Liver Cancer Analysis using Machine Learning Techniques –A Review

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Abstract: **This paper gives survey on different types of methods used in the prior identification of liver cancer from abdominal images using machine learning techniques. Liver is the largest internal organ in human body which is also known as acid factory management system in human body. An accurate and automatic approach of liver parenchyma segmentation is crucial to a computer-aided liver disease diagnosis and liver surgical planning system such as a system for liver transplantation. However the liver delineation in computer tomography (CT) images is very difficult because of two main reasons. One is that the gray level intensities of liver parenchyma are overlapped with those of the surrounding tissues and organs such as the heart and kidney. The aim of this paper is to extend the better comprehension of different Machine Learning Techniques (MLT) used in liver lesion detection and to identify the important research orientation in image processing.**

Keywords: Computer Tomography (CT), Image Processing, Machine learning techniques (MLT) and Acid factory Management.

INTRODUCTION

One of the most complex internal biological structures in the human body is liver [1]. Upper right hand part of the abdomen is located by the liver which is reddish brown in color and measures eight and half inches [2][3]. Liver is wedge shaped gland normally weighs 1440grams to 1660 grams [4]. Liver is divided into Left lobe and right lobe and filters 1.5L of blood per minute approximately [5][6]. Liver functions include production of bile, production of cholesterol and special proteins, metabolizes drug and detoxifies chemicals [3][7]. Liver is also having some diseases such as hepatitis, cancer, cirrhosis, hemochromatosis and jaundice [8].

Liver cancer is the most dangerous cancer among variety of cancer [9]. Due to this every third living is cause of death and which is nearly a sixth most common cancer in the world [10]. Liver cancer is also known by the name hepatic cancer and most of the liver cancer is common to Hepatic cellular carcinoma (HCC) [11] [12]. Liver cancer is the uncontrolled growing of tissue within the liver. Tumors are of two types such as non-cancerous cells (benign) and cancerous cells (malignant) [13]. There are 12000 deaths per year in world due to liver cancer. To avoid this, problem need to be analyzed in earlier stages because earlier detection can help doctors to save lives and does not make very much complication on the human health [14].

There are various techniques to acquire the image of liver from the patients those are Computed Tomography (CT), Magnetic Resonance Imaging (MRI) and Ultra Sounds but CT image is represented as accurate liver cancer diagnosis imaging modularity [13]. Hence Computed Tomography has extent use in the field of medical technology. However detection of the liver lesion, liver image segmentation and Liver lesion extraction are crucial because it requires experienced radiologist to identify differentiable tissues between liver and non-liver [15] [16]. Sometimes experienced radiologist also failed to identify the tumor in earlier stages because of tumor which are invisible to the human eye.

Generally there are many improvements in field of medical imaging techniques such as image processing machine learning techniques and artificial intelligence and these technologies can be used by experience radiologist [17]. Together with experienced radiologist and medical technology for computer aided diagnosis results in the accurate characterization of liver lesion [18][19]. These techniques will provide clinical assistance to the doctors to improve the diagnosis and maximizes the accuracy of the diagnosis. This technique helps in avoiding surgery and biopsy risks toward the victim.

Tumor extractions in the liver CT images are absolutely necessary process in computer aided surgery and computer aided nature of illness identification [20] [21]. But still authoritative analysis and prior detection of liver cancer is a significant difficulty in the field of practical radiology doctors should know the feature of the tumor in order to give effective treatment for victim also helps doctors in further diagnosis [22]. Any general method of automatic/semi-automatic computer aided system will help doctors to provide the effective treatment for the patients by diagnosing the liver cancer feature [23] [24].

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[25], [26].

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.

LITERATURE SURVEY

Vincey Jeba Malar.V et. Al. [27]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) is presented. This paper describes a computer aided diagnosis system for liver cancer that detects the liver tumor at an early stage from the chest CT images. This automation process reduces the time complexity and increases the diagnosis confidence.

In this paper, a novel method of segmenting the CT images been discussed. This research work carried out by taking 2 CT images. The proposed work was carried out in 5 phases. In first phase, image acquisition of liver features and the second phase is related to the segmentation of ROI features of liver which can be determined using segmentation algorithm such as region growing approach. Third phase is removal of the noise. Fourth phase is feature extraction, it extract the corresponding liver nodule. Finally, the extracted liver nodules are classified. In this paper authors analyses the result for 2 images. So early detection of Liver Cancer cells can be highly possible and it reduces the risk as well. This Bio-imaging method will enhance the proper radiotherapy treatment for Liver Cancer patients.

R.Rajagopal et.al [28] This paper, present a new and accurate method for liver tumor segmentation from computed tomography (CT) scans. Initially, the liver CT image is pre-processed, i.e., noise removal and contrast of the image is enhanced. author then employ a support vector machine (SVM) classifier, which is trained using the user fed image sets, to classify the tumor region from liver image. Sequentially, morphological operations and feature extractions are performed over the segmented binary image to further refine the rough segmentation result of SVM classification. The experiment results prove that the accuracy and efficiency of the proposed algorithm to be higher than conventional methods. Author presented a new method and validation study for the automatic segmentation of liver tumors from liver CT image. The tumor segmentation method proposed in this paper includes a novel method for tumor classification which helps the medical experts for further diagnosis. The main advantage of our method is that it yields accurate results for different types of liver tumors with ease and without manual interaction.

Dr. S. Vijayarani et.al. [29] In recent years in healthcare sectors, data mining became an ease of use for disease prediction. Data mining is the process of dredge up information from the massive datasets or warehouse or other repositories. It is a very challenging task to the researchers to predict the diseases from the voluminous medical databases. To overcome this issue the researchers use data mining techniques such as classification, clustering, association rules and so on. The main objective of this research work is to predict liver diseases using classification algorithms. The algorithms used in this work are Naïve Bayes and support vector machine (SVM). These classifier algorithms are compared based on the performance factors i.e. classification accuracy and execution time. From the experimental results it is observed that the SVM is a better classifier for predict the liver diseases.

Classification is the major data mining technique which is primarily used in healthcare sectors for medical diagnosis and predicting diseases. This research work used classification algorithms namely Naïve bayes and Support Vector Machine (SVM) for liver disease prediction. Comparisons of these algorithms are done and it is based on the performance factors classification accuracy and execution time. From the experimental results, this work concludes, the SVM classifier is considered as a best algorithm because of its highest classification accuracy. On the other hand, while comparing the execution time, the Naïve Bayes classifier needs minimum execution time.

E-Liang Chen et.al. [22] Computed tomography (CT) images have been widely used for liver disease diagnosis. Designing and developing computer-assisted image processing techniques to help doctors improve their diagnosis has received considerable interests over the past years. In this paper, a CT liver image diagnostic classification system is presented which will automatically find, extract the CT liver boundary and further classify liver diseases. The system comprises a *detect-before-extract* (DBE) system which automatically finds the liver boundary and a neural network liver classifier which uses specially designed feature descriptors to distinguish normal liver, two types of liver tumors, hepatoma and hemageoma. The DBE system applies the concept of the normalized fractional Brownian motion model to find an initial liver boundary and then uses a deformable contour model to precisely delineate the liver boundary. The neural network is included to classify liver tumors into hepatoma and

hemageoma. It is implemented by a modified probabilistic neural network (PNN) [MPNN] in conjunction with feature descriptors which are generated by fractal feature information and the gray-level co-occurrence matrix. The proposed system was evaluated by 30 liver cases and shown to be efficient and very effective.

A system based on fractal geometry and MPNN was developed for the CT liver image classification. The system consists of an automatic liver contour extraction process, an image enhancement algorithm and a hepatoma/hemageoma classification network. During the process of liver contour extraction, the liver area is first located using the fractal feature values, then followed by a deformable contour model to iteratively generate the accurate liver contour. With the help of the deformable contour model, the liver contour can precisely be extracted After the liver area is extracted, it will be further enhanced for future feature texture-based classification. experiments show that using the NFB feature values, the correlation and sum entropy of the spatial gray-level dependence matrices in conjunction with a MPNN has better performance in classification than using other feature descriptors in MPNN. It should be noted that the MPNN used in this paper is not necessarily optimal in all applications. It can be replaced by any classification system as long as it performs better than MPNN. This shows that the designed system is object-oriented. In other words, any component in the system can be replaced by a better system if there exists one.

CONCLUSION

This paper gives survey on different types of Machine Learning Techniques used in liver cancer analysis. However the liver tumor is difficult to detect from the CT or MRI images because of two reasons: one is the difference in the liver and non-liver pixel intensities in CT images and another one is detection of liver from overlapped organs. Hence segmentation helps doctors to provide effective treatment by knowing nature of the tumor.

The first paper focused on the solution to these problems, a Medical Diagnosis System based on Hidden Markov Model (HMM) is presented. This paper describes a computer aided diagnosis system for liver cancer that detects the liver tumor at an early stage from the chest CT images. Second paper employ a support vector machine (SVM) classifier, which is trained using the user fed image, sets, to classify the tumor region from liver image. Third paper algorithms used in this work are Naïve Bayes and support vector machine (SVM). These classifier algorithms are compared based on the performance factors i.e. classification accuracy and execution time. From the experimental results it is observed that the SVM is a better classifier for predict the liver diseases. Fourth paper describes a modified probabilistic neural network (PNN) [MPNN] in conjunction with feature descriptors which are generated by fractal feature information and the gray-level co-occurrence matrix.

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