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A Review: Liver Cancer Detection Algorithm

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Abstract: The liver is the largest internal organ in the human body. It performs a multiplicity of life sustaining functions and fundamentally affects every physiological process in the body. The liver is the second organ most normally involved by metastatic disease, being liver cancer one of the prominent causes of death worldwide. The early detection and diagnosis of liver tumor is consequential for the detection of liver tumor. Medical image processing is used as a non-invasive method to detect tumors. Many techniques have been developed for the detection of liver tumor utilizing the aberrant lesion size and shape. This paper reviews many different liver tumor detection algorithms and methodologies utilized for liver tumor diagnosis. The novel methodology for the detection and diagnosis of liver tumor is additionally proposed in this paper for the detection and diagnosis of liver tumor.

Keywords: liver tumor segmentation, CT image, computed tomography.

I. INTRODUCTION

Liver cancer is one of the major death factor in the world and also known as hepatic cancer; it is a cancer which starts in the liver, and not from another organ which ultimately travels to the liver. In other words, there may be cancers which start from somewhere else and end up in the liver - those are not (primary) liver cancers. Cancers that originate in the liver are known as primary liver cancers. Liver cancer comprises of malignant hepatic tumors (growths) in or on the liver. The most common type of liver cancer is hepatocellular carcinoma (or hepatoma or HCC), and it tends to affect males more than females. Early detection and accurate presentation of liver cancer is a significant issue in practical radiology. Liver lesions refer to those abnormal tissue cell that are found in the liver. Liver lesions are a wound or injury in the tissue areas of the body due to harm caused by a wound or disease. These lesions can be identified in a CT scan by a difference in pixel intensity from other regions of the liver. For proper clinical treatment, manual segmentation of this CT scan is difficult and excessively time consuming task. [1] Alternatively, automatic segmentation is very challenging task, due to numerous issues, including liver stretch over 150 slices in a CT image, poor intensity contrast between lesions and other nearby similar tissues and indefinite form of the lesions.

Segmentation of liver tumors is a significant prerequisite task afore any medical intervention. A precise and perfect examination of the lesions/tumors allows for accurate staging and evaluation of the available therapies that can be provided to the patient. Over an interval of time it track the progress of the therapy as well as it can help in deciding the best treatment approach. Also, tumor segmentation plays a vital role in the development of 3D surgical tools that can help and guide the surgeon for the complete removal of the tumor rendering the patient free of the underlying disease.
Accurate and early detection of the tumor is very important for the diagnosis and treatment of the disease.
Since CT is one the most commonly used imaging modalities in the diagnosis of liver tumors, segmentation and calculation of volume becomes essential. Various automatic/semiautomatic techniques for liver tumor segmentation have been developed based on strategies which include Bayesian approaches, entropy based segmentations, level set techniques, multi-level thresholds, and region growing techniques.
So, we have studied different methodologies to detect cancer as well as proposed a new, less computational complex, robust comparatively accurate methodology of cancer diagnosis.

CT SCAN IMAGE

A computerized axial tomography scan (CT scan) is an x-ray method that combines several x-ray images with the aid of a computer to produce cross-sectional views and three-dimensional images of the interior organs and structures of the body. A CT scan is used to define normal and abnormal structures in the body and/or assist in procedures by helping to precisely guide the placement of instruments or treatments.

It is a medical imaging method that employs tomography. Tomography is the method of producing a two-dimensional image of a slice or section through a 3-dimensional object (a tomogram). CT scans of the abdomen are extremely helpful in defining body organ anatomy, including visualizing the liver, gallbladder, pancreas, spleen, aorta, kidneys.

To verify the existence of tumors, infection, abnormal anatomy, or changes of the body from trauma, CT scans in this area are used. The CT image is sufficient for analysis for this proposed method. Moreover MRI Scan is very costly and the tissues can’t able to view clearly. But the CT is not so costly but also the tissues can be clearly visible in CT scan.

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II. EARLIER WORK

M V Sudhamani, G T Raju proposed that Segmentation of CT liver images helps to analyse the occurrence of hepatic tumor and classify the tumor from images. Here, to examine the neighbouring pixels of initial seed points and determine whether the pixel neighbours should be added to the region or not they used region growing technique. The procedure is iterative and seed point is selected interactively in the suspected region. The watershed segmentation method is used to segment the contour, which is generated by the region growing. The texture features for segmented region are extracted through Grey Level Co-occurrence Matrix (GLCM). These features are used to classify the tumor as benign or malignant using Support Vector Machine (SVM) approach. In this paper, a semi-Automated system has been presented which is robust, allows radiologist and surgeons to have easy and convenient access to organ measurements and visualization. Experimental results shows that liver segmentation errors are reduced significantly and all tumors are segmented from liver and are classified as benign or malignant. [2]

In segmentation module, the selection of ROI from the suspicious region is done using region growing algorithm. The region growing is a region-based image segmentation method. Here, the human expert intervention is needed to select the seed point of the suspected region. For this purpose, the CT image has to be pop up from the location where it is stored and then seed pixel has to be selected by using plus mark curser with clicking one time on the suspected area of the image.

L. Ali, A. Hussain, J. Li, U. Zakir, X. Yan, A. Shah, U. Sudhakar research objective is to grow a robust and intelligent clinical decision support framework for disease management of cancer based on legacy Ultrasound (US) image data collected through numerous stages of liver cancer. The proposed intelligent CDS framework will automate real-time image enhancement, segmentation, disease classification and progression in order to enable efficient diagnosis of cancer patients at early stages. The CDS framework is motivated by the human interpretation of US images from the image acquisition stage to cancer progression prediction.

Specifically, the proposed framework is composed of a number of stages where images are first acquired from an imaging source and pre-processed before running through an image enhancement algorithm. The detection of cancer and its segmentation is considered as the second stage in which different image segmentation techniques are utilized to partition and extract objects from the enhanced image. The third stage involves disease classification of segmented objects, in which the meanings of an investigated object are matched with the disease dictionary defined by physicians and radiologists. In the final stage; cancer progression, an array of US images is used to evaluate and predict the future stages of the disease. For experiment purposes, we applied the framework and classifiers to liver cancer dataset for 200 patients. Class distributions are 120 benign and 80 malignant in this dataset. [3] Classifiers performance is measured by introducing WEKA Explorer where several classifiers such as Bayesian Logistic regression, Multi-Layer Perception, KNN, J48graft and SVM classifier were tested on LESH features. SVM produced 95.29% accuracy results and performed better among the machine learning algorithms tested.

Yu Masuda, Amir Hossein Foruzan, Tomoko Tateyama and Yen Wei Chen proposes a new method to detect liver tumors in CT images automatically. The proposed method is composed of two steps. In the first step, tumor candidates are extracted by EM/MPM algorithm; which is used to cluster liver tissue. To cluster a dataset, EM/MPM algorithm exploits both intensity of voxels and labels of the neighbouring voxels. It increases the accuracy of detection, with respect to other probabilistic approaches. In the second step, false positive candidates are filtered by using shape information. They use tumor shape information to reduce the false positive regions. As tumors have usually a sphere-like shape, we just need to check the circularity of the candidate regions in each slice to reject false positive. In proposed method they also reject those candidate tumors that their centroids are near the liver boundary. Quantitative evaluation of our method shows that it can decrease false positive rate successfully without decreasing true positive rate, compared with other conventional methods. [4]

Pedro Rodrigues, Jaime Fonseca and João L. Vilaça proposed an interactive algorithm for liver tumour segmentation was developed, allowing the user to quickly paint the object of interest in the image using an intelligent paintbrush. This technique was based on an image partitioning into homogeneous primitives regions by applying a pseudo-watershed algorithm on an image gradient magnitude. Outcome of this initial segmentation was the input of an efficient region merging process to find the best image partitioning, based on the minimum description length principle. The algorithm was evaluated on Computed Tomography (CT) and Magnetic Resonance (MR) data using the dice similarity coefficient (DSC) as a statistical validation metric. This led to a DCS mean scores of 87% and 84% on the CT and MR studies, respectively. [5]

A semi-automatic algorithm was presented providing a powerful technique allowing liver tumour segmentations in CT and MR images. The segmentation was reduced by selecting all primitives regions belonging to the anatomical target, instead of having to considerer all pixels. It decreased the total number of decisions, time-consumption and user dependence and increases the segmentations efficiency and robustness. It also has a high sensitivity detecting tumor boundaries located near other anatomical structures, identifying weak edges, robustness against image noise, and being able to segment hyper dense and hypo dense metastasis with different size and shape.

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III. METHODOLOGY

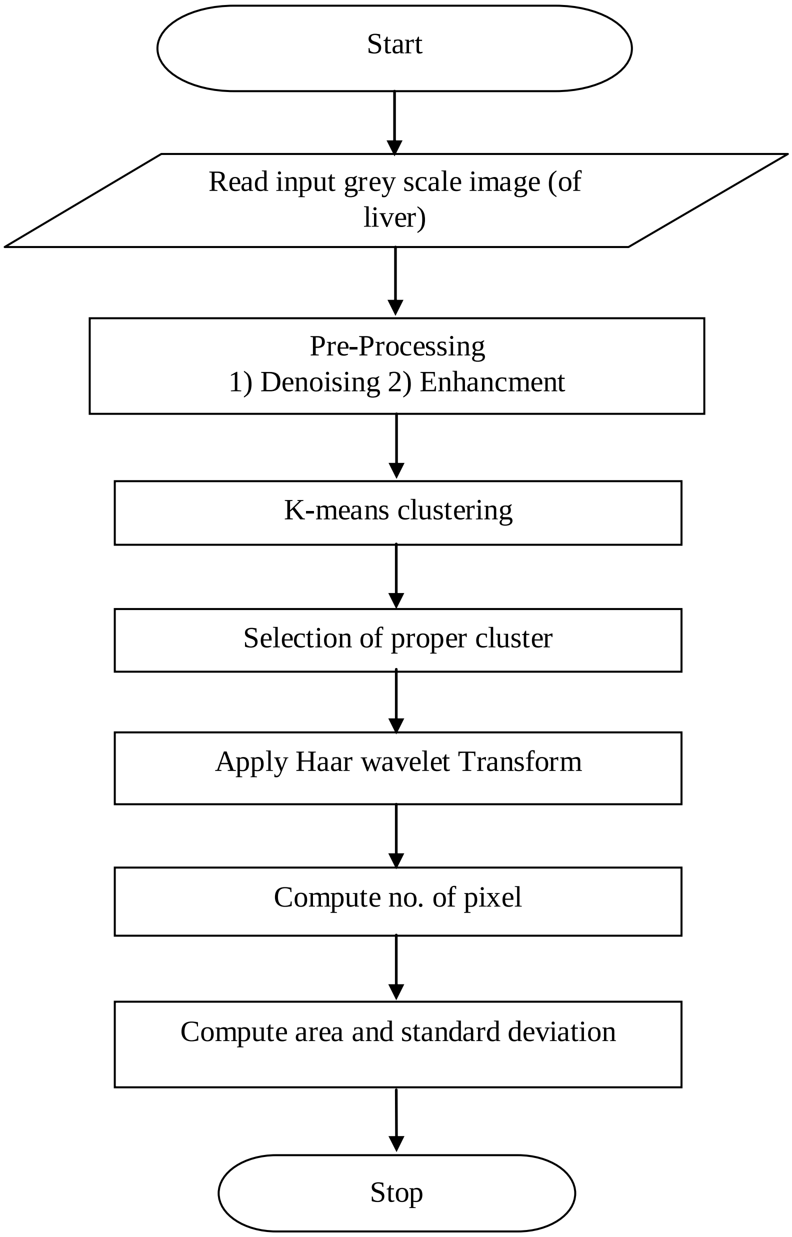

Fig. 1 flowchart of methodology

Now, as the cancer cell is considered to be the region of interest segmenting the liver alone from the abdominal CT image is difficult due to the fact that the image includes other organs like kidney, spleen, pancreas etc. very close to the liver. In order to amass only the liver part and analyse the cancer cell the experimentation makes use of image segmentation using K-means clustering. Now the clustered image that shows the excerpts of cancer cell which is additionally used for detection procedure. So as to analyse if the given image is a cancer cell or not. The feature is extracted by picking the region of interest, and for these images the threshold range is to be fixed. As the area of the affected part is to be calculated, the number of pixels has to be determined which is done using MATLAB software. [1]

IV. CONCLUSION

This contributes by providing a computer aided diagnostic system for the diagnosis of the liver cancer using the images framed through the CT scan of certain patients. This diagnostic application makes use of MATLAB software for processing of the image, by making use of Haar wavelet transformed and clustering techniques.

The whole analysis is based on the selection of cluster and threshold values and the images are justifying by checking if the threshold falls within the same range estimated for each image. The experimentation gave an accuracy of about 80% besides being less time complex, reducing the computational complexity for the purpose of detection.

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Table 1 Comparison of various methodology

Sr. no.	Name of author	Year	Technique used	Features	Limitations
1.	M V Sudhamani, G T Raju	2014	Region growing technique, watershed segmentation, SVM classifier	Robust, convenient access to organ measurements	Human expert intervention is needed, complex
2.	L. Ali, A. Hussain, J. Li, U. Zakir, X. Yan, A. Shah, U. Sudhakar	2014	Intelligent CDS framework, Classifiers	Accuracy of 95.29% could be achieved	Very complex, Different classifiers used
3.	Yu Masuda, Amir Hossein Foruzan, Tomoko Tateyama	2014	EM/MPM algorithm	it can decrease false positive rate	Complex, Only considers sphere like structure
4.	El-Masry W.H	2014	Invasive Weed Optimization	Multi-objective optimization in CAD Applications	Computational time is high
5.	Abdalla Zidan, N. Ghalli, H. Hefny	2012	Watershed Segmentation and Artificial Neural Network	Accuracy of 92.1% could be achieved	The use of Ant Colony is Ignored
6.	Pedro Rodrigues, Jaime Fonseca and João L. Vilaça	2011	Pseudo-watershed algorithm	It decreased the no. of decisions, time-consumption and user dependence	A semi-automatic algorithm, Has low accuracy

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