

Classification of Liver Tumor on Ct Images using Machine Learning



A.Keerthana, G.Srividhya, R.J.Hemalatha, Jaya Rubi

Abstract: Liver tumor is one of the most severe types of cancerous diseases which is responsible for the death of many patients. CT Liver tumor images have more noises which is difficult to diagnose the level of the tumor. It is a challenging task to automatically identify the tumor from CT images because of several anatomical changes in different patients. The tumor is difficult to find because of the presence of objects with same intensity level. In this proposed system, fully automated machine learning is used to detect the liver tumor from CT image. Region growing technique is used to segment the region of interest. The textural feature are extracted from Gray level co-occurrence matrix (GLCM) of the segmented image. Extracted textural features are given as input to the designed SVM classifier system. Performance analysis of SVM classification of CT liver tumor image is studied. This will be useful for physician in better automatic diagnosis of liver tumor from CT images.

Keywords: CT Liver image, Region growing, Gray level co-occurrence matrix (GLCM), SVM.

I. INTRODUCTION

Liver cancer tumor, is sixth dangerous disease in the world and leading cause of cancer mortality. It is very difficult to diagnose at initial stage because of its position inside the body [1]. The cause of liver cancer is cirrhosis due to either hepatitis B, hepatitis C, or alcohol. This type of cancer can be identified by chemicals found in blood. Like high levels of alpha-fetoprotein (AFP) in the blood can be found in many cases of Hepatocellular carcinoma (HCC) and intrahepatic cholangiocarcinoma. Nowadays computer is used in modern medicine to diagnose the disease. There are many imaging modalities are used in diagnosing primary liver cancer like Ultrasound, PET (Positron Emission Tomography), Computer Tomography (CT) and Magnetic Resonance Imaging (MRI) [kumar]. There are two classes of liver tumors: benign and malignant [3]. Non Invasive and Non-Ionizing medical imaging techniques are very safe for human beings and can be repeated for several times. However these techniques only provide information on the

anatomical structure which depends primarily on anatomical variations of the tumour from the surrounding breast tissue, lacking functional information.

CT image provides proper outline of liver than any other diagnosing techniques and provides fine details of liver. An estimate of 24,550 liver cancer deaths is expected in 2015. Early detection can vastly improve survival by obtaining clear details from CT liver image. Large database provides clear details of tumor and current condition, severity of tumor which is helpful in diagnostic and therapeutic purposes.

II. MATERIALS AND METHODOLOGY

A. Image Processing

It is very difficult to segment the tumor from CT image automatically because of variation in size, shape and position of tumor and presence of other objects with same intensity. So, it is required to segment the liver from the background so obtain the only tumor. This paper presents a new technique for segmenting the liver tumor from CT images automatically. The proposed method uses combination of pre-processing steps for automatic segmentation of liver and region growing process for tumor segmentation. The proposed scheme consists of two sub-routines: initial segmentation and refinement. Experimental results show the ability of the proposed algorithm to accurately segment the liver structure in presence of liver tumor and other anatomic organs, and suggest its suitability to other medical image segmentation tasks.

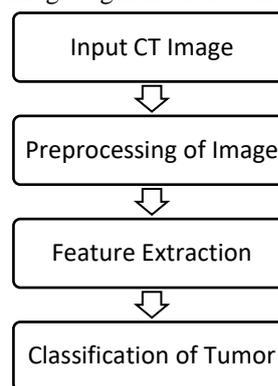


Fig.1 Block Diagram

CT images usually contain many noises so we need to do smoothing for the image which makes the intensity distribution of liver to be smoothed too, so pre-processing step is necessary for accurate liver segmentation. The granular noise in CT image can be reduced by using median filter. The 3 x 3 pixel square kernel will be convolved cross the input image.

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To reduce the computational efforts it is better to know the shape, intensity and location of abdominal CT image which helps in accurate segmentation.

B. Region Growing

Region growing technique is used to segment the region of interest of CT image.

It is the method of segmentation in which seed points will be fixed and the region grows by adding the neighboring pixels to it. Region-based segmentation is a technique is used for determining the region directly. The region growing process involves selection of seed point. Subsequently, the similarity between the seed point and the 4-connected neighborhoods are determined.

C. Feature Extraction

Features will be extracted from the processed CT Liver image. The Features like Contrast, Correlation, Energy, and Homogeneity.

D. Gray Level Co-occurrence Matrix (GLCM)

The gray level Co-occurrence matrix (GLCM) is calculated to know the pixel intensity value i to the spatial relationship to pixel value j . Each element (i,j) in the resultant glcm is the sum of the number of times that the pixel with value I occurred in the specified spatial relationship to pixel with value j in the input image. The texture filter functions, described in texture analysis cannot provide information about shape, i.e., According to co-occurrence matrix, Haralick defines fourteen textural features measured from the probability matrix to extract the characteristics of texture statistics of CT images.

E. Classifier

The feature extracted in the previous step is taken and is utilized in training the classifier. The classifier used for the classification of these features is SVM classifier. Linear Support vector Machine is a technology used to classify the vectors with high accuracy in minimizing errors. The SVM technology used to classify the non-linear and linear data which is the gives good accuracy in statistical learning theory. Non-linear mapping is used to transform the original training data into higher dimension. SVM technique can be useful in optimizing various problems such as regression, the classic problem is that of data classification.

III. RESULTS

There are 12 images are the input images that are segmented using region growing algorithm.



Fig.2 Original Image

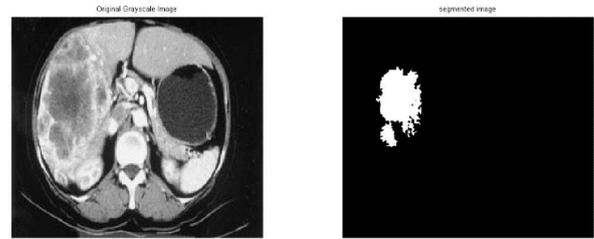


Fig.3 Segmented Image

The texture features extraction of region of interest is made and the results are tabulated in Table 1

Table 1 Feature Extraction of Normal Images

S.NO	CONTRAST	CORRELATION	ENERGY	HOMOGENITY
1	0.0072	0.9842	0.5266	0.9964
2	0.0461	0.7011	0.8020	0.9770
3	0.0059	0.8644	0.9506	0.9971

Table 2 Feature Extraction of Abnormal Images

S.NO	CONTRAST	CORRELATION	ENERGY	HOMOGENITY
1	0.0042	0.9681	0.8652	0.9979
2	0.0052	0.9503	0.8894	0.9974
3	0.0081	0.9829	0.5158	0.9959
4	0.0318	0.8674	0.7292	0.9841
5	0.0104	0.9788	0.5014	0.9948
6	0.0078	0.9181	0.8969	0.9961
7	0.0069	0.7034	0.9699	0.9965

The features extracted from the segmented regions are classified using SVM classifier. Feature extraction of abnormal images.

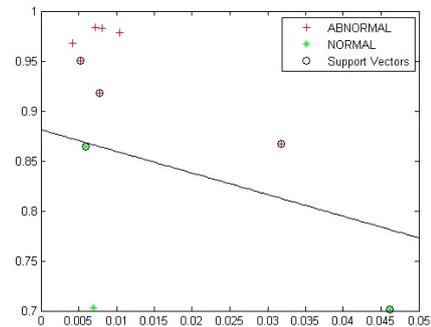


Fig.3 Output of SVM Training

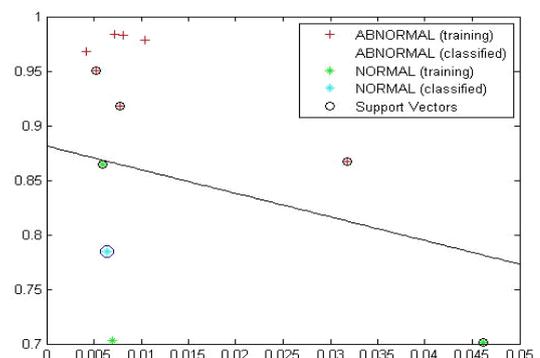


Fig 4 Classification of testing image- Abnormal

Table 3 Feature of Testing Images

Features	Values
Contrast	0.0157
Correlation	0.9156
Energy	0.7992
Homogeneity	0.9922

Depending on the classifier output a confusion matrix is constructed from which the accuracy of the design is calculated. The calculated accuracy is 91%.

Table 3 Confusion Matrix

	P	N
T	9	2
F	0	1

IV. CONCLUSION

The tumor region is segmented using region growing algorithm for segmentation and tumor detection, then followed by classification using Support vector machine(SVM) by using GLCM features. The obtained accuracy using SVM is 91%.In future the application can be further developed by applying the technique to a large database, time efficiency should be improved in such a case. Different types of classifiers can be implemented to determine the best classifier that gives more accurate decision in determining the cancer.

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A.Keerthana Experienced Assistant Professor in Biomedical Engineering Department, VISTAS, Chennai, India. Skilled in Research and development in Instrumentation and Image Processing. She published research paper in reputed journals and wrote 2 book chapters. She has membership in Indian Academicians And Researchers Association (IARA), Institute for Engineering Research and Publication etc...



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