A Detection of Liver Cancer Using Artificial Neural Network

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Abstract— **People diagnosed earlier with cancer are not only more likely to survive, but importantly also to have better experiences of care, lower treatment morbidity, and improved quality of life compared with those diagnosed late. More than 11 lakh people are diagnosed with cancer in India every year. About 6 lakh patients die due to the disease annually which is the second biggest cause of death in the country after heart disease. Hepatic cancer thus becomes a white elephant that everyone knows about, but nobody speaks of. Liver cancer is emerging as one of the fastest spreading cancers in India. India sees about 3-5 cases of liver Cancer per 1, 00,000 people which translates to 30,000 "50,000 new cases per year. It is however, likely to be grossly under-reported as India does not have any population based data due to the absence of systematic cancer registry in the country. Proposed system helps for early detection of liver cancer with accuracy. In proposed project we are using CT scan images for Liver cancer diagnosis using Statistical parameters and artificial neural network.**

Index Terms—Liver cancer, Mean square error, peak signal to noise ratio, Variance.

1. INTRODUCTION

The liver is the largest organ in the body. It lies under the lower part of the rib cage on the right hand side of the body, but stretches across the middle about as far as the left nipple. The liver performs many important functions in the body, including processing of many of the body's waste products (or toxins) to render them harmless. It also produces bile, which is not only needed to digest certain foods, but also helps to absorb several important vitamins. It is helpful to think of the liver as a 'factory', which manufactures many important proteins and other chemical substances that the body needs to work normally. The liver helps regulate the energy and fluid stores in the body.

The condition is the 18th most common cancer in the UK with more men being affected than woman. The incidence of it increases with age, with around nine out of ten cases occurring in those over the age of 55. The lifetime risk of developing liver cancer is around one in 120 for men and one in 215 for women.

Liver cancer or Hepatocellular carcinoma (HCC) is one of the commonest cancers in the world, especially in countries like India, which have a high incidence of Hepatitis B infection. Apart from Hepatitis B, it may be caused by other Diseases that lead to cirrhosis of the liver (see below) such as Hepatitis C infection, and alcohol abuse. Unfortunately, like many other cancers, liver cancer may go undetected until a late stage. It is often brought to attention by an ultrasound or CT scan done for pain in the upper abdomen or another unrelated symptom. It may also develop in a person previously known to have cirrhosis of the liver. Once suspected, Alpha feto protein (AFP) is a simple blood test to confirm its presence. At times, a malignant tumour in the liver may be due to a secondary spread from a cancer elsewhere, commonly the large intestine. [3] In this paper first we will do paper survey.

II. PAPER SURVEY

In paper 'Expression of ADAM8 in liver cancer', published in 2012 International Conference on Biomedical Engineering and Biotechnology. It states that "ADAM8 (disinterring and metalloprotease 8) belongs to a family of transmembrane proteins implicated in cell-cell interactions, proteolysis of membrane proteins, and various aspects of carcinogenesis. In this study, we want to evaluate whether ADAM8 is highly expressed in liver cancer. So western blot, RT-PCR and Immunohistochemistry were used to evaluate the expression of ADAM8 in liver cancer and normal liver. The results of Western blot and RT-PCR show that ADAM8 is highly expressed in liver cancer. The results of immunohistochemistry show that ADAM8 is mainly expressed in the cytoplasm of liver cancer cells. Our results first prove that ADAM8 is expressed in the liver cancer, which may play important roles in the genesis and development of liver cancer."[4]

In paper 'Liver Tumor Ablation Enhancement by Lean Concept', published in 2018 1st International Conference on Cancer Care Informatics (CCI).it states that "Patient suffering from Liver Tumors are facing a lot of difficulties and challenges starting from day one of admission till leaving the hospital. Liver tumor ablation by minimal invasive treatment is done by radio frequency ablation and the process of this technique take several stages. Therefore, applying lean methodology, thinking helps cancer patient in his treatment with delivery of therapy without any delay time, minimizing process complications, and eliminating unnecessary steps. Thus, by applying Lean concept and Fish Bone Cause Effect study we can decrease the Liver Tumor Ablation process from 8 days to one day, save hospital time so more patients can be treated, saving cost and Intensive Care Unit bed availability."[6]

In paper 'Evaluating the Effect of Various Speckle Reduction Filters on Ultrasound Liver Cancer Images', published in IEEE 2018. It states that "The main goal of Ultrasound (US) image preprocessing is to reduce noise of an image. It helps Consecutive stages of image analysis like classifications or segmentation of liver cancers to differentiate easier and efficiently. In pre-processing stage filtering is the key process used for reducing signal depended noise, so called speckle. The optimal filter model has the main objective of reducing speckle noise by enhancing contrast, smoothing and sharpening of the image signal.

Several noise filters are introduced for different capacities and purposes with its own advantages and disadvantages. This paper describes the evaluation and performance analysis of five image filtering techniques, namely Kuan, Frost, Mean, Median and Speckle is reducing anisotropic diffusion filter (SRAD) from the spatial filtering process for liver US data.

An application of US hepatic liver cancer image was chosen and selected de-noising algorithms are applied to estimate the impact on the US speckle image signal. Experiments are investigated based on Peak Signal-to-Noise Ratio (PSNR), Mean Structural Similarity (MSSIM) and Mean square error (MSE). The result shows that SRAD filter performs better than other de-noising filters with a PSNR =31.11 dB, MSE=31.07, MSSIM=0.895."[1]

On paper 'Impact of Enhancement Features on Image Registration for Liver Cancer Interventions using CT Images', published in IEEE 2018 states that "In minimally invasive interventions for liver cancer treatment, image registration is a powerful technique to align diagnostic information, such as tumors and vessels, to the interventional images. In this paper, we investigate how the contrast-enhanced features in computed tomography (CT) images, i.e. the tumors and the vessels, helps the registration. For this, we de-enhance the contrast-enhanced CT image (edict) of

The liver acquired during the intervention; and then we compare the accuracy of the registration between the diagnostic contrast enhance CT image (dCECT) and the original interventional contrast-enhanced image (iCECT) versus the dCECT image and the de-enhanced image (iDECT). In addition, we use a rigidity term to improve the registration using the de-enhanced image. The method is evaluated on 11 clinical datasets."[5].

In Paper 'Prediction of liver cancer using Conditional Probability Bayes theorem', published in 2017 International Conference on Computer Communication and Informatics (ICCCI -2017), Jan. 05 – 07, 2017, Coimbatore, INDIA. It states that "Cancer is the one of the hazardous disease in the World. Cancer spreads in lungs, liver, breast, bones etc. Liver Cancer is the most dangerous and it will continue lifelong. The symptoms of liver cancer are Jaundice, loss of weight, yellow colored urine, vomiting, and pain in the upper right abdomen, sweats, fever and enlarged liver. The liver cancer which begins in the liver apart from moving from other part of the body is called as a primary liver cancer. Cancer which spreads all other part of the body and finally it reaches liver is called as secondary liver cancer. The liver is one of the important parts of the human. WHO surveys say out of 100,000 people, around 30 people are suffering from liver cancer and mostly it affects the African and Asian countries earlier. Nowadays it became a popular disease the most common kind of a liver cancer is called hepatocellular carcinoma, this particular affects male rather than female. The liver cancer occurs mainly due to the more alcohol consumption. Many data mining algorithms, Artificial intelligence concepts are used to predict the liver cancer. The probability of predicting the liver cancer is performed using the Bayes theory with the WEKA tool" [2].

In paper 'Laser Induced Human Serum Raman Spectra of Liver Cancer and Florescence of Liver Tissue', published in Proceedings of the Second Joint EMBSBMES Conference Houston, TX, USA October 23-26, 2002. It states that "Laser induced human serum Raman spectra of liver cancer are measured. The spectra differences in serum from normal people and liver cancerous people are analyzed. There is obvious difference between the spectrum of liver cancer and that of normal people. For the typical spectrum of normal serum there are three sharp Raman peaks (A at- 10 1 Ocm-1, at-l160cm-1, C at-1525cm-1) and relative intensity of Raman peak excited by 514.5nm is higher than that excited by 488.0nm. However, for the Raman spectrum of liver cancerous serum there are no peaks or very weak Raman peaks at s the same positions of spectrum and intensity of Raman peak excited by 514.5nm is lower than that excited By 488.0nm. Results of more than two hundred case measurements show that clinically agnostic accuracy is 92.86%. And then, the liver fibrosis is studied applying the Technology of LIF. The experiment indicates that there is notable fluorescence difference between the abnormal and normal liver tissue, there is blue shift abnormal tissue in Compare with normal liver tissue. These results have important reference values to explore the method of laser spectrum diagnosis."[3]

In next section we will review training based algorithm for liver cancer diagnosis.

III. ARTIFICIAL NEURAL NETWORK

Classification techniques are key point of liver cancer diagnosis. These classification techniques decides algorithm to be used for diagnosis purpose. In proposed system we are using artificial neural network technique.

An artificial neural network (ANN) is the piece of a computing system designed to simulate the way the human brain analyzes and processes information. It is the foundation of artificial intelligence (AI) and solves problems that would prove impossible or difficult by human or statistical standards. ANNs have self-learning capabilities that enable them to produce better results as more data becomes available. Some the key points of ANN are:

i. An artificial neural network (ANN) is the component of artificial intelligence that is meant to simulate the functioning of a human brain.
ii. Processing units make up ANNs, which in turn consist of inputs and outputs. The inputs are what the ANN learns to produce the desired output.
iii. Backpropagation is the set of learning rules used to guide artificial neural networks.
iv. The practical applications for ANNs are far and wide, encompassing finance, personal communication, industry, education, and so on. [10].

IV. STATISTICAL PARAMETERS

Statistical parameters are used to characterize the image. Here different parameters are analyzed against two classes of an images. These two classes are cancerous and non-cancerous. In proposed system Mean square error, peak signal noise ratio, entropy, variance, Mean etc. parameters are analyzed and used. These parameters are used as a principle components. These principle components are used as an input to artificial neural network. It is important to

select these parameters by correlating cancerous and non-cancerous characteristics.

V. SYSTEM DEVELOPMENT

As shown in figure.The 1 proposed system is based on statistical parameter analysis using artificial neural network. CT scan images of a liver are used as an input images. Preprocessing includes RGB to gray conversion, resizing of an input image and De-noising. Image enhancement is performed to get accurate results. It uses a histogram equalization technique to enhance the image.

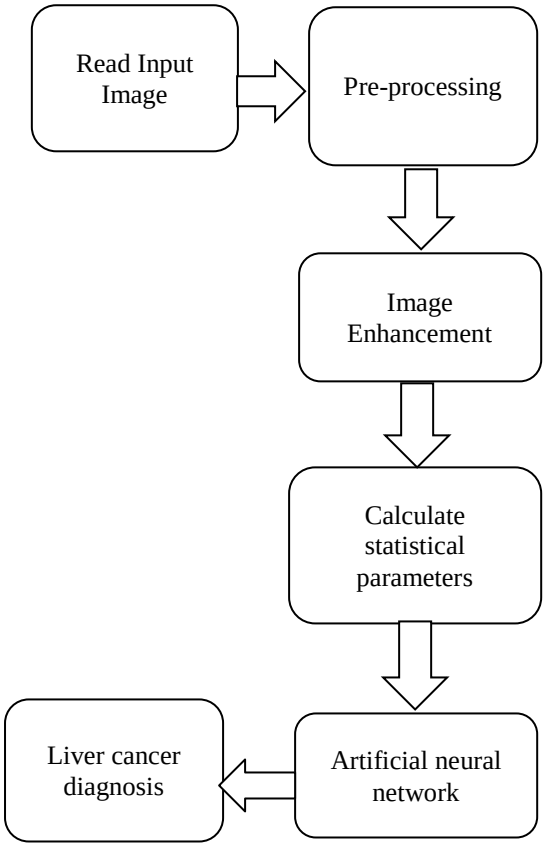

Figure.1 Proposed system.

VI. ALGORITHM

The algorithm is based on flow diagram shown in figure. 1
1. Read input image.
2. Resize the image
3. RGB to gray conversion
4. De-noise the image.
5. Enhance the image.
6. Calculate statistical parameters of target image.
7. Feed statistical parameters to ANN classifier
8. Make a decision on Diagnosis of liver cancer.
8. End.

VII. RESULT

The proposed system is designed to detect cancerous and non cancerous liver scan images. As shown in figure. 1 , it is an original image to be analysed. This image is preprocessed to get accuracy.

Figure 2.

Figure. 3

Preprocessing included RGB 2 gray conversion as shown in figure.2. After gray conversion image is resized in to 256*256 pixel size.

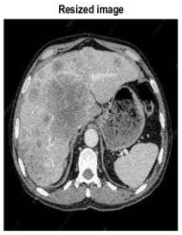

Figure 4.

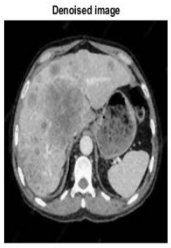

Figure.5

As shown in figure.3. And finally it is denoised using Median filter as shown in figure.5. After preprocessing target image is analysed using statistical parameter and ANN technique to detect the cancerous or noncamcerous image.

VII. CONCLUSION

The proposed system is cost effective and highly accurate. It avoids manual errors in diagnosis. The artificial neural network enables easy, fast and accurate classification of cancerous and non-cancerous CT scan images. The proposed system can be adapted for diagnosis of different types of cancers. Statistical parameters used in this system can be experimented for diagnosis analysis and further work. The system outstands itself from existing methods of diagnosis. End user application of Diagnosis using MATLAB is easy to handle. It requires less training for end users. Over all system is found to be media of quality and efficiency.

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