OPEN ACCESS
International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-9 Issue-4, February 2020

Implementation of Morphological Operation through Intercept Based Euclidean Distance Algorithm

S. Jayachitra, M. Karthihadevi, G. Mariammal, T. Pushparaj

***Abstract:** Skeletonization is the process of extracting the region-based shape features that represents a common form of original object. It can be employed to binary images thatproduces alternative binary image as the resulting output. The main goal of thinning is to degrade particular foreground pixels from original input image. A pruning focused on removing short spurs present in an image. By Employing morphological operation for the process of extracting skeleton can be used in wide range of application. In this paper, we proposed a model which is a robust intercept based Euclidean distance (IBED) algorithm to perform morphological operation to extract the surface of the skeleton from the computed Tomography image. In this edge points of the skeleton have been analyzed over set extraction, hence the characterization has been improved by presenting a novel skeleton with edge points. The index value, edge points, Euclidean distance and fracture length have been calculated. The proposed technique is employed to four men and two women with different fractures in CT scanned image.*

***Keywords:** Skeletonization, Morphological Operation, Thinning, Pruning, IBED*

I.INTRODUCTION

Skeletonization mainly involved in converting 2D object towards onto one Dimensional image with line representation. Connected Skeletons can be done through analytical thinning. Various alternative approaches are required for the purpose to evaluate distance map. Implementing the algorithm to extract the skeleton with large number of endpoints and branch points with intrusion paths; hence the skeleton can be extracted with redundant elements.

Different Euclidean metrics is implemented to extract the skeleton but there is hidden connectivity which remains unsolved. Pruning techniques depends up on examining disk radii with Skeleton branches.[10].Though, Euclidean distance transform presents the dislocation of pixel towards nearest background with edge point[1], It was exploited in numerous applications such as smoothing, detecting edge points through digital curves, which helps in determining convex hulls Mitchell et al engaged in performing gray scale operation by executing mathematical morphological technique for Euclidean distance transform algorithm[2],[3]. Through Morphological operation, erosion can be done that selects minimum value from combination of an original image with predefined weighted structure within a sliding window, which is the most appropriate for Euclidean Distance Transform. The decomposition properties with mathematical morphological operation can be utilized for parallel computing. Shihetalaccomplished exact Euclidean Distance Transform with invariant size using four-scan algorithm and two-scan algorithm [5]. Vincent [6] encrypted the objects boundaries with chains since they propagate and the structures can be analyzed with employed rules. This method w a s efficient that achieve good results with more accuracy. Euclidean distance Transform can be employed with different variations through fast algorithm and can be properly utilized [7]. However the medial axis method of extracting the skeleton does not sustain the analysis of fracture detection and surface feature extraction that provides the connectivity information about the edge points. However, it is not suitable for selecting precise opening scale with this massive micro fractures MFs [9].

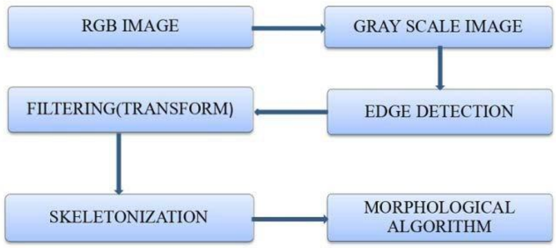

Fig.1. Illustration of Skeleton Extraction

Fig.1. shows that the original CT image ie raw input is converted into gray scale image which is undergone for skeleton extraction. Gray scale image is detected with edge points and move to filtering process to remove unwanted noise. Then it is forwarded to morphological operation through thinning and pruning. The proposed work illustrates about the connected junction of edge points which is more comprehensive than existing ideal model which was analyzed through the observed results. The existing skeleton satisfies extraction model with the proposed technique for fracture extraction. This proposed method was most accurate method for analyzing skeleton extraction with fracture classification.

Revised Manuscript Received on February 28, 2020.
* Correspondence Author
S. Jayachitra*, Assistant Professor, ECE Department, Karpagam Academy of Higher Education, Coimbatore, India. Email: jayachitraece@gmail.com
M. Karthihadevi, Assistant Professor, PSNA College of Engineering and Technology, Dindigul, India
G. Mariammal, Assistant Professor, PSNA College of Engineering and Technology, Dindigul, India
T.Pushparaj, Assistant Professor, PSNA College of Engineering and Technology, Dindigul, India

II. MATERIALS AND METHODS A.PROPOSED METHODOLOGY

The proposed system is categorized into three major Processes. Initially data acquisition can be carried out which is followed by data processing and then feature extraction can be done. During data acquisition process, the are preserved features like color of an image, depth and skeleton information can be collected for data processing. Data processing and feature extraction module focused at processing the data for feature extraction with data normalization. The Flowchart can be illustrated below

Step-1: Original CT image.
Step-2: Image Segmentation.
Step-3: Skeleton mapping.
Step-4: Skeleton Extraction
Step-5: Feature Extraction from joints
Step-6: Calculate distance map of the skeleton.

Fig.2.Flowchart of IBED

The Operators will not always remove spurious skeleton branches completely. After the skeleton is extracted the distance mapping algorithm expands each skeleton points to its neighboring points until the object boundary is reached. The Proposed work on IBED calculates the Euclidean distance between the first boundary point reached and the skeleton point is computed and assigned to the skeleton point. In addition to the distance information the shortest map between the skeleton branches also calculated. The boundary pixel information is extracted and the shortest distance across the boundary is calculated.Fig.2. Shows that the original gray scale images are extracted and the distance point is calculated through intercept points of the skeleton and fracture has been analyzed.

B. SKELETONIZATION

The practice of reducing all objects of an image to lines can be done through skeletonization without changing the fundamental structure of the image. The binary image with skeleton can be extracted through skeletonization. The process of minimizing foreground regions from binary image through skeletal region that preserves in large extent hence the connectivity remains same in original region which throws away the original foreground pixels of an image. Through end of the process major soft tissues have been completely eliminated and thus leaves only disarticulated bones.

Skeletonization was implemented to analyze removal of iterated voxel and distance-transform- based technique. The proposed technique computes the surface and the edge of the skeletons through intercept points. We employed IBED based distance transform to calculate edge points, that guarantee the skeleton, and which is reduce the cost of number of iteration in thinning. Skeletonization techniques is classified into types

• Detecting edges through distance map with boundary points,

• Thinning can be performed for morphological operation for extracting skeleton to remove selected foreground pixels.

. Curve skeletons: only curve-end voxels are preserved during thinning

Surface skeletons: both curve-end and surface-end voxels

It is a mathematical morphological operation can be done to remove unwanted from obtained binary image for skeletonization process which can be carried through layer by layer. The main goal of Edge detection is to reduce lines into single pixel value. The process of Thickening foreground pixel value is equal to thinning of background pixel. It can create curve skeleton in 2D and curve or surface skeleton in 3D.The binary images carries wide line on pixel by the process of Thinning. The branch points along with endpoints are extracted hence the image is transformed to graph.

The thinning has some added advantages:

• It preserves the characteristics of original image,

• It conserves the shape ie object recognition and feature extraction

• It enforces "skeleton" presence in the mid of the object, and

• It yields single pixel/voxel width "skeleton". Thinning functioning set can be calculated by

$$A \otimes B = A - (A \circledast B) = A \cap (A \circledast B)^c \quad (1)$$

D. PRUNING

Pruning can be carried out to remove unwanted spurs present in the skeleton with small irregularities present in boundary of original image. It can be utilized as auxiliary component of skeleton. The extracted lines are completely reduced to single pixel width.

Edge points

The main goal is to extract edge points by electing tracking points accurately. Although the existing system often provides irrelevant edge points such as background points, accuracy recognition and efficiency. The sampling technique utilized canny edge detection to detect edge points.

Medial Surface Skeleton contains porous skeletal lines are the major components of surface skeleton. The development of medial surface layer is used to quantify the accuracy of finding edge points. It also accomplishes the matrix pores and medial surface layer which denotes the connectivity information about the edge point of the skeleton. Separation of pores from the tissue is used for feature extraction with edge points. Medial Fracture are analyzed with linear and cluster formation of edge points. Generally the skeletons with lines having edge points and branch points shows the connectivity about the matrix and medial surface skeleton. Many parameters with spatial points are measured to calculate with intercept based branch points and edge points. Each and every point with branch points and edge points are extracted with set points using algorithm. The combination of surface skeleton and skeleton line provides the connectivity information of edge points.

The characterization finds out the micro fractures present in the scanned CT images. According to that fractured bone with edge points can be extracted.

C. INTERCEPT BASED EUCLIDEAN DISTANCE TRANSFORM

A new algorithm was implemented that is Intercept based Euclidean Distance Transform to apply for measuring the dimensions with intercept points with edge points of CT image. It was imposed with uniform edge points and intercept point with distance map. The algorithm employed with linear computational complexity of O (m), where m is the number of pixels in the object. The algorithm can be applied in dynamic images whose boundary doesn't need to be close and its pixels can increase dynamically. I is an binary image in n dimensional space, in which O is the set of pixels in the object, and B = O is the set of pixels on the background. 2 n X = x x x $\in Z$ n is a pixel in image I and m=|O| is the medial surface point set and the medial axis the total number of pixels in the object. The value of the pixel X is defined as follows:

□(Y) = 1 □□ YƐ □

0 YƐ□ (2)

The main goal of intercept based Euclidean distance transform of pixel Y in the object is to find the minimal intercept based Euclidean distance from background pixels to Y, which is equal to identify the pixel in S that minimizes the distance between the pixel Y and the background. Function g represents intercept based Euclidean distance transform from binary image I to gray scale image I', and d means Intercept based Euclidean distance.

$g(Y) = d(Y,B) = d(Y,S) = \min\{d(Y,X), X \in S\}$

At last, to a pixel X in the object, we define the nearest pixel in background as NP(X). Generally, there is may be more than one pixel which has the smallest Euclidean distance. In this situation, we select one of them randomly.

$NP(X)$ arg $\min\{d(X,Y), Y\ S\}$

For the sake of the requirement of the algorithm, NP(X) also has definition when X$\in S$. S was also called zero-distance set in [1] since the Euclidean distance of pixels in S equal to zero from this definition.

$NP(X) = X \text{ if } X \in S$

By Euclidean distance transform, we can easily find center pixel and connecting all center pixel clusters to form skeleton.

Algorithm Test of ANN

```
inputs: thinning_parameter, test_data find
Intercept based Euclidean distance, train the
data,
Calculate dist(b)
calculate diverge effect term,
d (b, a) = e(i(b, a)−jmax) ∗ i (a, b) calculate
normalization layer
end
```

II. RESULTS AND DISCUSSIONS

The obtained outcome values are demonstated.Fig.3.shows that the original CT scanned image is given as input image for skeleton Extraction. The original sample image is transformed to gray scale image specifically a binary image.

Fig.3.Input CT Image

Fig.4. Reconstructed Image

Fig.4. illustrates the reconstructing of an image is nothing but resizing the original image. By Segmentation process, binary images are generated through color images. The mechanism of assigning each and every pixel from source image that can be classified into two or more classes.

Fig.5.Binary Image

Fig.5 shows the binary image obtained after the conversion of original image to segmented image. By performing morphological operation noise and short spurs are removed and the skeletal part is extracted.

Fig.6.a

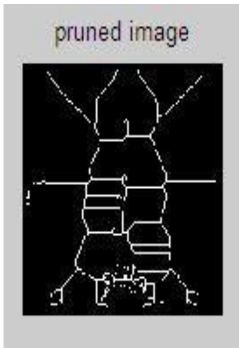

Fig.6.b

Fig.6.c

Fig.6.a,b,c. Illustration of Morphological Operation Fig.6.a,b,c demonstrates

morphological operation undergone for thinning and pruning. The fractured part can be analyzed with the proposed method.

Fig.7. Extraction of Skeletal Part from with edge points

Fig.7. shows the proposed method implemented with skeletal part extraction with detected edge point through intercept of the skeletons.

II. CONCLUSION

We have presented thinning and pruning algorithm that can be used to extract the surface of the skeleton. The results have shown that our proposed algorithm produces more desirable skeletons than existing algorithms. Thus by performing morphological operation we can reduce the noise spurs in the skeleton model.

REFERENCES

1. Ye Q. Z.: The Signed Euclidean Distance Transform and Its Applications. Proc. ninth Int. Conf. Pattern Recognition. (1988) 495-499
2. Huang C. T., Mitchell O. R.: A Euclidean Distance Transform Using Grayscale Morphology Decomposition. IEEE Trans. Pattern Analysis and Machine Intelligence. 16 (1994) 443-448
3. Shih F. Y., Mitchell O. R.: A Mathematical Morphology Approach to Euclidean Distance Transformation. IEEE Trans. Image Processing. 1 (1992) 197-
4. 204
5. Shih F. Y., Liu J. J.: Size-invariant Four- scan Euclidean Distance Transformation. Pattern Recognition. 31 (1998) 1761-1766
6. Shih F. Y., Wu Y. T.: The Efficient Algorithms for Achieving Euclidean Distance Transformation. IEEE Trans. Image Processing. 13 (2004) 1078-1091
7. Vincent L.: Exact Euclidean Distance Function by Chain Propagations. IEEE Proc. Computer Vision and Pattern Recognition. (1991) 520-525
8. Cuisenaire O. Macq B.: Fast and Exact Signed Euclidean Distance Transformation with Linear Complexity. Proc. Int. Conf. Acoustics,
9. Speech, and Signal Processing. (1990) 3293-3296
10. Schouten T., Broek E. V. D.: Fast Exact Euclidean Distance (FEED)
11. Transformation. Int. Conf. Pattern Recognition. (2004) 594-597
12. C. Arcelli,G Sanniti di Baja, and L. Serino, "Distance-driven Skeletonization in voxel images, *IEEE Trans. Pattern Anal.Mach.Intell.*, vol. 33,no. 4, pp. 709–720, Apr. 2011.
13. Essam A. El-Kwae, Mansur R.Kabuka*"Binary object representation recognition using the Hilbert morphological skeleton transform" ,IEEE Trans (2011) 654-659.

AUTHORS PROFILE

S.Jayachitra received the B.E. degree in Electronics and Communication Engineering from Anna University, Chennai and M.E Degree in Communication System from Anna University, Chennai. She is currently working as an Assistant Professor. Her Research interests include Image Processing, Signal Processing.

M.Karthihadevi received the B.E. degree in Computer Science & Engineering from Anna University, Chennai and the M.E degree in Computer and Communication from Anna University, Chennai. She is currently working as an Assistant Professor. Her research interests include Image Processing, Wireless Sensor Networks, Cloud computing and Computer Networks.

G.Mariammal received the B.E. degree in Science and Engineering from Anna University, Chennai and the M.E degree in Computer Science and Engineering from Anna University, Chennai. She is currently working as an Assistant Professor. Her research interests include Cloud Computing, Wireless Sensor Networks, and Image Processing.

T.Pushparaj received the Master of Computer Application from Anna University, Chennai.