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Liver Tumour Diagnosis Using Computed Tomography Images

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ABSTRACT:Liver tumoris observed as one of the life threatening disease that causes death. Early detection of tumor in the liver is considered as a live saving process. To make the process of detecting the liver tumor easy, less time consuming, a very effective an efficient method is adopted for the same. One of the important tools that helps in the early detection of tumor is image processing. The abdominal CT images are characterized by inferior in contrast and indistinct edges which increase the complexity of liver image segmentation. Initially, the images are subjected to pre-processing which involves noise removal, thresholding and non-linear mapping. K-means clustering technique is used to segment the image so as to capture region or area of interest. Then, threshold values for the region of interest, and morphological operation is considered for detection of tumor.

KEYWORDS: Image processing, k-means clustering, liver tumour, morphological operation.

I.INTRODUCTION

The liver is the largest internal glandular organ in our body and situated on the right side of the abdominal cavity just under the rib and most complex. [2]The liver continuously filters out blood that circulates through the human body, converting nutrients absorbed from the digestive tract into ready-to-use chemicals. The liver performs too many other crucial functions, such as removing toxin and other chemical waste products from the blood and readying them for excretion. Because all the blood in human body must pass through it, the healthy liver is necessary for healthy life. It stores nutrients absorbed from abdominal tract, some nutrients metabolized in the liver before used by rest of the body to build and repair body tissues. It makes clotting factors that keep human from bleeding too much when we are injured.

Cancer is clinically described as a malevolent neoplasm. It is a wide group of diseases, involving uncontrolled growth of cells. In cancer/tumor, cells grow fast, forming malignant/benign tumors, and badly affects surrounding parts within the body. These tumors may grow and obstruct the digestive system, nervous system, and circulatory systems and releases hormones that may alter the body functionality. There are about more than 200 different known cancers are found in human body. Based on first affected cell in body the type of cancers are characterized.

With the expansion and magnification in biomedical technology it has become most paramountcy to having a mechanism that is reliable for detecting cancers at early stages. Mechanism should be facilely accessible, so that it can be used as the first-line guidance. [1] With an incrementation in cancer effect and deaths due to this disease and lack of early detection techniques, it gave motivation to present a conception that would not only be a new approach, less time involute, less computational involute but also could be made available for all the people at low cost, Therefore to make liver cancer easy to detect we are using image processing techniques, in which we are using computed tomography images. In computed tomography, While CT imaging, an x-ray tube revolves around the patient’s body so that more fold images are amassed from many different angles. These images are accumulated in a computer that analyzes them to create a new image. In CT images radiologists and other physicians can easily identify internal structures of human body with their shape, size, density and placement. [4]This newly found information can be used to identify if there is any medical problem, extent and other important details [6].

Methodology used for cancer detection in this paper uses MATLAB software for the execution, here-in we consider grayscale liver CT scan image as input. Liver part in the abdominal CT scan image is extracted using K-means clustering segmentation method. From different clusters we choose most appropriate cluster and the no. of pixel for that cluster is calculated after thresholding, and morphological operations are performed. [1]

II.RELEATED WORK

M V Sudhamani, G T Raju [2] in their paper proposed that Segmentation of CT liver images helps to analyze the presence of tumor and classify the tumor from liver CT images. Here, they used region growing technique to under see the nearby pixels of initial seed points and identify whether the adjacent pixels should be joined to the region or not. The task is repetitive and seed point is selected interactively in the suspected region. The region growing generated contour has been segmented using watershed method. Grey Level Co-occurrence Matrix (GLCM) is used to extract texture feature for segmented region. Support Vector Machine (SVM) used to classify the tumor as malignant or benign based on these features. In their paper, a semi-Automated system has presented which is robust, allows surgeons and radiologist to have simple and suitable access to organ measurements and visualization. Experimental results shows all tumors are segmented from liver and classified as benign or malignant. 2014

L.Ali, A. Hussain, J.Li, U. Zakir, X.Yan, [5] Proposed clinical decision support framework for disease management based on liver ultrasound sonography images. Automate real time image segmentation, enhancement, and relegation to enable efficient diagnosis of CDS framework. CDS framework Comprises of a number of stages. From an imaging source the images are first acquired and pre-processed before running through an algorithm such as image enhancement algorithm. Segmentation and the detection of cancer is assumed as the stage after pre-processing in which different image segmentation techniques are used to extract objects from the segmented image. Disease classification of segmented objects is third stage, in which object are compared with the disease classifier defined by radiologists. In the last stage; cancer progression, prediction is evaluated based on array of US images. The texture features forsegmented region are extracted through Grey LevelCo-occurrence Matrix (GLCM). [3]These features areused to classify the tumor as benign or malignantusing Support Vector Machine (SVM) approach. A semi-Automated system has beenpresented which is robust, allows radiologist andsurgeons to have easy and convenient access toorgan measurements and visualization. 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.

Yu Masuda, Amir Hossein Foruzan, Tomoko Tateyama and Yen Wei Chen [4] proposed 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. It 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.2010

Pedro Rodrigues, Jaime Fonseca and João L. Vilaça [6]proposed an interactive algorithm for liver tumour segmentation was developed, allowing the user to quickly paint the object of interest in the image usingan 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 efficientregion 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.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 tumours boundaries located near other anatomical structures, identifying weak edges, robustness

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against image noise, and being able to segment hyperdense and hypodense metastasis with different size and shape.2011

III.PROPOSED METHODOLOGY

The objective of this research work is to process and analyse the images that are framed from the CT scan and generate results whether the said image contains cancer cells or not. These images are collected from various multispecialty hospitals and diagnostic centers. The experimentation procedure makes use of MATLAB R2014a software in order to process the images. Fig.1 shows proposed methodology as the images that are framed via the CT scan exist as a grayscale image.

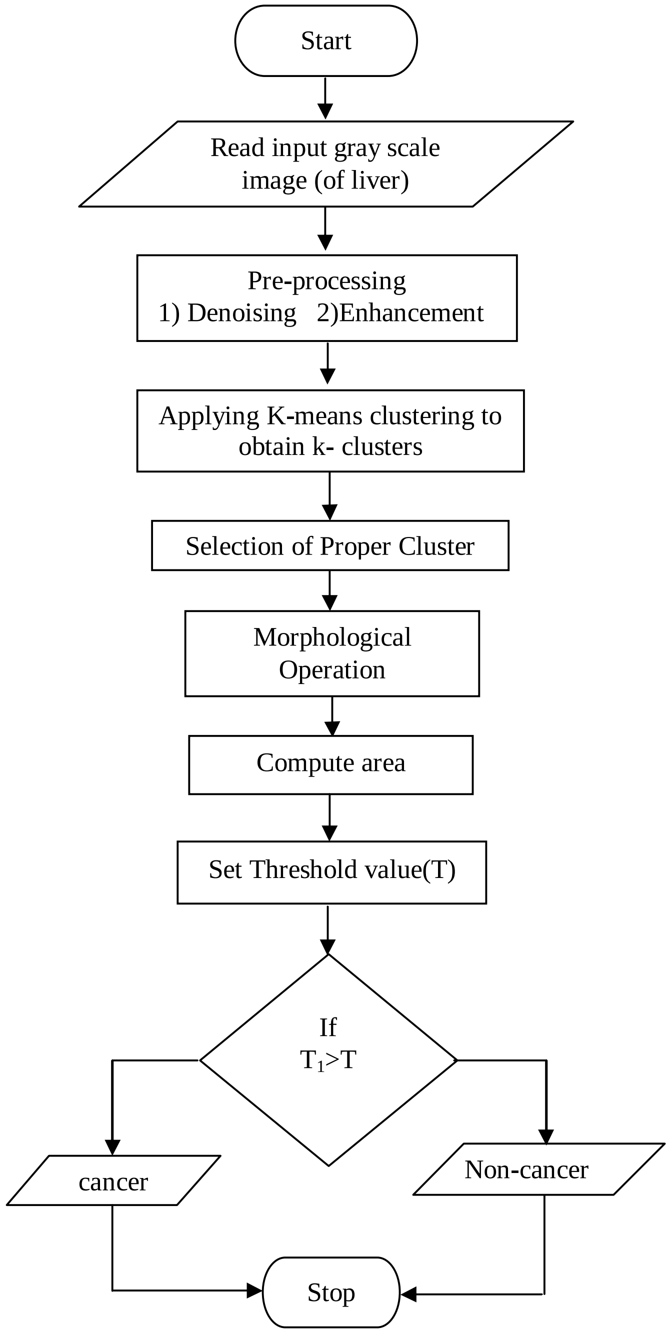

Fig.1 Flow Chart of overall methodology.

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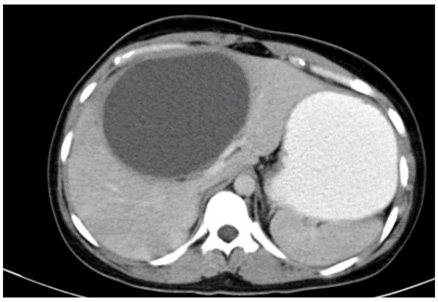
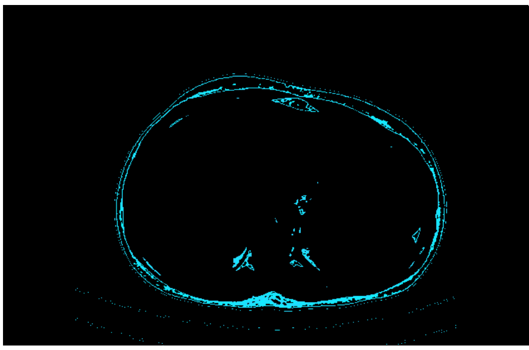


Fig.2 Original Grayscale Liver Cancer Image

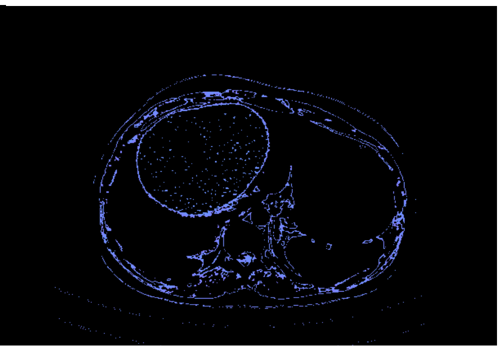
As shown in fig.2 abdominal CT scan images not only contains different types of noises but also low contrast grayscale image. There for this images make difficulties in identifying the cancer cell in the CT scan image. The pre-processing step converts the image according to the need of the next level. It performs filtering of noise and other artifacts in the image and sharpening the edges in the image. The famous algorithms have been chosen for the Segmentation of liver cancer,K-Means is the one of the unsupervised learning algorithm for clusters. After applying k-means clustering algorithm we need to choose proper clustered image for further procedure as shown in fig.3. To select proper clustered image expert intervention is required. We are setting the threshold values for the region of interest and for detection of cancer. On processing the clustered image, and applying morphological operation we diagnosed the cancer region in the CT image.

IV.EXPERIMENTAL RESULTS

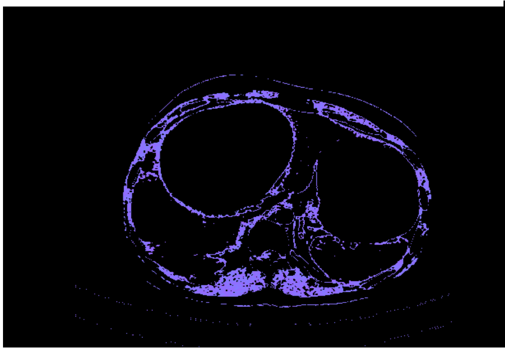
Fig.3 shows segmented images based on different cluster which depends on seed points so we have to select proper segmented cluster for the further process.



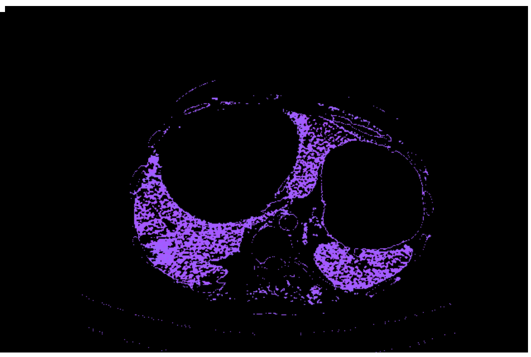
a)



b)



c)



d)

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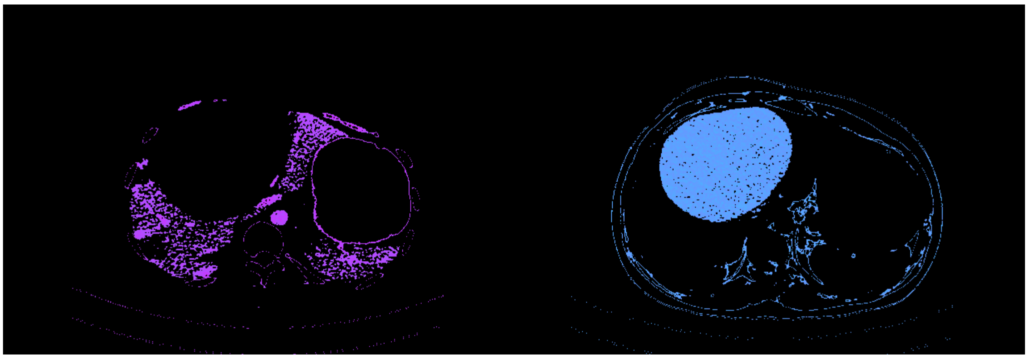

e) f)

Fig.3 (a-f)Segmented image (k-means)

As shown in above fig.3 there are many different segmented images and we need to choose proper segmented image based on the knowledge of liver, there for expert intervention is required for the selection of the image. Fig. 4 shows the final output of the proposed methodology.

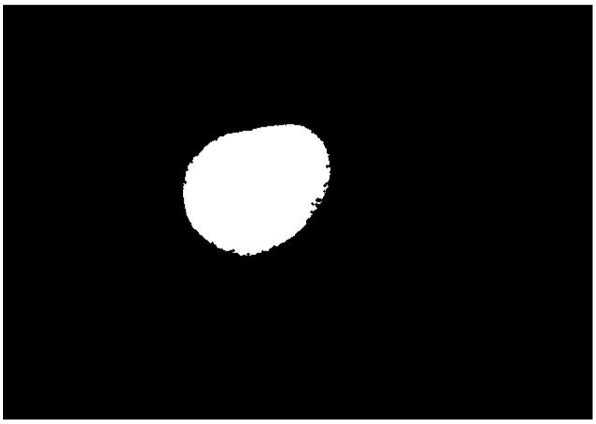

Fig.4 Final Region of Interest with tumour

V.CONCLUSION

Computer aided diagnosis of disease is very fast, less time consuming, effective and efficient method. MATLAB software has used for biomedical image processing to detect abnormalities. K-means clustering algorithm along with thresholding and morphological operations are used to detect cancer present in the CT scan image.

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