Performance Analysis of Different Feature Extraction Algorithms

V. Ranjath Kumar[1], R. Nathiya[2]

[1]PG Student, WC, [2]Senior Assistant professor, ECE
Christ College of Engineering and Technology, Puducherry, India

Abstract – Feature extraction is the method of defining a set of features, which will most effectively represent the information that is important for analysis and concurrence. Gray level co-occurrence matrix (GLCM) is an important method to take out the texture features in medical image. Gray level co-occurrence matrix can simply take out the texture under single scale and single direction. However its description of the texture feature is not so detailed that is not good enough to extract the feature by this method. Nonsubsampled counter transformation (NSCT) is a kind of algorithm. This use the iterative nonsubsampled filter store to achieve a series of multi-scale, multi-direction and translation invariant frequency field sub-image. It is an move toward to texture extraction fall under the category of pixel base scheme. Quad tree decomposition is to be proposed to achieve more accuracy and it can highlight the details of image, more feature details can be extracted from the visual important objects that from the monotone area of the image. The image retrieval performance is highly improved as compared with the pixel based method.

Keywords – Gray level co-occurrence matrix, Nonsubsampled counter transformation, Quad tree decomposition, pixel based method.

I. INTRODUTION

Image processing is computer imaging where the image are to be examined and a acted upon by people. Image Processing is a technique to improve the quality of the raw images received from cameras & sensors placed on satellites, space probes and aircraft's or pictures taken in normal day-to-day life for various applications. There are various techniques which are emerging in Image Processing during the past decades. Most of the techniques are developed for improving or increasing the quality of images obtained from space probes and military reconnaissance flights.

Image segmentation is the method of dividing an image into regions or categories, that corresponds to different objects or parts of objects. Each and every pixel in an image is allocated to one of a number of these categories. A good segmentation is one where:

i. Pixels in the same category have same grey-scale which involves two or more variable quantities. values and thus forming a connected region.
ii. Neighboring pixels which are in different categories have different values.

Segmentation is often the critical step in image analysis. If segmentation is done well then all other stages in image analysis are made simpler.

There are three general approaches to segmentation, termed as

i. Threshold
ii. Edge-based methods
iii. Region-based methods

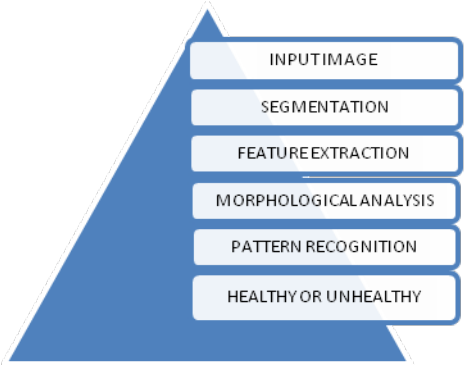

Fig 1 System overview

Thresholding is the simplest method of image segmentation. From a image which is in grayscale, thresholding can be used to create binary images.The region based segmentation is the dual approach of finding the object region instead of its edges. In theory, finding an object by locating its boundary and finding it by establishing the region it covers will give

you exactly the same object; the boundary and the region are just different representations of the same object. In practice, however, taking an edge based approach to segmentation may give radically different results than taking a region based approach. The reason for this is that we are bound to using imperfect images and imperfect methods, hence the practical result of locating an object boundary may be different from locating its region.Region based segmentation methods has only two basic operations: splitting and merging, and many methods even feature only one of these

This paper aims is to improve the accuracy rate and good edge retention effect using Feature Extraction method.

The rest of this paper is organized as follows. In section II, a brief overview of the existing GLCM AND NSCT method In section III the proposed method which Quad tree method and explains how the proposed scheme is more beneficiary than the existing models .Section IV consists of the simulation results and the results have been compared with the existing model. Section V concludes the paper

II. REVIEW OF GLCM AND NSCT METHODS

This section explains about the existing GLCM and NSCT methods

A. GLCM

(i) Gray Level Co - Occurrence Matrix

One common texture classification technique is Haralick feature extraction, that uses gray-level co-occurrence matrices (or GLCMs), which give an indication of how uniform or non uniform a given texture is. While gray-level co-occurrence matrices are rotation invariant where statistical analysis performed on these GCLMs (developed by Haralick) provide useful information about how gray scale values in the image matrix vary in a rotation invariant manner. This is done by calculating the GLCM over the four possible orientations for the four pixel neighbor orientations

(ii) Haralick Statistics

The idea of Haralick texture classification is that these statistics give a general idea of the pattern of neighbouring pixels. Since GLCMs give information about the relations of neighboring pixels to each other, they are a very good measure of the variation patterns of image pixel values in an image. There are several different statistics that are used on each GLCM to formalize these so called ”patterns.” . To reduce dimensional and induce rotation invariance, these quantities were averaged over the four possible GLCMs for the typical Moore neighbourhood pixel representation.

(iii) Gabour Features

The Gabor wavelets are constructed using the Gabor filter method, which is a band pass filter applied to the image at different orientations and scales, similar to a mechanism used by the human visual system. I used the starter code from the author of [1, 2] and use of these features was inspired by a patent on phase contrast texture classification.

(iv) Radial Component

The first step in calculating the Gabor features is to use a low pass filter in order to ensure that the normalization of the Gabor filter can be performed. Since low pass filter use the function sin cx = sin x s, multiplying this to the Gabor filter will allow the values of the Gabor filter to fall off at the corners of the image as required.

Homogeneous Area:

$$HOM = \sum\sum_j \frac{p(i,j)}{[1+(i-j)^2]} \quad (1)$$

Angular Second Moment:

$$ASM = \sum_{i=0}^{n}\sum_j [p(i,j)]^2 \quad (2)$$

Entropy:

$$ENT = \sum_{i=0}^{n}\sum_j p(i,j)\log(p(i,j)) \quad (3)$$

Dissimilarity:

$$DIS = \sum_{i=0}^{n}\sum_j |i-j|p(i,j) \quad (4)$$

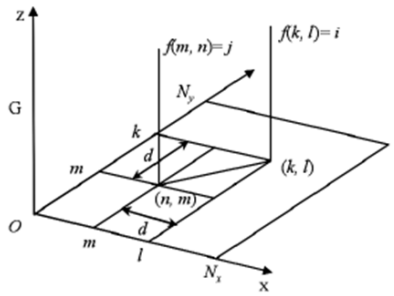

Fig 2 Schematic diagram of gray level co –occurrence matrix structure

B. NSCT

Gray level co-occurrence matrix (GLCM) is an important method to extract the image texture features. However, GLCM can only extract the textures under single scale and single direction.

A kind of texture feature extraction method combining non-subsampled contour transformation (NSCT) .

The segmentation quality of the images directly influences the late target. The general image segmentation methods often fail due to the imaging particularity of medical images. However, it is difficult to achieve good medical image segmentation just by using gray features. The reason is because medical images reflect the backscattering characteristics of the microscopic outcome. If different objects have same or similar backscattering coefficients, they will exhibit same or similar gray values in the medical images, and accordingly confusion will occur. The texture information of medical images is very rich. The different shapes and different physical features of the imaging targets show different textures, and these textures can become the important basis for the radar to distinguish different objects. The segmentation method based on pixel features can make full use of the intrinsic properties of the images (Such as texture features), and conduct multi-feature fusion through extracting various different features, so as to achieve high segmentation precision.

Gray level co-occurrence matrix (GLCM) is the common method to describe the textures. However, its descriptions of the texture features are not so detailed that it is not good enough to extract the features by this method. In order to make full use of the advantages of GLCM and multi-resolution transformation, many scholars have researched the texture feature extraction method of multi-scale GLCM. A method to conduct the symbiosis feature extraction on the approximation sub-band on each scale of wavelet transforms. This method can describe the texture structure effectively under different resolutions and it is successfully used for the fabric texture recognition, but it ignores to use the detail sub-band of wavelet transform. To use GLCM in the wavelet detail sub-band to extract the symbiosis features of the texture, and used it for the defect detection of texture surface. But it is insufficient to describe different texture details just with wavelet detail sub-band. The previous experiments conducted by many scholars showed that the classification accuracy of using different ways to extract the texture feature for fusion was higher than that of the classification only using a kind of texture. A texture image segmentation algorithm combining non-subsampled contour transformation (NSCT) then extracted the texture features, and finally completed the segmentation of the entire feature image by SVM. However, only the multi-scale feature of the image is extracted through this method, while the spatial structure information of the texture is ignored. In view of the features such as large gray change complex texture and fuzzy boundaries the wavelet transform has limited isotropy and directionality (Three), there is no translation invariant, and the singularity on the line is not the optimal basis, so the texture information is fully shown. As a kind of multi-scale geometric analysis tool, NSCT has the optimal representation form on the curve singularity function, it can overcome the above-mentioned shortcomings of the wavelet transform, and it has obtained good effect in the field of the image analysis (such as noise reduction, feature extraction and retrieval). GLCM is a kind of texture analysis method which is used most widely and it is commonly used to extract the texture features of the images. The multi-resolution and multi-direction characteristics of NSCT can be combined with the texture structure information of GLCM to extract the texture features of medical images with GLCM in the NSCT domain, so that the gray symbiosis features can provide the dynamic information of texture space scale change and have better descriptive ability for the texture. At the same time, we can give full play to the characteristics of multi-direction of NSCT by extracting the symbiosis amount of different sub-band in the NSCT domain (Each sub-band of NSCT represents different direction information)

III. PROPOSED SCHEME USING QUAD-TREE

The image is segmented into variable sized blocks, named homogeneous blocks, which are very important of feature extraction process. Because the quad tree decomposition can brighten the details of the image, more feature facts can be extracted from the visual important objects than from the monotone areas of the image. The experimental results clearly proves that image retrieval performance is effectively improved as compared with the pixel based method.

All feature sets are computed directly from the Quadrature Mirror Filter (QMF) wavelet representation of the images. While the QMF wavelet features have been found to provide good classification of textures, that feature sets derived from other image representations, such as DCT and uniform sub band representation, are also effective. QMF wavelet features - the application to large image databases.

The spatial quad-tree approach, each quad-tree node points to a block of image data. Children nodes are merged when the discriminate functions indicate that the children blocks contain sufficiently similar textures. A "Query-by- texture" examines the blocks identified by the final quad- tree structures to test the similarity to a texture-key used for the search.

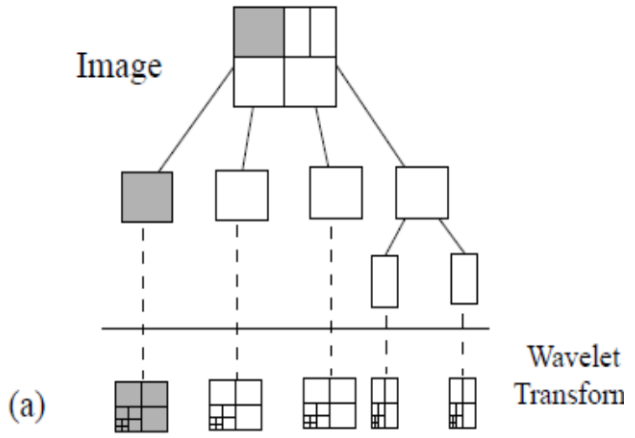

Fig 3. Quad tree method

Quadtree decomposition divides a square image into four equal-sized square blocks, and then tests each block to see if it meets some criteria of similarity.The result can have blocks of several different sizes.

S = qtdecomp (I) performs a quadtree decomposition on the intensity image I and returns the quadtree structure in the sparse matrix S

S = qtdecomp (I, threshold) splits a block if the maximum value of the block elements minus the minimum value of the block elements is greater than threshold

S = qtdecomp(I, threshold, min dim) will not produce blocks smaller than min dim, even if the resulting blocks do not meet the threshold condition

IV. SIMULATION RESULTS AND ANALYSIS

This section provides the simulation results of the proposed model and it is compared with the exisitng GLCM method.

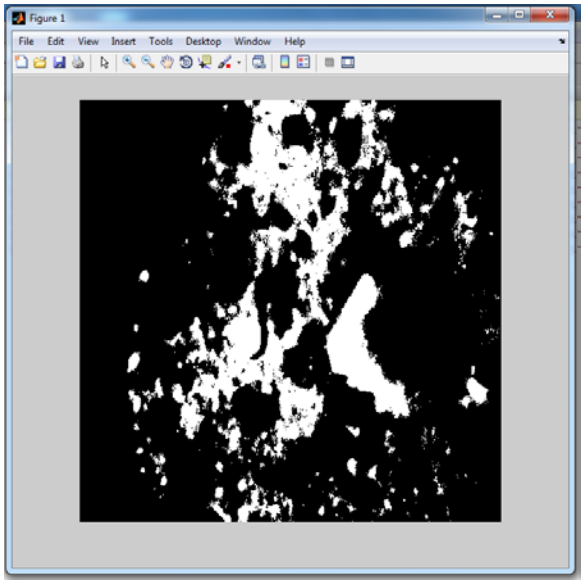

Fig 4 Input Image

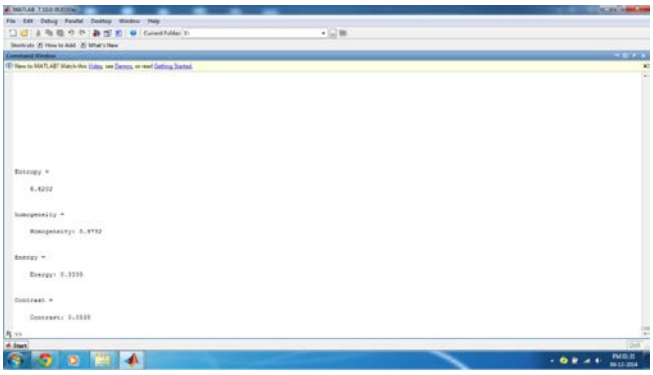

Fig 5 GLCM Output

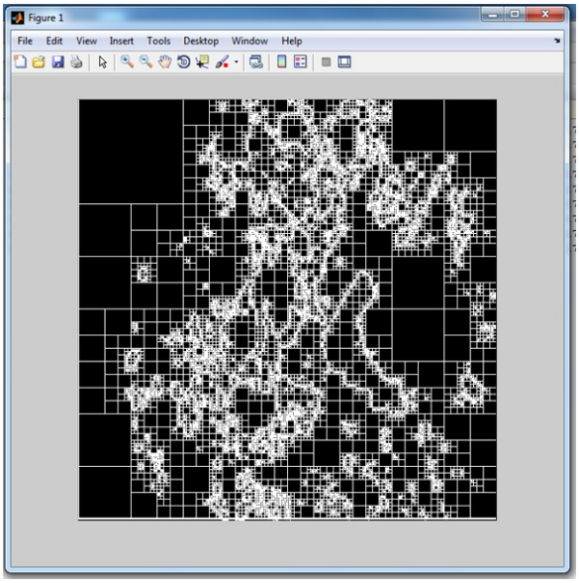

Fig 6 Quadtree Output

A Performance Comparison Of Different Feature Extraction Method

Property	GLCM	NSCT USING GLCM	Quadtree
Entropy	6.6202	6.586	0.8714
Homogeneity	0.9732	0.9712	0.8429
Energy	0.3335	0.3380	0.4396
Contrast	0.0176	0.0535	8.7964

V. CONCLUSION

A GLCM textural feature extraction method based on NSCT domain and a multi-feature vector was formed combining with gray feature; at the same time, through correlation analysis, the feature quantity extracted to eliminate the redundancy of feature quantity and reduce calculation amount and storage space is proposed . At last a new tool SVM with good performance to divide the feature quality and achieved the segmentation of medical images is used. Experimental result clearly shows that the detailed and smooth boundary direction information, eliminated effectively. The incorrect segmentation in the domain and provided accurate segmentation result. By extracting symbiosis amount in NSCT domain, a multi- scale and multi-direction textural feature extraction was realized textural feature could be better described. The experimental results showed the effectiveness of multi-feature fusion. In the next step, GLCM in other multi-scale transformations, such as direction let and others; in terms of feature extraction, we should seek for the features that can describe the inherent attributes of objects in images, such as extracting stable textural features with different feature extraction methods; the sample selection in the paper was selected by manual work and to realize automatic selection. GLCM output is not efficient so we use quadtree output as input to GLCM for feature extraction so we efficient out when compare to other method

REFERENCES

[1] He Xiaolan and Wu Yili,"Texture Feature Extraction Method Combining Nonsubsampled Contour Transformation with Gray Level Co-occurrence Matrix", *Zhejiang University City College, Hangzhou 310015, China Wu Yiwei Valparaiso University, IN 46383,* USA .2013

[2] An Chengjin, Niu Zhaodong, Li Zhijun et al. Threshold Comparison of Typical Otsu Algorithm and Water Area Segmentation Performance Analysis of its SAR Image. *Journal of Electronics Information Technology*, 2010, 32(9) pp. 2215-2219.

[3] Jiao Licheng. Intelligent SAR Image Processing and Interpretation. *Beijing: Science Press*, 2008.

[4] Kandaswamy U, Adjeroh D A, Lee M C. Efficient texture analysis of SAR image. *IEEE Transactions on Geoscience and Remote Sensing*, 2005, 43(9) pp. 2075-2083.

[5] Wang Zhi-Zhong, Yong Jun-Hai. Texture analysis and classification with linear regression model base on wavelet transform. *IEEE Transactions on Image Processing*, 2008, 17(8) pp. 1421-1430.

[6] Su Hui, Fei Shumin. Fabric Texture Recognition Based on Multi-resolution Analysis and Gray-level Co-occurrence Matrix: the second term of Chinese Control Conference. Beijing: *Press of Beijing University of Aeronautics and Astronautics*, 2006 pp. 1867-1871.

[7] Han Yanfang, Shi Pengfei. Texture Surface Damage Inspection Based on the Multi-layer Wavelets and Co-occurrence Matrix. *Journal of Shanghai Jiaotong University*, 2006, 40(3) pp. 425-430.

[8] Shang Zhaowei, Zhang Mingxin, Zhao Ping et al. Texture Retrieval and Similarity Calculation Based on Different Complex Wavelet Transform Methods. *Journal of Computer Research and Development*, 2005, 42(10) pp. 1746-1751.

[9] Zhong Hua, Yang Xiaoming, Jiao Licheng. Textural image classification Based on Multi-resolution Co-occurrence Matrix. *Journal of Computer Research and Development*, 2011, 48(11) pp. 1991-1999.

[10] CLAUSI D A. Improved Texture Recognition of SAR Sea Ice Image by Data Fusion of MRF Features with Traditional Methods. *IEEE Transactions on Geoscience and Remote Sensing Symposium*, 2001, 3 pp. 1170-1172

[11] Wang Haifeng, Li Zhuang, Ren Honge et al. Textural Image Segmentation Algorithm Based on Non-subsample Contourlet Transform and SVM: *the 29th term of Chinese Control Conference Proceedings. Beijing*, 2010 pp. 2712-2716.

[12] Wang Qingxiang, Li Di, Zhang Wujie. Non-supervision Segmentation Based on Multi-feature SAR Images. *Computer Science*, 2010, 37(10) pp. 267-270.

[13] CUNHA A L, ZHOU Jian-Ping, DO M N. The Nonsubsampled Contourlet Transform: Theory Design, and

Applications. *IEEE Transactions on Image Processing*, 2006, 15(10) pp. 3089-310l

[14] HARALICK R M, SHANMUGAM K, DINSTEIN L. Textural features for image classification. *IEEE Transactions on Systems, Man and Cybernetics*, 1973, 3(6) pp. 610-621.

[15] Bo hua, Ma Fulong, Jiao Licheng. Analysis of Gray Co-occurrence Matrix Computational Problems of Image Texture. *Chinese Journal of Electronics*, 200634(1) pp. 155-158.

[16] FABIO D A, PAOLO G. Texture-based characterization of urban environments on satellite SAR images. *IEEE Transactions on Geoscience and Remote Sensing*, 2003, 41(1) pp. 153-159

[17] Zhang Xuegong. About Statistics Learning Theory and Support Vector Machine. *Acta Automatica Sinica*, 2000, 26(1) pp. 32-42.

[18] Chang Chih-Chung, Lin Chih-Jen. LIBSVM toolbox [EB/OL]. (2012-11) [2012-11-22]. *http: //www. csie. ntu. edu. tw/~cjlin*

[19] Wang Xingling, Li Zhanbin. Determination of Kernel Function Parameters of Support Vector Machine Based on Grid Research. *Journal of Ocean University of China*, 2005, 35(5) pp. 859-862.

[20] Huang liang, Shu Ning. Simple Target SAR Image Segmentation Based on Support Vector Machine. *Geospatial Information*, 2011, 9(1) pp. 60-62.