ISSN: 0974-2115
www.jchps.com Journal of Chemical and Pharmaceutical Sciences

Medical Image based Segmentation using DTCWT and Marker Controlled Watershed Algorithm

Rajmohan K*, Thirugnanam G and Mangaiyarkarasi P
Departtment of EIE, Annamalai University, Chidambaram, India
***Corresponding author: E-Mail: ggtt_me@yahoo.com**

ABSTRACT

The images are partitioned into numerous mechanisms, thus every mechanism is meaningful, and this is image segmentation. Given that an image is poised of a number of pixels, the segmentation problem can be treated as a labeling problem which aims to assign each pixel a label demonstrating an exacting component in the scene. On the other hand, the segmentation task can be considered as extracting the boundaries between diverse objects, so that the image is partitioned into meaningful regions according to the boundaries. This paper proposes a new segmentation technique that combines Dual Tree Complex Wavelet Transform (DTCWT) decomposition with the watershed transform for an X-Ray medical image. The DTCWT is applied to the intensity image, producing detail and approximation coefficients. If simply watershed algorithm be used for segmentation of image, then it will have overlap in segmentation. To resolve this, we used the proposed approach which combines DTCWT and watershed algorithm. First we used the DTCWT to produce additional medical images, then watershed algorithm is applied for segmentation of the approximation image, then by using the inverse DTCWT, the segmented image is projected. The results demonstrate that combining DTCWT and watershed transform can help us to get the very high accuracy segmentation, even for noisy and satellite images.

KEY WORDS: X-Ray Imaging, Dual Tree Complex Wavelet Transform, Marker Controlled Watershed Algorithm, Image segmentation.

1. INTRODUCTION

Image segmentation is the separation of an image into significant areas relies on consistency. The aim of this is to make things easier the representation of an image into impressive that is further significant and easier to assess. It is useful to create matter and boundaries in images. Even if the performance of customary segmentation algorithms are incomplete by gloom harms and clamor leads to more-segmentation in little spaces, resulting in inferior precision. To exist over these problems, inspecting the images at multi-resolution is being measured. A chief calamity in watershed algorithm is severe more segmentation owing to the huge and diversity of tumult inside the image. Two restrictions in this algorithm are sustained to hard squeal and estimate needed to combine these areas. This problem is surmounting once segmentation technique is integrated in a multi-decree attitude.

Dual Tree Complex Wavelet Transform (DTCWT): The DTCWT was better to DWT and WPT because it not only overcomes over-completeness in DWT, but also shows better directional warmth than DWT. It uses real valued filters to employ analysis and synthesis. In added terms, it employs two real DWTs to acquire the true division and unreal division of complex wavelet. In this way, it avoids the problem of reconstruction using Complex Wavelet Transform and has more directional information. Figure 2 shows the process of 2-D DT-CWT decomposition, where H_{0a} and H_{0b} represent the low-pass filters for Tree A and Tree B respectively, and H_{1a} and H_{1b} represent the high-pass filters for Tree A and Tree B respectively. ↓2 denotes down sampling. The basic idea of DT-CWT is to employ two different filters for different trees. At the first level of decomposition, odd length filter is used for both trees. At the higher levels, odd length and even length filters are engaged in turn to make sure symmetric arrangement. It uses 1-D DT-CWT through rows and columns. 2-D DT-CWT decomposition will produce two low-frequency sub-bands and six high-frequency sub-bands at each level. Low-frequency sub-bands are used to construct approximation and detail frequency sub-bands at the subsequent level.

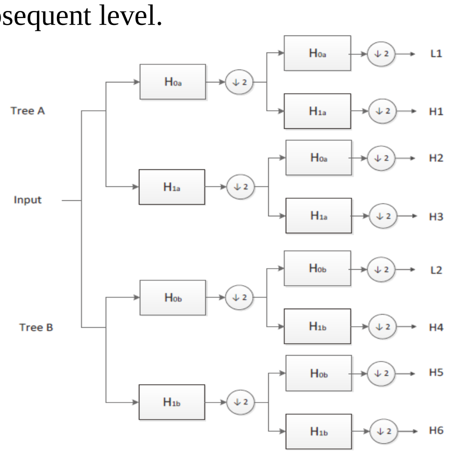

Figure.1. Two level DTCWT Decomposition

Marker Controlled Watershed Algorithm: Marker controlled watershed algorithm understands the catchment basins and crest position in an image. In supplies of the holdup connected to image segmentation the solution scrutiny is to alter the preliminary image into a dissimilar one whose catchment basins are the substance to recognize. In the image exploration, noise barring, exclusive of filtering the edge, is complicated. Noise is represented as pointed fine points in an image. Generally Fourier Transform holds back the piercing enviable frequencies, but reduces the roughness. Thus this is not applied for noise removal. So DTCWT is appropriate selection to pertain in time domain and in frequency domain.

2. PROPOSED TECHNIQUE

Marker controlled watershed based segmentation is the proposed technique in this work. In this part, watershed segmentation is used to opening sensitive substance in an image. This Marker controlled watershed segmentation procedure is to evaluate the purpose of segmentation, to assess the markers sense right to front and to detail the markers robust in to background. To become accustomed the minima at the front and back marker locations, the segmentation efficacy is adapted. To conclude, the Marker controlled watershed transform of the customized segmentation is determined.

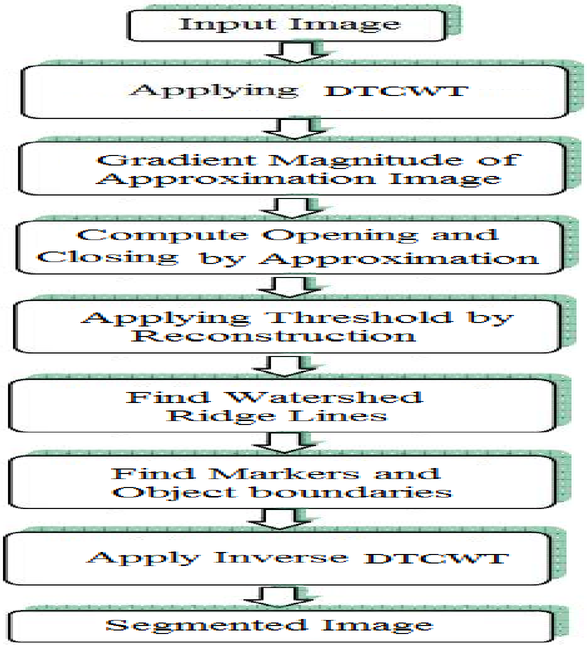

Figure.2. Image segmentation procedure

3. RESULTS AND DISCUSSION

In this work, X-Ray medical input image of size 512 x 512 is considered as shown in Fig.3. Principally the input image is examined to two levels using DTCWT for the development of multi-resolution sub-bands. 6 real and 6 imaginary coefficient images for +15˚, +45˚, +75˚ and -15˚, -45˚, -75˚ in six orientations, respectively are produced is shown in Fig.4. Gradient magnitude segmentation function is used in the low frequency sub-band and the boundaries of the objects are shown in Figs.5-13. Using marker controlled watershed transform directly on the image outcome in over segmentation. The segmented image is shown in Fig.14.

Figure.3. Input image

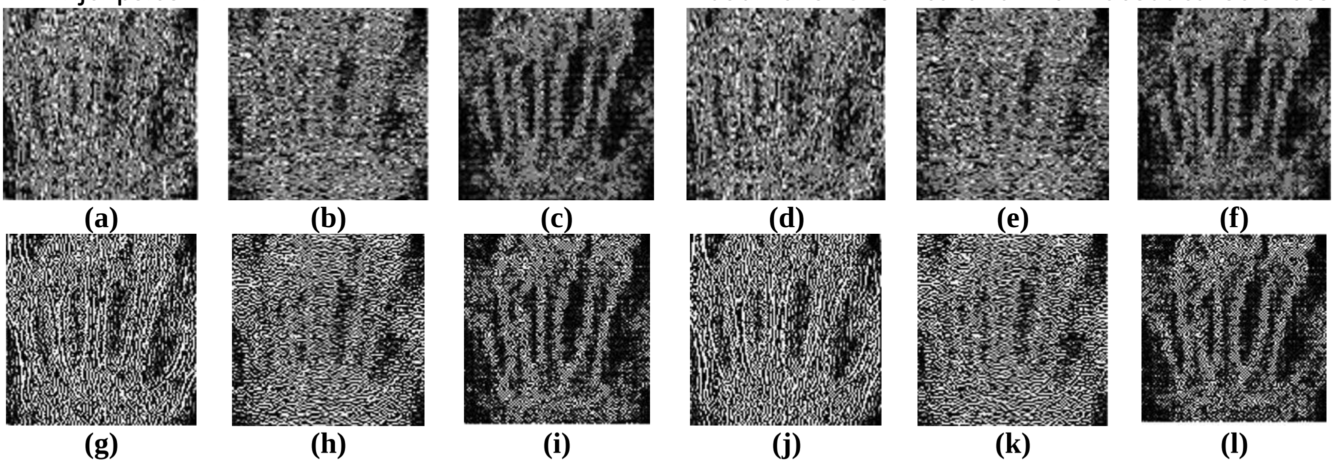

Figure.4. (a - f) Real coefficient images, (g - l) Imaginary coefficient images

Figure.5. Gradient magnitude

Figure.6. Opening

Figure.7. Opening by reconstruction

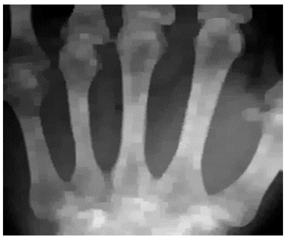

Figure.8. opening closing

Figure.9. Regional maxima opening

Figure.10. Maxima superimposed

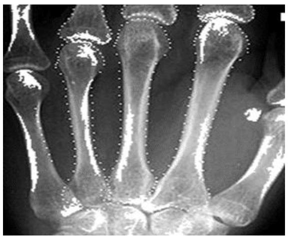

Figure.11. Modified regional maxima

Figure.12. Thresholded

Figure.13. Markers & object boundaries

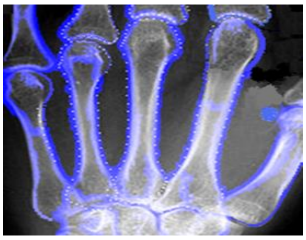

Figure.14. Segmented output

Table.1. Evaluation indices of hybrid DTCWT over DWT and WPT for medical images

Images	**Completeness (%)**			**Correctness (%)**			**Quality (%)**		
	DWT	**WPT**	**DTCWT**	**DWT**	**WPT**	**DTCWT**	**DWT**	**WPT**	**DTCWT**
MRI - 1	92.8723	96.3712	98.2098	92.9479	97.1098	98.9334	93.4219	96.4587	98.5782
MRI - 2	92.9856	96.4765	98.5231	93.6882	97.7403	98.5908	93.9034	97.2341	98.4876
CT Angio	91.8923	95.1459	97.4923	92.7092	96.9347	98.1357	92.5321	96.6423	98.2519
X-Ray	**92.1719**	**95.2674**	**97.6392**	**92.1098**	**96.3098**	**98.0023**	**91.7293**	**95.2916**	**98.6285**

4. CONCLUSION

This exertion explains advanced image segmentation by integrating the DTCWT and Marker controlled watershed transform. Watershed is appallingly vulnerable to resound and results in surfeit segmentation. To resolve this impede, the proposed transforms are synthesized for getting higher the result precision. The simulation results divulge that this proposed technique can able to separate the entity in accurate manner. The proposed hybrid DTCWT based scheme performs better for segmentation when compared to wavelet and wavelet packet transform based segmentation for various medical images.

REFERENCES

Bhandarkar S.M, Hui Z, Image segmentation using evolutionary computation, IEEE Trans. Evolut. Comput, 3 (1), 1999, 1–21.

Gonzalez R.C, Woods R.E, Digital Image Processing, 2nd ed, Prentice-Hall, Reading, NJ, USA, 2002.

Kim H.J, Kim E.Y, Kim J.W, Park S.H, MRF model based image segmentation using hierarchical distributed genetic algorithm, IEE Electronics. Letters, 34 (25), 1998, 1394–1395.

Kim J.B, Kim H.J, Multi-resolution –based watersheds for efficient image segmentation, Patt. Recognition Lett, 24, 2003, 473- 488.

Ma W.Y and Manjunath B.S, Edge flow: a technique for boundary detection and image segmentation, IEEE Transactions on Image Processing, 9 (8), 2000, 1375-1388.

Meinel G, Neubert M, A Comparision of segmentation programs for high resolution remote sensing data. Int. Arch. of Photogrammetry, 35 (B4), 2004, 1097-1102.

Pal N.R, Pal S.K, A review on image segmentation techniques, Patt. Recognit, 26 (9), 1993, 1277–1294.