Identification of Knee Osteoarthritis Using Hybrid Segmentation Technique

Basavaprasad B[1], Ravi M[2], Chandrashekhar S[3], Rajeshwari Horakeri[4], Arshi Jamal[5]

[1, 2, 3, 5] Dept. of Computer Science, Govt. First Grade College, Raichur

[4] Dept. of Computer Science, Govt. First Grade College, Hubli

Abstract

Osteoarthritis (OA) is one of the bigger parts and typical knee joint problem of which is inadequacy found in overweight and more established people which has the tendon of bone joints like feet, knee, spine and hip. In OA conventionally, tendon is spitted due to the control of bones with each other which will wrap up causing barbarous torture. In this situation, it is fundamental to explore the earnestness of OA which incorporates distinctive clinical imaging and clinical evaluation techniques. In this paper, modernized assessment and affirmation of OA is proposed by figuring the thickness of tendon which furthermore serves to sufficiently distinguish and examine the deformation in bone structures. Where we have considered different knee X-beam pictures. From the outset, preprocessing and commotion removal is performed. Further by executing Hybrid division using Graph based method and Thresholding the particularly knee zone is altered and inspected to handle the thickness of tendon to perceive the presence of OA.

Keywords: Osteoarthritis, Knee, Segmentation, cartilage, Thresholding.

I. INTRODUCTION

II. Osteoarthritis is one of the essential joint torment conditions among various kind of bone joint issues which can be commonly seen in overweighed people, more seasoned people and females [1]. There are two kinds of osteoarthritis which are generally found. Basic osteoarthritis and Secondary osteoarthritis. Basic OA which is achieved by developing or inherited reasons that can be normally found in developed people

[2]. Picture division is a standard and critical task in PC observation. It will in general be described as the path toward disengaging and sub-parceling an image into different separate fragments called as segments with the objective that each segment addresses an imperative bit of the image. After that the image division task is handled in a liberal strategy by using operational instruments of speculation of chart theory. So we have combined the graph based system with standard division strategy to get the ideal results.
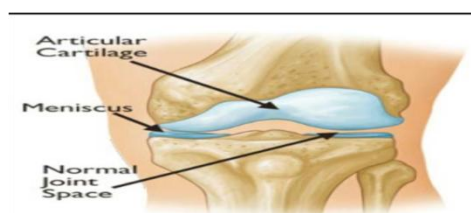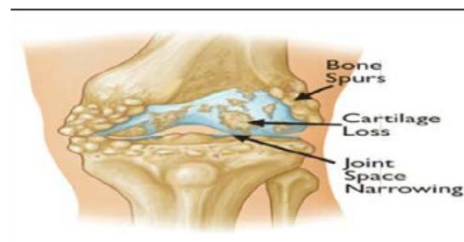

Fig.1. Normal Knee Image

Fig.2. Osteoarthritis knee Image

Clinical imaging is the technique used tocreate visual portrayals of the inside structures of the body which are concealed by exorbitantly thin. In any case, clinical picture division is inconvenient and require a ton of data and experience. Regardless, this will wind up being an extraordinary cycle if the proportion of data is growing which will over the long haul make the

interest for modified area [3]. Where the vital surface is adequately arranged using wavelet package rot. Moreover, a prior shape model is made by dismembering a great deal of shapes by following and to portray the assortment alive and well. Further,the PSO count is used to totally piece the clinical picture by realizing the prior shape display as necessities be to picture features.

Literature Survey

Different experts haveproposed diverse clinical picture division methodsto recognize and analyze Osteoarthritisby considering different pictures like MRI, X-beam, etc. Normally there are two kinds of clinical picture division: Pixel-based which incorporates region creating, thresholding and area combining and Geometry (shape) based which incorporates dynamic appearance models, deformable and dynamic counter models [4]. As per the survey.

Bindushree R et al [5], haveproposed two or three picture dealing with methods to recognize the width of the joint space using knee x-beam pictures. The different techniques which are realized to eliminate, separate figure the width are wise edge area count, contrast enhancement,thresholding, and histogram change. By then the handled width of the data picture is differentiated and a standard width (5.7 for men and 4.8 for women) of the normal individual to perceive osteoarthritis.

In [6] Subromonium.Met al, have proposed a system to measure and gathering the features of electronic x-beam pictures by using LTP (Local Ternary Pattern)and SVM (Support Vector Machine) Classifier. To survey the show of the proposed estimation 50 X-beam tests pictures were considered. By executing these strategies the makers have gained 91.66% of identity and 80% of affectability from Linear and Polynomial limits and 94.59% of unequivocality and 66.66% of affectability from RBF.

In [8] Shamir et al., have proposed Local Binary Pattern (LBP) vector algorithmto find the OA genuineness from the x-beam pictures. Where LBP vector count incorporates the going with progresses. From the outset, the inspected window is parceled into cells, by then every pixel in the cell is differentiated and all of its neighbor pixels. This is acted in a round solicitation for in either clockwise or anticlockwise for all the pixels. Further, the assessment of the central pixel is differentiated and neighbor pixel and an octa-twofold worth (eight digit matched worth) is consigned for each pixel and histogram is resolved for each cell and normalized to secure the important results. Regardless, the procured results are not precise and the resultant pictures are not palatable.

PROPOSED METHOD

The proposed technique contains three stages; preprocessing, division and Result appraisal as showed up in Fig.3.
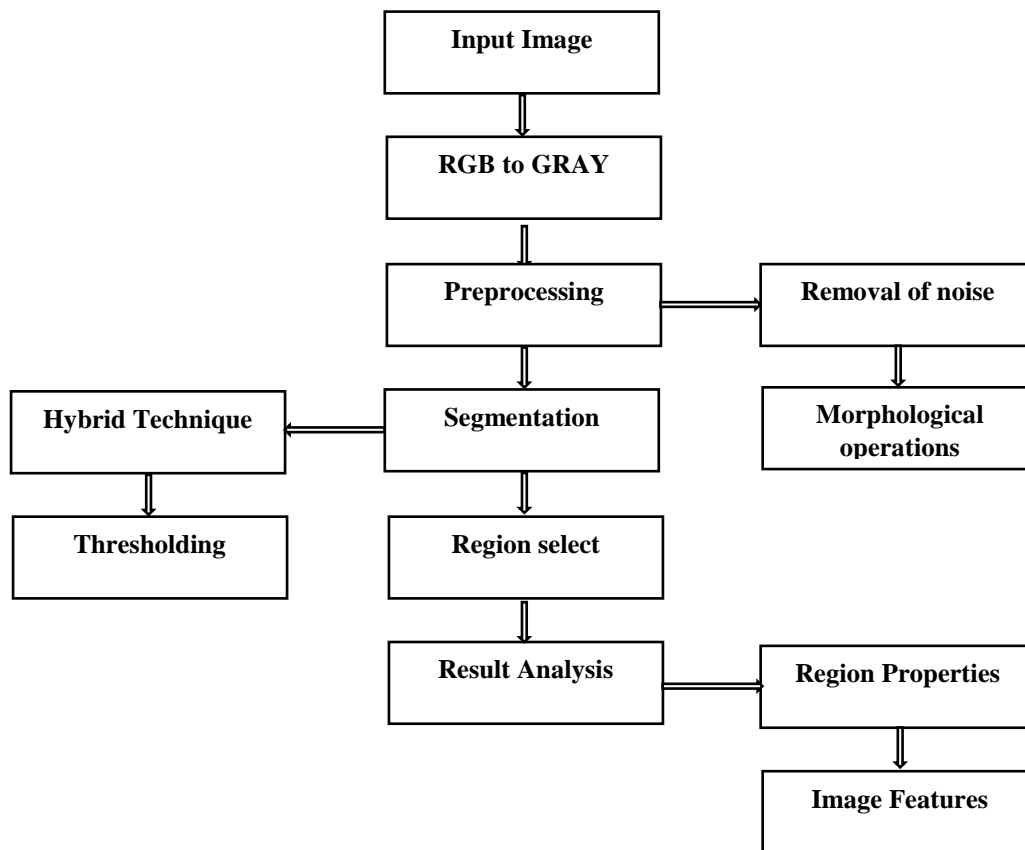
Fig.3. Block Diagram of Proposed System

1. Input Image

The data image(Fig.4) of Osteoarthritis knee is typically in the RGB design and picture Bit Depth is 24 going before heading off to the chief period of the proposed structure, The Given

RGB picture is changed over to Gray by taking the ordinary of all of the three tints (bit significance of the dull picture is 8) (Fig.4).

Fig.4.Input image

2. RGB to Gray Conversion

In MATLAB, "rgb2gray()"function is used to change over RGB picture to grayscale picture. Nonetheless, in this paperrgb2gray() work isn't used to change over a RGB picture to grayscale picture. Where, trio regard relative to red, blue and green colorcomponent at a predefined spatial region of RGB picture pixel is used to change over by calculating the weighted entire of RGB concealing [12].

Fig.5.RGB to Gray converted image

3. Preprocessing

In preprocessing stage Image filtering, Morphological exercises and picture sharpening is performed to the obtained greyscale picture which improves the distinction of the image. In like manner, isotropic dispersal filterand Gaussian channel is used to dispense with the uproar in the greyscale picture to highlight the structure and edge of bones and tendon of greyscale knee picture. The pattern of preprocessing is according to the accompanying.

3.1 Removal of Noise

In this stage, Anisotropic dispersal channel and Gaussian channel is used to dispose of the disturbance. Where anisotropic spread which is similarly called as Perona–Malik diffusion,is a method used to diminish noisewithout affecting huge bits of the image substance like edges, lines or various nuances that are basic for the examination of the image.The coming about image of this technique isobtained by a convolution of the data picture and a 2D-isotropic Gaussian channel, which constructs the width of thefilteralong with the limit. The resultant pictures are as shown as follows:

Fig.6. Anisotropic filtered imageFig.7.Gaussian Filtered image

3.2 Morphological Operations

In this stage, to highlight the edges of express territories in the image, we have realized unsharp covering (USM).In picture planning USM isan picture sharpening technique which is usedto sharpen the fundamental region in cutting edge picture .

The "unsharp" is the name/code used to make a front of the primary darkened or negative image.Then the unsharp disguise picture is gotten together with the principal (positive) picture to make a generally less dim picture than the first. In spite of the way that the resultant picture is moreclear it may be a less precise with respect to the image's subject
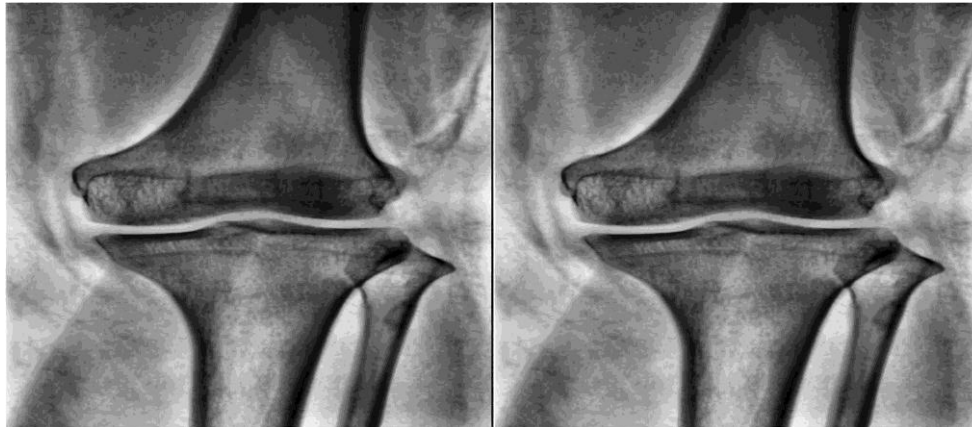
Fig.8: Output of morphological operations

3.3 Image Sharpening

In this stage, to feature the edges of explicit areas in the picture, we have actualized unsharp concealing (USM).In picture preparing USM isan picture honing strategy which is usedto hone the necessary locale in advanced picture .

The "unsharp" is the name/code used to make a cover of the first obscured or negative image.Then the unsharp conceal picture is joined with the first (positive) picture to make a relatively less hazy picture than the first. Despite the fact that the resultant picture is moreclear it might be a less exact as for the picture's subject

Fig.9.Sharpen Image using unsharp masking

4. Segmentation

In the stage HYBRID figuring is realized close by inaction weight to segment the specific zone/object in the X-beam picture. The essential article is isolated by using HYBRID division to get the level set limit that unequivocally parcels the image.

4.1 Hybrid Technique

HYBRID Algorithm:

Stage 1: Each pixel isallocatedwith an underlying position and speed

Stage 2: Enhance the position and speed esteems by order

Stage 3: The upgraded qualities for the position a speed can be chosen utilizing the underneath conditions (3) and (4).

$$X_{k+1}^i = X_k^i + v_{k+1}^i$$

$$(3)$$

Page no 2570

$$v_{k+1}^{i} = v_{k}^{i} + c_1 r_1 (p_{k}^{i} - X_{k}^{i}) + c_2 r_2 (p_{k}^{g} - X_{k}^{i}) \tag{4}$$

Stage 4: Until a union measure is met stage 2 and 3 are rehashed.

4b. Thresholding

Thresholding is the essential technique used in picture taking care of division divide and extensively used methodobtain a twofold picture from a grayscale picture.

In thresholding, we set a specific edge valuethen all the dull level characteristics which is less thanthe picked limit regard is considered as 0(black i.e establishment) and all the faint level which is comparable to or more conspicuous than the edge regard are named 1(white i.e frontal zone) [13].

$$g(x, y) = \begin{cases} 1 & \text{if } f(x,y) \geq T \\ 0 & \text{otherwise} \end{cases}$$

Here g(x, y) speaks to limit picture pixel at (x, y) and f(x, y) speaks to greyscale picture pixel at (x, y) [14].

(b)

(a)

Fig.10. Segmented images using PSO (a) and thresholding (b)

Conclusion and future work

Generally, specialists will assessment of clinical pictures genuinely which is monotonous and difficult to separate in a practical way as a result of complexities present in the X-shaft pictures. Conventionally, X-pillar pictures of knee are a ton of affected with bothersome distortions and commotion which makes issues to separate the structures of bones sufficiently. To decide these issues, in this paper an automated assessment and area of the thickness of tendon is proposed which similarly gives a quick and effective methodology to perceive and stall the anomalies in bone structures. Close by Preprocessing and uproar clearing measure, HYBRID division is completed which serves to successfully look and analyze needed articles reliant on its limits in an image. For examination, diverse X-pillar knee pictures have been considered and inspected to induce the thickness of tendon which recognizes the presence of OA. In future, we intend to improve division exactness by using notwithstanding everything better pre-planning and division techniques.

References:

[1] MahimaShanker Pandey, RajithaB,Suneeta Agarwal " Computer Assisted Automated Detection of Knee Osteoarthritis using X-ray Images", Science& technology The International Quarterly Journal, ISSN 2394-3769, Volume 1, Issue 2,PP:74-79, ,April 2015.

[2] LilikAnifah, Ketut Eddy Purnama, MochHariadi, MauridhiHeryPurnomo "Automatic Segmentation of Impaired Joint Space Area for Osteoarthritis Knee X-ray Image using Gabor Filter based Morphology Process", IPTEK, The Journal of Technology & Science, Volume 22,Issue 3, pp:159-165,August 2011.

[3] MahimaShanker Pandey, RajithaB,Suneeta Agarwal " Computer Assisted Automated Detection of Knee Osteoarthritis using X-ray Images", Science& technology The International Quarterly Journal, ISSN 2394-3769, Volume 1, Issue 2,PP:74-79, ,April 2015.

[4] Shivanand S. Gornale, Pooja U. Patravali, Ramesh R. Manza "A Survey on Exploration and Classification of Osteoarthritis Using Image Processing Techniques", International Journal of Scientific and Engineering Research (IJSER), ISSN 2229-5518, Volume 7, Issue 6,July 2016.

[5] Bindushree R, Sanjeev Kubakaddi, NatarajUrs" Detection of Knee Osteoarthritis by Measuring the Joint Space Width in Knee X ray Images", International Journal of Electronics & Communication, ISSN 2321-5984, Volume 3, Issue 4, PP:18-21,April 2015.

[6] Subramonium.M&Rajini.V "Support Vector Machine Approach for the Diagnosis of Arthritis from Digital X-ray Images Using Local Ternary Pattern", Indian Journal of Applied Research, Volume 3, Issue 9, Sept 2013.

[7] G.W. Stachowiak, M. Wolski, , T. Woloszynski, P. Podsiadlo, "Detection and prediction of osteoarthritis in knee and hand joints based on the X-ray image analysis", Biosurface and Biotribology, Volume 2, Issue 4, December 2016, DOI: 10.1016/j.bsbt.2016.11.004, pp. 162-172.

[8] Shamir, L., Ling, S.M., Scott Jr, W.W., Bos, A., Orlov, N., Macura, T.J., Eckley,D.M., Ferrucci, L., Goldberg, I.G.: Knee X-ray image analysis method for automated detection of osteoarthritis. IEEE Transactions on Biomedical Engineering 56(2), 407-415 (2009).

[9] N. Alamelumangai, Dr. J. Devishree, "PSO Aided Fuzzy Inference System for Ultrasound Image Segmentation", International Journal of Computer Applications, vol. 7, No. 14, pp. 16-20, 2010

[10] M.G.H. Omran, A. Salman, A.P. Engelbrecht, "Dynamic Clustering using PSO with Application in Image Segmentation", Pattern Analysis and Applications, Springer, Vol. 8, No. 4, pp. 332-344, 2006.

[11] F. Yi, Z. Chongxun, P. Chen, L. Li, "White Blood Cell Image Segmentation using On-Line Trained Neural Network", 27th Annual International Conference of the Engineering in Medicine and Biology (IEEE-EMBS), pp. 6476-6479, 2005

[12] B.Jyothi, Y.MadhaveeLatha, P.G.Krishna Mohan, V.S.K.Reddy "Medical Image Retrieval Using Moments", International Journal of Application or Innovation in Engineering & Management (IJAIEM), ISSN 2319 – 4847, Volume 2, Issue 1, January 2013.

[13] Ravishankar, Snehalatha&Mariamichael, Anburajan& v, Sowmiya&Balasubramaniam, Venkatraman&Menaka, M "Automated hand thermal image segmentation and feature extraction in the evaluation of rheumatoid arthritis". Proceedings of the Institution of Mechanical Engineers. Part H, Journal of engineering in medicine. 229. 319-31. 2015.

[14]Shivanand S. Gornale, Pooja U. Patravali, Ramesh R. Manza, "Detection of Osteoarthritis using Knee X-Ray Image Analyses: A Machine Vision Based Approach", International Journal of Computer Applications (IJCA), ISSN-0975-8887, Volume 145, Number 1, July 2016,pp.20-26.

[15] D E T Shepherd, B BSeedhom "Thickness of human articular cartilage in joints of the lower limb" Rheumatology and Rehabilitation Research Unit, University of Leeds, 36 Clarendon Road, Leeds LS2 9NZ.