pixels
n_k= pixels at intensity level.

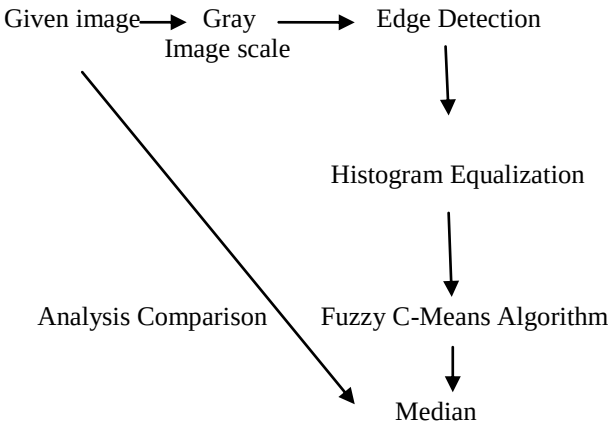


Fig. 2 Proposed Systems

V.FUZZY C-MEANS CLUSTERING

Fuzzy C-Means (FCM) is a method of clustering which allows one part of data to belong more than one cluster. It is based on minimization of the following purpose function:

$$J_m= \sum_{i=1}^{N}\sum_{j=1}^{C} u_{ij} \left\|x_i-c_j\right\|^2,$$

$$1\le m<\infty$$

m = real number greater than 1

u_{ij} = degree of membership of x_i in the cluster *j*,

x_i = *i*th of d-dimensional measured data,

c_j = d-dimension center of the cluster,

||*|| = similarity between measured data and the center.

In this study, the number of cluster is n, and the number of data set is 2 and *h* respectively. In each step of the iteration, the cluster centers point and the membership points are reorganized to find the best location for the clusters the objective function is minimized. The process stops when the maximum number of iterations is obtained, or when the objective function increase between two consecutive iterations is less than the minimum amount of increase specified.

VI. IMAGE QUALITY MEASURE

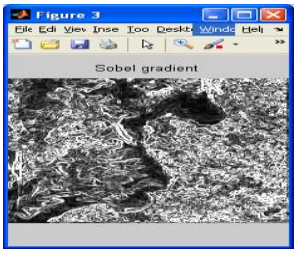
For the original image total median is calculated. In this we have to find the median of a probability distribution **[12]**. These can be calculated using Mat lab. We have to define limits of integration. Because we cannot sum from positive to negative infinity, we have to select values that are large compared to the mean of the function.

VII. RESULTS

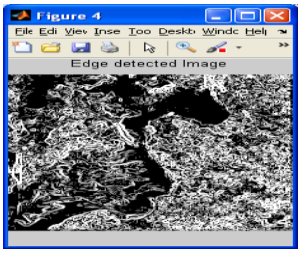
The figure.3 shows the experimental results of the proposed work .The total Median for the image is 75 and the test image is taken as Input image and the proposed work is shown in below images

(A) INPUT IMAGE

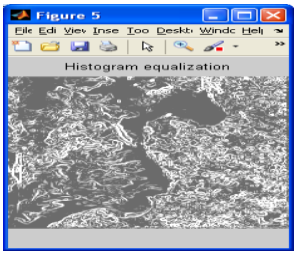
(B) GRAY SCALE IMAGE



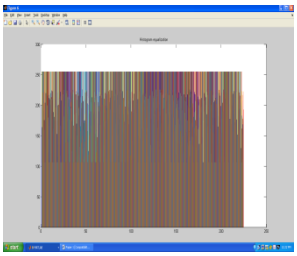
(C) SOBEL GRADIENT



(D) SOBEL EDGE DETECTION



(E) OUTPUT IMAGE



(F) HISTOGRAM

VIII. CONCLUSION

An edge is a position where there is a change in the brightness of an image. In this paper the original image is converted to Gray scale image. Sobel edge detection method is used for better edge detection which gives better result.

Histogram Equalization is also used to increase the contrast of an image in order to stretch the intensity variety. In the Proposed method Fuzzy C-Means clustering Algorithm has been used to cluster the gray scale image. Median values are also calculated. The approach described here is simple and effective for shape based edge detection method.

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