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Computer Aided Diagnosis for liver Cancer Feature Extraction

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----------ABSTRACT----------
Liver Cancer is one of the most difficult cancer to cure and the number of deaths that it causes generally increasing. The signs and the symptoms of the liver cancer are not known, till the cancer is in its advanced stage. So, early detection is the main problem. If it is detected earlier then it can be helpful for the Medical treatment to limit the danger, but it is a challenging task due to the Cancer cell structure. Interpretation of Medical image is often difficult and time consuming, even for the experienced Physicians. Most traditional medical diagnosis systems founded needs huge quantity of training data and takes long processing time. Focused on the solution to these problems, a Medical Diagnosis System based on Hidden Markov Model (HMM) can be presented. This paperdescribes a computer aided diagnosis system for liver cancer feature extraction at an early stage from the chest CT images.

KEYWORDS: CT image, Segmentation, Morphological operation, Feature Extraction.

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I. INTRODUCTION

Liver cancer, also known as hepatic cancer is a cancer which starts in the liver, and not from another organ which eventually migrates 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 consists 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. According to the National Health Service (NHS), UK [3], approximately 1,500 people in the United Kingdom die from HCC each year. The World Health Organization (WHO) [4]says that liver cancer as a cause of death is reported at less than 30 cases per 100,000 people worldwide, with rates in parts of Africa and Eastern Asia being particularly high. Experts say that common causes of HCC are regular high alcohol consumption, having unprotected sex and injecting drugs with shared needles[1],[2]. Signs and symptoms of liver cancer tend not to be felt or noticed until the cancer is well advanced. Hepatocellular carcinoma (HCC) signs and symptoms may include Jaundice , Abdominal pain, Unexplained weight loss, Hepatomegaly , Fatigue, Nausea, Emesis (vomiting), Back pain, General itching, Fever.

Liver cancer, if not diagnosed early is much more difficult to get rid of. The only way to know whether you have liver cancer early on is through screening, because you will have no symptoms. High risk people include those with hepatitis C and B, patients with alcohol-related cirrhosis, other alcohol abusers, and those that have cirrhosis as a result of Hemochromatosis. Diagnostic tests may include Blood test, Imaging scans(either an MRI or CT scan) and Biopsy(a small sample of tumor tissue is removed and analyzed). Unfortunately, because symptoms do not appear until the liver cancer is well advanced, currently only a small percentage of patients with HCC can be cured; according to the National Health Service (January 2010) only about 5%.

Some of the CAD system uses Support Vector Machine(SVM), Fuzzy Logic, Artificial Neural Network(ANN)algorithm. Their disadvantages are time consumption and needed a lot of data for training. Focused on the solution to the above problem, Hidden Markov Model (HMM) can be presented for getting more advantage.

II. PROPOSED METHOD

CT scan

A computerized axial tomography scan (CT scan or CAT scan) is an x-ray procedure that combines many x-ray images with the aid of a computer to generate cross-sectional views and three-dimensional images of the internal 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 accurately guide the placement of instruments or treatments.

It is a medical imaging method that employs tomography[11]. Tomography is the process of generating a two-dimensional image of a slice or section through a 3-dimensional object (a tomogram) (Figure 1).CT scans of the abdomen are extremely helpful in defining body organ anatomy, including visualizing the liver, gallbladder, pancreas, spleen, aorta, kidneys, uterus, andovaries.

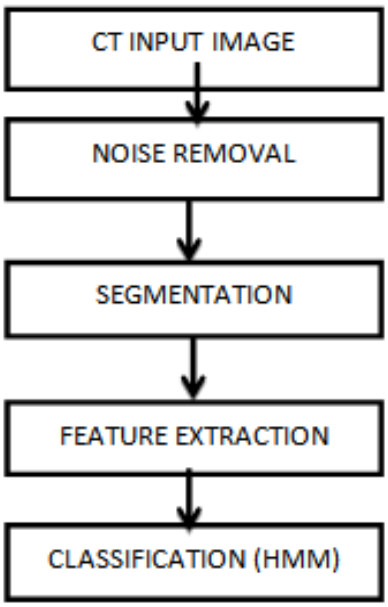

Figure 1. Block Diagram of Automatic Liver Cancer Detection

CT scans in this area are used to verify the presence or absence of tumors, infection, abnormal anatomy, or changes of the body from trauma. The Original chest CT image is shown (Figure 2).

Figure 2. Chest CT image

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.

Noise Removal

The most important technique for removal of blur in images due to linear motion and also due to vibrations. Normally an image is considered as the collection of information and the occurrence of noises in the image causes degradation in the quality of the images. So the information associated with an image tends to loss or damage. It should be important to restore the image from noises for acquiring maximum information from images.

Since CT images contain more Gaussian noise, a Gaussian filter is used for noise removal. Gaussian filters are a class of linear smoothing filters[10]. The weights are chosen according to the shape of Gaussian function. The Gaussian smoothing filter is a very good filter to remove noise drawn from a normal distribution.

Segmentation

After the primary noise removal, the segmentation has to be carried out. The goal of the segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. The segmentation of medical images of soft tissues into regions is a difficult problem because of the large variety of their characteristics[8]. All connected components in the eroded image are labeled and number of connected components is computed. The labeled components are segmented depending on region of interest.Here the region growing techniques is used. This technique is enough for segmented the lung region. Moreover it will take less time. Here from a seed it starts growing. It will compare their neighbor-hood values and grows up.

Figure 3. Segmented CT image using Region Growing

The segmentation process will result in separating the liver tissue from the rest of the image and only the liver tissues under examination are considered as the candidate region for detecting tumor in liver portion.

Morphological Operation

Inorder to smooth the liver boundaries and to retain the original liver shape, the morphological operations have to be carried out. The most basic morphological operations are dilation and erosion. Dilation means adding new pixels to the boundaries of an object in an image. Erosion means removing pixels from the boundaries of an object in an image.The number of pixels added or removed from the object in an image depends on the size and the shape of the structural elements used to process the image.

Feature Extraction

When the input data to an algorithm is too large to be processed and it is suspected to be notoriously redundant (much data, but not much information) then the input data will be transformed into a reduced representation set of features (also named features vector). Transforming the input data into the set of features is called feature extraction. If the features extracted are carefully chosen it is expected that the features set will extract the relevant information from the input data in order to perform the desired task using this reduced representation instead of the full size input[5],[12]. Feature extraction involves simplifying the amount of resources required to describe a large set of data accurately. Analysis with a large number of variables generally requires a large amount of memory and computation power.

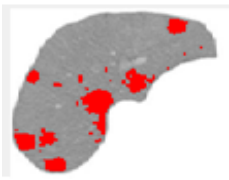

Figure 4. Feature Extraction

Feature extraction is a general term for methods of constructing combinations of the variables to get around these problems while still describing the data with sufficient accuracy.

III. CONCLUSION

In this paper, a novel method of segmenting the CT images been discussed. This research work carried out by taking 2-D CT images. The proposed work was carried out in 4 phases. In first phase, image acquisition of liver features and the second phase is removal of the noise. Third phase is related to the segmentation of ROI features of liver which can be determined using segmentation algorithm such as region growing approach. Fourth phase is feature extraction, it extract the corresponding liver nodule. In this paper we analyses the result for 2-D images. So early detection of Liver Cancer cells can be highly possible and it reduces the risk as well. This Bio-imaging methods will enhance the proper radiotherapy treatment for Liver Cancer patients.

IV. FUTURE SCOPE

Our current investigation is to further obtaining a clear identification of Liver Cancer by performing classification for the obtained features. Hidden Markov Model algorithm can be applied for classification. By this process time complexity can be reduced and diagnosis confidence can be increased.

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