# A Literature Review on Liver Cancer Diagnosis Research

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*Abstract*— **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. Hence it is important to perform literature review on Liver cancer diagnosis research. It will be so helpful for researchers, students and academicians to know further scope in respective studies.**

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

## I. INTRODUCTION

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 '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 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]

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. Liver is one of the important part of the human. WHO surveys say out of 100,000 people, around 30 people are suffered 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 as 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 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 tthis 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 result s of immunohistochemistry shows 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 '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, help the registration. For this, we de-enhance the contrast-enhanced CT image (iDECT) 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 '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 next section we will review training based algorithm for liver cancer diagnosis.

### III. CLASSIFICATION TECHNIQUES/ ALGORITHM

Classification techniques are key point of liver cancer diagnosis. These classification techniques decides algorithm to be used for diagnosis purpose. In Table .1 training based elements and respective algorithms are reviewed.

| S.N. | Training Element | Algorithm |
|---|---|---|
| 1. | Pixel | Spectral mixture analysis, sub pixel classifier, Fuzzy set classifier. GIS based classification approaches, e-Cognition Maximum likelihood algorithm, Artificial Neural Network(ANN), Support Vector machine (SVM)[9] |
| 2. | Parameter | Maximum likelihood algorithm, linear discriminant analysis Artificial Neural Network (ANN), Support vector machine (SVM), Decision Tree classifier [8]. |
| 3. | Sample | Parallel pipelined algorithm, maximum likelihood algorithm, minimum distance to mean algorithm [9] |
| 4. | Spatial | maximum likelihood algorithm, minimum distance, Artificial Neural Network (ANN), Support vector machine (SVM), Decision tree algorithm |
| 5. | Spatial Information | maximum likelihood algorithm, minimum distance, Artificial |

| | | |
|---|---|---|
| | | Neural Network (ANN) Frequency-based contextual classifier Combination of parametric or non-parametric and contextual algorithm [10] |

Table. 1 Classification elements based algorithms.

Next, we will discuss classification techniques used in liver cancer diagnosis.

### A. Artificial Neural network:

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 of 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 from 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].

### B. Decision Tree Algorithm

Decision Tree algorithm belongs to the family of supervised learning algorithms. Unlike other supervised learning algorithms, the decision tree algorithm can be used for solving regression and classification problems too.

The goal of using a Decision Tree is to create a training model that can use to predict the class or value of the target variable by learning simple decision rules inferred from prior data (training data).

In Decision Trees, for predicting a class label for a record we start from the root of the tree. We compare the values of the root attribute with the record's attribute. On the basis of comparison, we follow the branch corresponding to that value and jump to the next node. [11]

### C. Support Vector Machine

Support vector machine is another simple algorithm that every machine learning expert should have in his/her arsenal. Support vector machine is highly preferred by many as it produces significant accuracy with less computation power. Support Vector Machine, abbreviated as SVM can be used for both regression and classification tasks. But, it is widely used in classification objectives.[12]

### IV. CONCLUSION

In this review paper we reviewed significant factors of liver cancer diagnosis. Though it is so wide scope to review all the elements of liver cancer diagnosis, although we tried to cover two major factors from it. Classification algorithms and classification techniques are those two major factor. They are extremely important to diagnosis liver cancer. To overlook recent research work we did paper survey as well. In future we will try to cover remaining major factors related to Liver cancer diagnosis.

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