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# Stress Analysis on Human Shoulder Joint during MMH Using Soft Computing Technique

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**ABSTRACT:** Most industrial plants carry out Manual Material Handling Operations. During Manual Material Handling employees get problem in joints, such as elbow, shoulder, wrist joints pain due to over load lifting. To prevent this problem, stress is determined by the finite element analysis in the joints for lifting the various loads. The Segmentation of joints images from CT scan noise images are done using Sobel Edge Detection Algorithm and Canny Edge Detection Algorithm. The most difficult problem is to find the correct boundary in a noisy image of joints. A standard result can be used to find out absolute edges from noise images. Finally solution is produced by the canny edge detection algorithm as a accurate boundary in a noise images of joints

KEYWORDS: Edge detection, ROI, Edge Length, Contrast, Canny Edge and Sobel operator

### I. INTRODUCTION

The approximate solutions to boundary value problem for differential equation can be found using the finite method which is a numerical technique .A more complex equation over a larger domain connects many simple element equation over many small sub domains named finite element is encompassed by FEM. During manual material handling employee get trouble on their joints, by following proper policies and procedures can help employee to perform these task safely and easily. The FEM modeling the joints is analyzed under some injuries. The explanation along with its uses in the field of orthopedics for the joint region is analyzed by finite element analysis. Edge detection technology is the fundamental tool used to explicate proper information from the images. This provides the outline of an image and boundaries. The removal of noises in the images and enhancement of the appearance is made by this tool. For pre-processing the boundary detection of the CT scanned image of the joints Canny Edge Detection Algorithm has been proposed which is based on the magnitude and edge length algorithm. A better result is produced by the canny edge detection algorithm that is used to detect the boundary of the joints image from the noisy CT scanned image

### II. PROPOSED WORK SEQUENCE

The proposed work sequence of edge detection is shown in Figure 1. Edge detection is detected by these following processing. The Original image is obtained from the image centre and then it will be incorporated by using canny edge detection algorithm. Both the results have been compared and analysed. Shoulder joint anatomy is shown in Figure 2.



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Fig. 1. Work Sequence flow chart



Fig. 2. Normal shoulder Anatomy



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#### III. PRE-PROCESSING OF INITIAL POSITION OF EDGE PARAMETERS DETECTION

Step 1: determine the average magnitude

$$\mathbf{M}(\mathbf{1}, \mathbf{2}) = \frac{1}{M} \sum_{(\mathbf{1}, \mathbf{2})}^{n} \sqrt{\mathbf{M}\mathbf{x}(\mathbf{1}, \mathbf{2})^{2} + \mathbf{M}\mathbf{y}(\mathbf{1}, \mathbf{2})^{2}}$$
in of the oder length. It is calculated from [1]

Step 2: determine the density of the edge length. It is calculated from

$$L(1,2) = \frac{C(1,2)}{\max C(1,2)}$$
[2]

Where C(i,j) is the number of connected pixels at each position of image Step 3: determine the Initial position of map from summation of average magnitude and density of edge length

$$\mathbf{P}(\mathbf{1}, \mathbf{2}) = \frac{\mathbf{1}}{2(M(\mathbf{1}, \mathbf{2}) + L(\mathbf{1}, \mathbf{2}))}$$
[3]

Step 4: determine the thresholding of the initial position map. If

$$P(1,2) > T_{\max} []$$
[4]

Then P(1, 2) is the initial position. And then we obtained the initial position by setting  $T_{max}$  to 92% of the maximum value. Figure 3 shows the significant results of preprocessing.



Fig.3. (a). Noisy Shoulder image; (b). Average Magnitude Image; (c). Density of the Edge Length;(d). Final Noise removed image; (d). Initial Position map.



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#### IV. CANNY EDGE DETECTION ALGORITHM

The Canny algorithm can be used an ideal edge detector based on a set of criteria which include finding the most edges by reducing the error rate, marking edges close to the actual edges to enhancing localization, and Final edges are determined by quenching all edges that are not connected to a very certain (strong) edge. The optimal filter that meets all three criteria above using the first derivative of a Gaussian function by using canny. Fig.4 shows the image results after image processing using the canny algorithm.

$$GF(i,j) = \frac{1}{2\pi\sigma^2} e^{\frac{i^2 + j^2}{2\pi\sigma^2}}$$
[5]

Step 1: Calculate the average magnitude

$$M(1,2) = \frac{1}{M} \sum_{(1,2)}^{n} \sqrt{Mx(1,2)^2 + My(1,2)^2}$$
 [6]

Step 2: determine the density of the edge length The density of the edge length is calculated from

$$\mathbf{L}(1,2) = \frac{C(1,2)}{\max C(1,2)}$$
[7]

Where C(i,j) is the number of connected pixels at each position of image in pixel

Step 3: determine the Initial position of map from summation of average magnitude and density of edge length.

$$\mathbf{P}(1,2) = \frac{1}{2} \left( M(1,2) + L(1,2) \right)$$
[8]

Step 4: determine the thresholding of the initial position map. If

$$P(1,2) > T_{\max} []$$
[9]

The initial position of the edge is P(1,2). by setting  $T_{max}$  to 92% of the maximum value then we attained initial position.



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[a]





[b]



Fig.4. (a). Noisy Eye image; (b). Average Magnitude Image; (c). Density of the Edge Length; (d). Final Noise removed image; (d). Initial Position map; (d). Final Thresholding of edge map.

### V. SOBEL EDGE DETECTION TECHNIQUE

Edge detection is very important in finding the absolute gradient magnitude at each point of input of grayscale image . spatial gradient measurement in 2D on images is performed by sobel operator. The Sobel edge detector uses a pair of 3 x3 covolution masks, one determine the gradient in the x-direction and the other determine the gradient in y-direction. The

Sobel edge detector is more sensitive. so it indicate noise as edges in the images. The Sobel operator is slower to compute than the Roberts cross operator, Although its larger convolution mask smooth's the input image to a greater extent.

$$|G_{1} = \sqrt{G_{x^{2}} + G_{y^{2}}}$$
[10]

Although typically, an approximate magnitude is computed using:  $|G| = |G_x| + |G_y|$ [11] Spatial gradient is given by:

 $\alpha = \arctan(G_y/G_x) - 3\pi/4$ [12]

In this case, orientation 0 is taken to mean that the direction of left to right and maximum contrast from black to right on the image,

Using this mask the approximate magnitude is given by:

 $|G| = |(N_1 + 2xN_2 + N_3) - (N_7 + 2xN_8 + N_9)| + (N_3 + 2xN_8 + N_9) - (N_1 + 2xN_4 + N_7)|$ [13]



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[b]



Fig.5. (a). Noisy Eye image, (b). Average Magnitude Image, (c). Density of the Edge Length (d). Final Noise removed image, (d). Initial Position map, (d). Final Thresholding of edge map

### VI. RESULTS AND DISCUSSION

To evaluate the efficiency of the proposed method in addition to the visual inspection, the final boundary detection method numerically using the probability of error in image partition and hausdorff distance. Where P(O) and P(B) are probabilities of objects and background in images. The objects encompassed by the contour obtained using the five snake model and the suggested method are compared with that manually drawn by skilled doctors from the medical hospital from the above table shows the average results of probability of error in image segmentation of sobel edge detection algorithm and canny edge detection algorithm were compared with accepted medical values and also predict the error difference. From that it shows the error difference value is minimum and also negligible in median filter. So the canny edge detection algorithm produce nearer to the standard value.

s.no	Image illustration	Medical standard value (%)	Sobel filter segmentation (%)	Canny filter segmentation (%)	Error difference in sobel filter segmentation (%)	Error difference in canny filter segmentation (%)
1	CT scan shoulder noise image	8	14	7	-7	-1
2	Average magnitude image	7	16	6	-10	-1

Table 1 Average Results	of Probability	of Error in	Image Segmentation	
rable 1. Average Results	of 1100a0mity	of Life in	mage Segmentation	



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3	Density of edge length image	10	13	7	-6	-3
4	Filtered CT scan image	6	13	7	-6	+1
5	Initial position map	6	16	10	-6	+4
6	Fine edge filtered image	7	13	5	-8	-2

#### Fig 6. Comparative Analysis Graph for Canny Edge Detection value, Sobel Value and Medical value

#### VII. CONCLUSION

This paper provide the comparative analysis of different edge detection algorithm like sobel edge detection algorithm and canny edge detection algorithm from that canny edge detection algorithm produce better results for noisy joints images. The proposed method can be applied for medical imaging and also be applied to any image processing problems.

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