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An Optimal Approach to Edge Detection Using Fuzzy Rule and Sobel Method

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ABSTRACT: Edge detection is one of the most fundamental operations in image processing and computer vision. It is defined as the process of locating the boundaries of objects or textures delineate in an image. It is because of the fact that, detection of edges simplifies the analysis of images by notably reducing the amount of data to be processed by filtering undesirable information, meantime preserving the vital structural information of an image. Sobel Edge Detection is commonly used in edge detection. In the edge function, the Sobel method uses the derivative approximation to discovery edges. But when the image has lots of white Gaussian noises, it is very unintelligible to get the peak value of the first derivative; the reason is so far as that the noise points and the useful signals mix up. The Sobel operator is simple, but its accuracy suffers in noisy conditions. This research paper endows the fuzzy filter based Sobel Edge Detection technique. This technique depends on fuzzy rule based system using 2X 2 window mask which comprises many fuzzy rules which are used to ameliorate the membership value of the image in three fuzzy sets, black, white or edge and this filtered image is given as input to Sobel Edge Detection technique. This perspective gives improved results than traditional Sobel Edge Detection technique based on smoothing effect of the unsystematic noisy images. An optimal edge-detection algorithm is necessary to provide an errorless solution that is adaptable to the different noise levels of these images to help in identifying the valid image contents produced by noise.

KEYWORDS: Fuzzy Rules, Edge Detection, Sobel Method, Fuzzy Logic, Gaussian Noises, Fuzzy Membership Functions.

I. INTRODUCTION

An edge corresponds to local intensity discontinuities of an image. In the real world, the discontinuities reflect an intense intensity change, such as the boundary between different regions, shadow boundaries, and abrupt changes in surface orientation and material properties. For example, the edges represent the outline of a shape, the difference between the colors and pattern or texture. Eventually, edges can be used for boundary estimation and segmentation in scene understanding. They can also be used to find corresponding points in multiple images of the same scene. Edge detection is an advantageous task to extract clear edges of digital images in computer vision. Edge detection is required for an object recognition, feature detection, and image segmentation. The problem is that in general edge detectors behave very peaky [1]. As long as their behavior may fall within permissiveness in specific situations, normally edge detectors have obstacle adapting to different situations. The quality of edge detection is highly dependent on lighting conditions, the existence of objects of similar intensities, density of edges in the scene, and noise [2]. The crucial problem with edge detection is when noise is existent in images. It is not sufficient to simply reduce the noise, because the image will be either distorted or blurred. So far as different edge detectors work preferable under different conditions, it would be ideal to have an algorithm that makes use of multiple edge detectors, applying each one when the scene conditions are most best possible for its method of detection. An edge in an image occurs when the gradient is greatest. The operator works by recognizing these large gradients to find the edges. There is a huge amount of operators designed to detect certain types of edges. The operators can be configured to search for vertical, horizontal, or diagonal edges.

The edge detection has been used by object recognition, target tracking, segmentation, etc. Hereupon, the edge detection is one of the most vital parts of image processing. There mainly exist many edge detection methods: Sobel, Prewitt, Roberts and Canny [3]. In this paper Sobel, which is an edge detection method is considered. Sobel is most commonly used technique due to it is preferable result compare to other traditional techniques. The fuzzy set that is

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characterized by membership function which assigns membership value between 0 and 1to each object. The approach of three level thresholding by using [4] fuzzy partitions to find the best edge of an image. They derived the conditions to maximize the entropy function due to which we get clear edges
[5]. At the identical time the corners get sharper and can be defined effortlessly are various developed fuzzy edge detection techniques. Fuzzy logic is a form of knowledge representation suitable for notions that cannot be defined precisely, [6] on their contexts. Fuzzy logic helps to highlight edges of an image. In this paper 2*2 pixel window is a scanned and fuzzy inference based system is developed for detecting edges. The rule base of 16 rules has been applied to mark the pixel as white, black or edge. The logic of fuzzy filter is used in the Sobel edge detection [2].

II. THE LITERATURE REVIEW

The edge detection is one of the most vital tasks in pattern recognition and image processing. It plays an important role in the multimedia and computer vision, Image discerns, Image enhancement and image compression, [7] etc. It is normally the first operation that is performed before tasks such as boundary detection, segmentation, classification, registration, understanding and recognition in image processing circumference [8]. The new edge detection method that gives better edge detection accuracy than 4-connected, 8- connected and Sobel techniques. It is based upon simple arithmetic and logic operations, consisting of three procedures: image binarization image contraction and image subtraction [9]. The algorithm works for automatic visual inspection. It makes use of no threshold. It can be used for both binary and grayscale images. According to this method, the grayscale images are first converted into binary images. This procedure can be eliminated for a binary image. Then, the image is contracted to get the contents of the inspected region. The contents are subtracted from the inspected region to produce the boundary [10].

The Wafa barkhoda, proposed a new fuzzy based edge detection algorithm which used two different methods, gradient and standard deviation of pixel values, which form two set of edges which are considered as inputs for fuzzy system and then based on fuzzy logic, the final decision is made by the fuzzy system about whether each pixel is edge or non edge according to 5 fuzzy rules and fuzzy membership functions [11]. This method showed the highest performance and quality of the extracted edges when compared to the other edge detection methods like Sobel, Robert, and Prewitt. The S Abid et al. proposed a unusual neural network approach for edge detection. This algorithm used Multilayer Perceptron (MLP) to detect edges in noisy & low [12] contrast grayscale images. Simulated results on synthetic and real images showed promising results in terms of precision & localization. The Fesharaki and Hellestrand apply, a student –t test to compare the distribution functions of the intensities in the neighborhood of a given pixel and the pixel can be accurately classified as edge pixel or region pixel. Using a 5x5 window, the method works well for both synthetic and natural images [13].

The next system which combines Sobel edge detection operator and soft-threshold wavelet de-noising for edge detection. This system used on images which include White Gaussian noises. The widely used operators such as Sobel, Prewitt, Roberts and Laplacain are sensitive to noise and their anti-noise performances are substandard [14]. This paper proposes an edge detection method which combines soft-threshold wavelet denoising and Sobel operator, its anti-noise performance is very strong. Firstly soft-threshold wavelet used to remove noise, then Sobel edge detection used for edge detection on the image. The effect by using this method to do edge detection is very benign and can remove the noise effect. Again Jesal Vasavada et.al proposed an edge detection method for grayscale images based on BP Feed-forward Neural Network to detect edges in grayscale images. The network is trained by back-propagation learning algorithm for Standard deviation and gradient values [15].

Afterwards ant colony optimization based edge detection approach. Ant colony optimization (ACO) is an optimization algorithm based on real ants' behavior and inspired by the natural behavior of ant species. In actual life, ants deposit pheromone on the ground in order to mark the path they used that should be followed by other members of the colony [16]. The proposed algorithm initiates a pheromone matrix, which represents the edge information at each pixel position of the image. For this number of ants are dispatched to move on the image driven by the local variation of the image rapidity values. The Qixiang Ye et al. Have introduced to find main edges meanwhile filter edges within texture regions [17]. They have computed pixels similarity degree around a pixel, have computed a new gradient, and applied a Canny like operator to detect and locate edges. This method also gives very transcendent results. The aragea detects the dissimilarity between pairs of pixel around a pixel and uses the highest value from the difference of four pairs of pixels that can be used to form a line through the middle pixel [18]. The HamedMehrara proposed a novel edge detection using Back Propagation Neural Network (BPNN). In this technique, the neural network is trained by using 16 possible quad pixels, binary images and then implemented on Input Gray scale images after single-level binarization [19]. Finally, the rital presents a two stage paradigm of edge detection. The Image is represented in Image Adaptive Neighborhood Hypergraph model. Local information of the given image is exploited. The hyper-edges of the image are classified as noise, edge or region based on combinatorial definitions. The researchers think about that local homogeneity characterizes edges, global homogeneity characterizes regions and under no circumstances homogeneity characterizes noise [20].

III. THE CRITERIA AND DIFFICULTY OF EDGE DETECTION

The quality of edge detection can be measured from various criteria impartially. The certain criteria are proposed in terms of mathematical measurement, certain of them are based on application and implementation requirements.The criteria of edge detection will help to evaluate the carrying out of edge detector techniques [21].

1. Surpassing detection: There should be a minimum number of false edges or maximum Signal Noise Ratio (SNR). Ordinarily, edges are detected after a threshold operation. The high threshold will lead to less false edges, but it also reduces the number of true edges detected.

2. Noise sensitivity: The robust algorithm can detect edges in certain acceptable noise environments. In fact edge detector detects the edges and also amplifies the noise simultaneously. Strategic filtering , consistency checking and post processing can be used to reduce noise sensitivity [21].

3. Surpassing localization: The edge location must be reported as close as possible to the correct position, i.e. edge localization accuracy.

4. Orientation sensitivity: The operator not only detects the edge magnitude, however, it also detects edge orientation correctly. The orientation can be used in post processing to connect edge segments, reject noise and suppress non-maximum edge magnitude.

5. Speed and competency: The algorithm should be fast enough to be used in an image processing system. An algorithm that allows recursive implementation or separable processing can greatly improve competency [21].

The edge detection is a difficult contention. The application images contain object boundaries and object shadows and noise. The second cause of problems is degradation in image acquisition. Infrequently it may be difficult to distinguish the exact edge from noise or trivial geometric features. The fingerprint found at a crime scene might be smeared, so that the tracks of the fingerprint may be connected or broken. Two level edge detection processes are often used since the difficulty of edge estimation cannot be effortlessly prevail over from detection operators alone. The first level process, called low-level process, extracts pieces of raw edge segments and geometric features, called primitives [22]. They may be incomplete and erroneous. The second level process typically is called high-level process. It will interpret and combine raw edges based on the edge models or deduction rules from a broader image context and a knowledge database. Besides pattern matching and statistical analysis will occur at this level. The second level process tries to stripping the uncertainty or make correct decisions using low level inputs and context. The more appropriate the low-level input is, the more accurate the high-level process result will be achieved. To measure the quality of low-level process, various criteria are proposed to help to improve the precision of edge detection.

IV. THE SOBEL EDGE DETECTION METHOD

Edge detection is the process of localizing pixel intensity transitions. The edge detection has been used by object recognition, target tracking, segmentation, etc. Therefore, the edge detection is one of the most important parts of image processing [23].

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The Sobel operators, for a 3*3 neighborhood, each simple central gradient rough calculation is the vector sum of a pair of orthogonal vectors. Every orthogonal vector is a directional derivative rough calculation multiplied by a unit vector specifying the derivative's direction. The vector sum of these simple gradients [24] estimates amounts to a vector sum of the 8 directional derivative vectors. Thus, for a point on Cartesian grid and its eight neighbors having density values as shown:

a	b	c
d	e	f
g	h	i

The directional derivative rough calculation vector G was defined such as density difference distance to neighbor. This vector is determined such that the direction of G will be given by the unit vector to the estimated neighbor. The pay attention the neighbors group into antipodal pairs: (a,i), (b,h), (c,g), (f,d). The vector sum of this gradient estimate is

$$G = \frac{(c-g)}{R} \cdot \frac{[1,1]}{R} + \frac{(a-i)}{R} \cdot \frac{[-1,1]}{R} + (b-h) \cdot [0,1] + (f-d) \cdot [1,0]$$

Where, R = √2 , This vector is procured as

$$G = [(c-g-a+i)/2 + f - d,\ (c-g+a-i)/2 + b - h]$$

Here, this vector is multiplied by 2 because of replacing the divide by 2.

$$G' = 2.G = [(c-g-a+i) + 2.(f-d),\ (c-g+a-i) + 2.(b-h)]$$

The following weighting functions for x and y components were acquired by using the above vector.

1	0	1
-2	0	2
-1	0	1

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

Now, we explain that the dimension of the matrices is extended by using [24]. The definition of the gradient can be used for 5×5 neighborhood. In this case, twelve directional gradient must be determined instead of four gradients. The following figure 5×5 neighborhood.

a	b	c	d	e
f	g	h	i	j
k	l	m	n	o
p	r	s	t	u
v	w	x	y	z

The resultant vector G' for 5×5 is given as

$$\begin{aligned} G' = [&20(n-l) + 10(i-r-g+t+o-k) + 5(e-v-a+z) + 4(d-w-b+y) \\ &+ 8(j-p-f+u), 20(h-s) + 10(i-r+g-t) + 5\cdot(e-v+a-z) \\ &+ 4(j-p+f-u) + 8(d-w+b-y)] \end{aligned}$$

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The horizontal and vertical masks are obtained by using the coefficients in this equation such as

-5	-4	0	4	5
-8	-10	0	10	8
-10	-20	0	20	10
-8	-10	0	10	8
-5	-4	0	4	5

5	8	10	8	5
4	10	20	10	4
0	0	0	0	0
-4	-10	-20	-10	-4
-5	-8	-10	-8	-5

Every direction of Sobel masks is applied to an image, then two new images are created. One image shows the vertical response and the other shows the horizontal response. Two images combined into a single image. The final cause is to determine the existence and location of edges in a picture [25]. This two image combination is explained that the square of creating masks pixel estimate coincidence, each other as coordinate are summed. Thus a new image on which edge pixels are located procured the value which is the squared of the above summation. The value of threshold in this above process is used to detect edge pixels.

Pseudo Codes For Sobel Edge Detection

Input: Any Sample Image.
Output: Detected Edges.
Step 1: Concede the input image.
Step 2: Apply mask Gx,Gy to the input image.
Step 3: Apply Sobel edge detection algorithm and the gradient.
Step 4: Masks manipulation of Gx,Gy aside on the input image.
Step 5: Outcome combined to find the accomplished magnitude of the gradient.
Step 6: The accomplished magnitude is the output edges.

V. THE FUZZY SETS AND FUZZY MEMBERSHIP FUNCTION

The fuzzy logic was initiated in 1965 [26] by Lotfi A. Zadeh, professor of computer science at the University of California in Berkeley. Basically, Fuzzy Logic is a multivalued logic, that allows intermediate values [27] to be defined between conventional evaluations like true/false, yes/no, high/low, etc. [28]. Notions like rather tall or very intense can be formulated mathematically and processed by computers, consecutively to apply a more human-like way of thinking in the programming of computers. Fuzzy systems are a substitute to traditional notions of set membership and logic that has its origins in ancient Greek philosophy. The precision of mathematics owes its achievement in large part to the efforts of Aristotle and the philosophers who preceded him. In their efforts to devise a concise theory of logic, and later mathematics, the so-called "Laws of Thought" were posited [29]. The "Law of the Excluded Middle," states that every proposition must either be true or false. Fuzzy Logic has come out as an advantageous tool for the controlling and steering of systems and complex industrial processes, as well as for household and entertainment electronics, as well as for other expert systems and classification applications [30]. A fuzzy logic

system can be defined as the nonlinear mapping of an input data set to a scalar output data. A fuzzy logic system consists of four main parts fuzzifier, rules, inference engine, and defuzzifier [31]. These components and the general architecture of a fuzzy logic system is shown in figure 1. Firstly, a crisp set of input data are gathered and converted to a fuzzy set using fuzzy linguistic variables, fuzzy linguistic terms and membership functions. This step is known as fuzzification. Subsequently, an inference is made based on a set of rules. Eventually,the resulting fuzzy output is mapped to a crisp output using the membership functions, in the defuzzification step [31].

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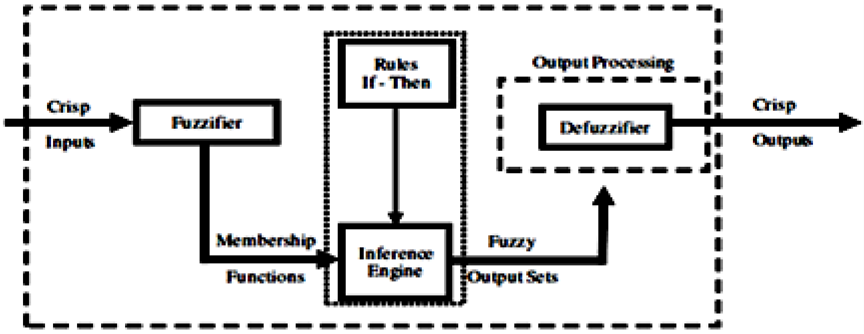

Figure 1. The Type-1 Fuzzy Logic System

The membership functions are used in the fuzzification and defuzzification steps of a fuzzy logic system, to map the non-fuzzy input values to fuzzy linguistic terms and vice versa. A membership function is used to quantify a linguistic term. Fuzzy inference is the process of formulating the mapping from a given input to an output using Fuzzy Logic. The mapping, then provides a basis from which decisions can be made, or patterns distinguished. The Fuzzy inference is the kernel in a fuzzy logic system. It has the capability of simulating human faisla [32] making based on fuzzy concepts. The process of fuzzy inference involves all of the pieces that are referred in the sections: membership functions, Fuzzy Logic operators, and If / Then rules. In a type-1 fuzzy logic system, the inference engine amalgamates rules and gives a mapping from input type-1 Fuzzy Sets to output type-1 Fuzzy Sets. Fuzzy inference systems are also known as fuzzy-rule-based systems, fuzzy models or fuzzy controllers. A fuzzy inference system is composed of five functional blocks [33] shown in figure 2.

1. A rule base includes a number of fuzzy If / Then rules.
2. A database which defines the membership functions of the Fuzzy Sets used in the fuzzy rules.
3. A decision-making unit which carries out the inference operation of the rules.
4. A fuzzification interface which transforms the crisp inputs into degrees of match with linguistic values.
5. A defuzzification interface which transforms the fuzzy outcome of the inference into a crisp output.

In a type-1 Fuzzy Logic system an output processor as a single entity having the sole intend on producing crisp numbers using the defuzzifier, and is known as defuzzification [31]. A crisp output is obtained from a type-1 set. The Defuzzifier performs the following functions.

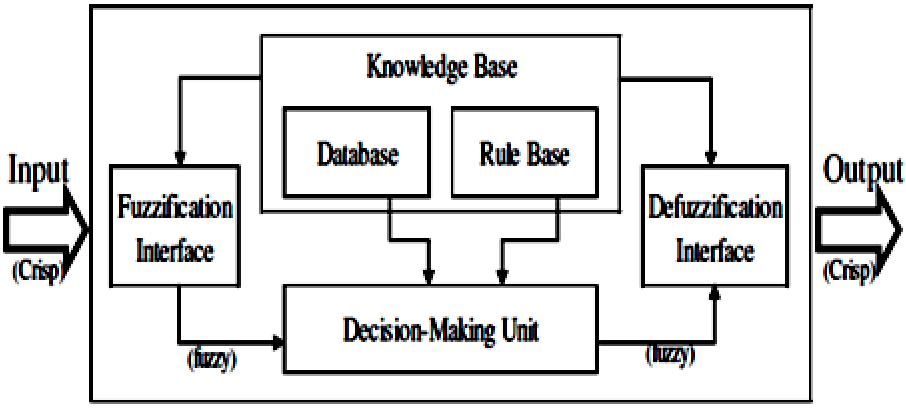

Figure 2. The Fuzzy Inference System

1. Metamorphose the range of values of output variables.
2. Defuzzification.

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In addition to that the figure 3 Maximum defuzzifier Examines the Fuzzy Set B and select as its output the value of which is a maximum. The next figure 4 Mean of maxima defuzzifier - Examines the Fuzzy Set B and first determines the values of μ for which it is a maximum. It then computes the mean of these values as its output.

Figure 3. The Maximum Defuzzifer

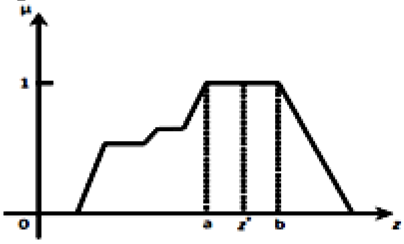

Figure 4. The Mean of Maxima Defuzzifier

Eventually, figure 5 centroid defuzzifier determines the center of gravity of the final fuzzy control space, and uses this value as the output. A Defuzzifier produces a crisp output for our Fuzzy Logic system from the [31] output of the inference block. The centroid defuzzifier is the most generally used methods.

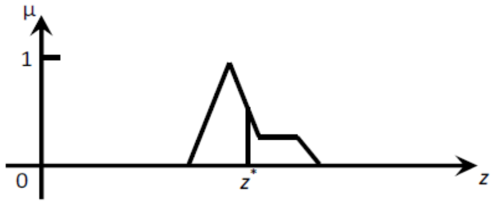

Figure 5. The Centrold Defuzzifier

VI. THE FUZZY INFERENCE RULES

Three fuzzy sets are made up to characterize each variable intensities these sets are symbolized to the linguistic variables “low”, “medium” and “high”. By the defined fuzzy rules, the output of this fuzzy system is classified into one of three classes. The output membership functions [34] are shown in figure 6.

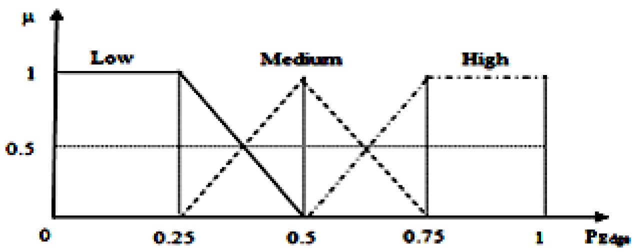

Figure 6. The Output Membership Functions

The fuzzy inference rules are applied to assign the three fuzzy sets characterized by membership functions $^{\mu}$High, $^{\mu}$Medium, and $^{\mu}$Low to the output set. The fuzzy inference rules are defined in such a manner, and the rules are shown below.

1. IF (M is low) and (hDV is low) and (HP is low) THEN (“Edge” is low).
2. IF (M is low) and (hDV is low) and (HP is medium) THEN (“Edge” is low).
3. IF (M is low) and (hDV is low) and (HP is high) THEN (“Edge” is low).
4. IF (M is low) and (hDV is medium) and (HP is low) THEN (“Edge” is low).
5. IF (M is low) and (hDV is medium) and (HP is medium) THEN (“Edge” is low).
6. IF (M is low) and (hDV is medium) and (HP is high) THEN (“Edge” is medium).
7. IF (M is low) and (hDV is high) and (HP is low) THEN (“Edge” is low).
8. IF (M is low) and (hDV is high) and (HP is medium) THEN (“Edge” is high).
9. IF (M is low) and (hDV is high) and (HP is high) THEN (“Edge” is high).
10. IF (M is medium) and (hDV is low) and (HP is low) THEN (“Edge” is low).
11. IF (M is medium) and (hDV is low) and (HP is medium) THEN (“Edge” is low).
12. IF (M is medium) and (hDV is low) and (HP is high) THEN (“Edge” is medium).
13. IF (M is medium) and (hDV is medium) and (HP is low) THEN (“Edge” is medium).
14. IF (M is medium) and (hDV is medium) and (HP is medium) THEN (“Edge” is medium).
15. IF (M is medium) and (hDV is medium) and (HP is high) THEN (“Edge” is high).
16. IF (M is medium) and (hDV is high) and (HP is low) THEN (“Edge” is medium).
17. IF (M is medium) and (hDV is high) and (HP is medium) THEN (“Edge” is high).
18. IF (M is medium) and (hDV is high) and (HP is high) THEN (“Edge” is high).
19. IF (M is high) and (hDV is low) and (HP is low) THEN (“Edge” is low).
20. IF (M is high) and (hDV is low) and (HP is medium) THEN (“Edge” is medium).
21. IF (M is high) and (hDV is low) and (HP is high) THEN (“Edge” is medium).
22. IF (M is high) and (hDV is medium) and (HP is low) THEN (“Edge” is medium).
23. IF (M is high) and (hDV is medium) and (HP is medium) THEN (“Edge” is medium).
24. IF (M is high) and (hDV is medium) and (HP is high) THEN (“Edge” is high).
25. IF (M is high) and (hDV is high) and (HP is low) THEN (“Edge” is medium).
26. IF (M is high) and (hDV is high) and (HP is medium) THEN (“Edge” is high).
27. IF (M is high) and (hDV is high) and (HP is high) THEN (“Edge” is high).

VIII. THE PROPOSED OPTIMAL VIEWPOINT

In this paper, the optimal viewpoint is proposed and implemented. This viewpoint suggests two circumstances for edge detection. First circumstance deals with fuzzy rule based system and second concerns about Sobel method. This proposed has been implemented and the preferable results have been acquired for edge detection. The next segment discuss about this proposed optimal viewpoint. Subsequently applying fuzzy rule based inference system intermediate image is fetched. In this manner original image is scanned and fuzzified and after experimentally fuzzy rules, membership, function of the pixels is modified. Then defuzzification using the centroid technique is applied and intermediate image is acquired. In this viewpoint, 2 X 2 window mask is applied to scanning an input image. In this place 4 pixel values are acquired which are used as input in the Fuzzy Inference system. Forthcoming experimentally fuzzy inference rules, the output pixel will be (X,Y). Two types of fuzzy sets are used as inputs, i.e. Black (or bit = 1) and White (or bit =0) and three types of fuzzy sets are used as outputs, i.e. Black(B), White(W), and Edge(E). In the gray scaled images, values of pixels are eternally between the range of 0 and 255, where 0 is with white color and 255 with Black color. Yet in a binary image, the pixel value 1 is considered as black and the pixel value 0 as white. The output pixels are divided into three fuzzy sets; Black, Edge and White. The limitation of the output fuzzy sets is as given in table 1. The Fuzzy inference system scrutinizes for the conditions of the Fuzzy rules with the four input pixels and to get back the resultant pixel that is Black, Edge or White as an output.

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Table 1. The Range of Fuzzy Output Pixel Set

The Rang (0to 255)	The Pixel Name	Fuzzy Pixel Output
[0 6 11]	White	
[221 243 255]	Black	
[120 127 152]	Edge	

Pseudo Codes For Fuzzy Rule Based System

Step 1: Transform the original image into a grayscale image
Step 2: The gray- scaled image is scanned by 2 X 2 window mask.
Step 3: The 4-scanned pixels are taken as a crisp input for the Fuzzy inference system, to be transformed into linguistic variable, i.e. black and white, by using the triangular membership function.
Step 4: Fuzzy rules are then enforced on fuzzy input to get fuzzy output someone as black, white or edge.
Step 5: Fuzzy output is defuzzyfied using the centroid method to get the intermediate output.

The Fuzzy Rule Based System algorithm for circumstance first is shown in a colored image is given as an input image and gives resultant image. The results of first circumstance are shown in figure 7.

(a) **(b)**

Figure 7. (a) An Input Image (b) The Resultant Image After First Circumstance

The Fuzzy output bring back from the Fuzzy Inference System is considered as an input to Sobel method edge detection technique. Later enforce the steps pseudo codes for Sobel System, the fuzzy- Sobel output is generated and the result of the fuzzy- Sobel logic is as shown in figure 8.

Pseudo Codes For Sobel System

Input: Intermediate Image from first circumstances.
Output: Resultant fuzzy Sobel output image with edge detection.
Step 1: The gradient and direction of the intermediate output image are calculated.
Step 2: By applying non-maximum suppression, emaciated edges are suppressed to get thin line.
Step 3: Subsequently, using double thresholding final output image is acquired.

(a) **(b)**

Figure 8. (a) The Intermediate Result First Circumstance (b) The Resultant Image After Second Circumstance

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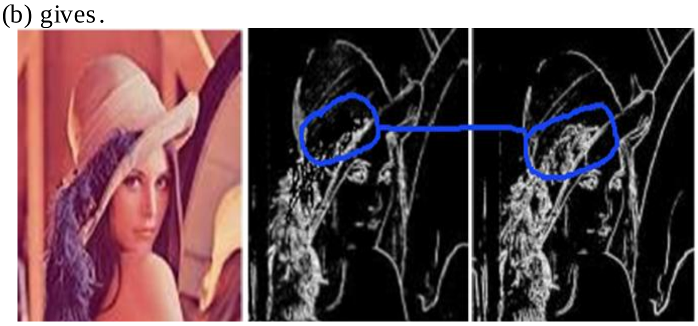
IX. RESULTS PROCURED

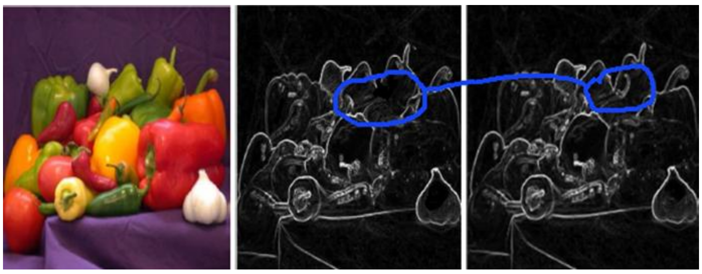
The proposed optimal standpoint is implemented in Matlab and gives improved results than the surpassing Sobel method. The figure 9 to figure 10 show the outcome acquired by proposed an optimal point of view. In these figures, (a) is colored input image, (b) gives.



(a) (b) (c)

Figure 9. (a) Input image (b) Results By Sobel Method (c) Results by Optimal Standpoint

Detected edges of input images using surpassing Sobel edge detection method and in the end, (c) show the resultant image after application of the optimal point of view. In figure (b) and figure (c), the Blue colored bubble is shown, the same signalize the differences between the results acquired by surpassing Sobel method and the proposed optimal point of view. From visual perceptions, figure (c) gives accurate and be more rectify results than the figure (b). The original image and the image acquired by using different thresholds. To minimize the point the threshold value is kept until 100. In case of threshold, single or double, we may acquire better outcome.



(a) (b) (c)

Figure 10. (a) Input image (b) Results By Sobel Method (c) Results by Optimal Standpoint

X. CONCLUSION

The domain of this work is in digital image processing and telecommunication engineering, which are very comprehensive fields. This work is purporting to implement the edge detection for digital image, it may be carried out to a big contour identification of an image. Edge detection is a crucial step in object recognition. It is a process of finding sharp discontinuities in an image. The discontinuities are sudden changes in pixel intensity which characterize boundaries of objects in a scene. In short, the goal of edge detection is to produce a line drawing of the input image. The edge detection is the primary step in identifying an image object, it is very necessary to know the advantages and disadvantages of each edge detection filter. In the edge function, the Sobel method uses the derivative approximation to find edges. This paper mainly used the Sobel operator method to do edge detection processing on the images. Sobel operator locating complex edges are not immaculate. It has been researched for the Sobel augmentation operator in order to locate the edge more immaculate and less sensitive to noise. In this paper presents an optimal Sobel-fuzzy rule base algorithm which is capable of detecting edges efficiently from the grayscale images. The performance of the proposed method is demonstrated through computer simulation in comparison with the existing Sobel edge detector. In consequence the novel technique called fuzzy viewpoint will be used impartially in the future for dissimilar tasks.

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