

# Computer Aided Diagnosis of Liver Cancer using Histogram Based Analysis

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## **ABSTRACT**

*Computer Aided Analysis is used as a second judgment in detecting tumors, access the level of diseases and making diagnostic judgement by Radiologists. Due to shape, size, position and existence of the non-tumor objects by means of the similar intensity in a picture made automatic segmentation of the tumor from CT images becomes difficult. In this paper, an attempt is made using histogram based analysis to automatically diagnose the liver tumor from CT image. The experiment was conducted with Histogram technique, which demonstrates relatively improved accuracy of 93.46% with ground truth value of 57946.*

**Keywords** *Liver Tumor, CT Image, Histogram Analysis*

## **1. INTRODUCTION**

Liver malignancy is one of the most general cancers worldwide and is a type of cancer which is on the rise. It is rated as the fifth most common cancer disease endangering human life among men and ninth among women. More than 80% of these cases are affected by Hepato Cellular Carcinoma (HCC) that originates from Hepatocytes which are the predominant cells in the liver. Incidence and mortality rates are more than twice in men as compared to women. Liver cancer always occurs at the age of 45 to 65 and is the malignant tumors which grow rapidly. If patients never look for medical opinion until the symptoms take place, it indicates the liver cancer is of a final stage. Therefore, if the liver malignancy was not diagnosed in near the beginning stage and obtain proper medicinal treatment, patients habitually pass away within half a year after the liver cancer was diagnosed. Liver cancer is measured as a foremost death factor in Japan. In 2008, number of casualty by liver cancer is the third mainly common source of death by cancer [1]. Therefore, early stage detection of liver cancer has become very prominent issue today to prevent it and promote early proper treatment. This increases the chance of a patient to survive.

The symptoms of the liver cancer are starts due to excess of fat in liver and it is out of the capacity for save in the liver [2]. The therapy of liver cancer depends on a mixture of factors including the size, number and distribution of tumours. It also depends on these variety of liver disease, the suitability of the patient for liver transplantation, the functional status of the patient and local expertise. The various therapies available for liver cancer are: (i) Liver resection and transplantation, (ii) Cryosurgery, (iii) Radiofrequency ablation, (iv) Hepatic arterychemoembolization, (v) Percutaneous Ethanol Injection, (vi)

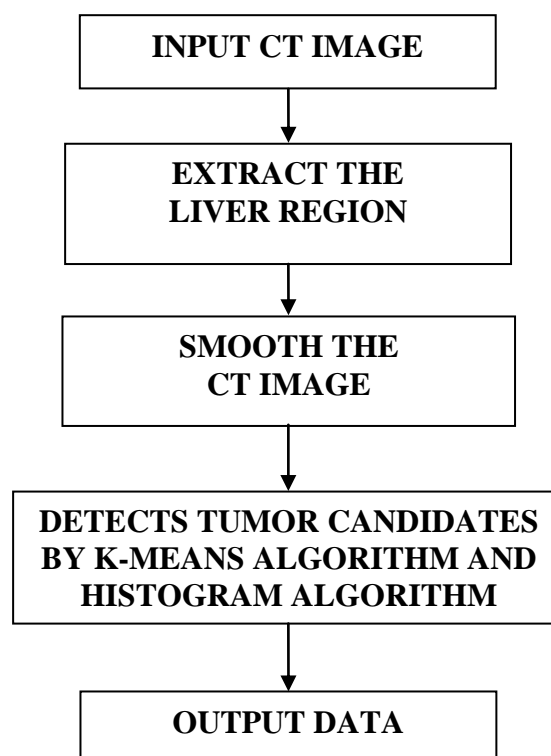
Percutaneous radio Frequency Ablation and (vii) Cisplatin Gel Infusion. Liver resection and transplantation provides the best possibility for a cure.

Emergence of Computer-Aided Diagnosis (CAD) systems has given promising results in their usefulness as complementary diagnostic tools. CAD systems, which use computer skills to detect irregularities in medical images and the use of these results by radiologists for diagnosis, can participate as key function in the early detection of liver cancer. CAD which integrates diagnostic imaging through computer science, artificial intelligence, image processing and pattern recognition areas can be defined as an efficient diagnostic tool for liver cancer. In the present today, a new, fast and accurate automatic CAD system to diagnose liver tumours is proposed. The major issues with image processing based techniques are efficiency, processing time and accuracy of detection.

To extract tumour candidate regions, the EM/MPM algorithm was proposed. The algorithm is one of the classification algorithms and it is based on a Bayesian framework which assumes a Gaussian mixture to model intensity distribution and estimates both labels of the pixels and model parameters, concurrently. In MPM, the cost function is defined so as to minimize total number of misclassified pixels. It can be proved that minimization of the cost function is equivalent to maximization of posterior marginal probability of the label fields [8], [9].

The goal of this paper is to segment a given image and make us to detect a tumor from a given liver image with higher accuracy and makes us to enhance performance for further processing and future use. Therefore, this work is intended for automatic detection of liver cancer from CT images using Histogram analysis technique. This technique demonstrates relatively improved accuracy of 93.46% with ground truth value of 57946.

## 2. METHODOLOGY



**Fig 1: Methodology Proposed to Diagnose Liver Cancer**

Fig 1 shows the proposed methodology to detect liver cancer from CT images using Histogram based analysis technique. The algorithm for segmentation through Histogram Thresholding is explained below:

**Step 1:** The CT image of the liver is divided into two equal halves around its central axis and the histogram of each part drawn. This will detect the infectious side of the liver.

**Step 2:** The threshold point of the histograms is calculated based on a comparison technique made among the two histograms.

**Step 3:** Segmentation is done using the threshold point for both the halves.

**Step 4:** The detected image is cropped along its contour to find out the physical dimension of the tumor.

**Step 5:** Create an image of the original size, check the segmented images pixel value; if it's value is greater than threshold value, assign 255 else assign 0.

**Step 6:** Segmented image is displayed.

**Step 7:** Find the physical dimension of the tumor, using the following three steps.

(i) Total number of the pixels, having pixel value 255 is found using the following command.  $Total = b_w \cdot area(\text{segmented image})$

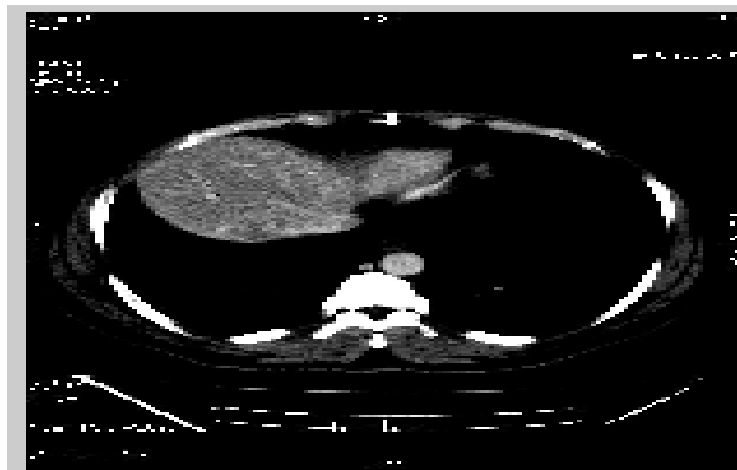
(ii) Resolution of X and Y axis is found. (Resolution is obtained from image information)  $a = 1/x \text{ resolution} * 1/y \text{ resolution}$

(iii) Area of the tumor is found by statement  $area \text{ of the tumor} = total * a$

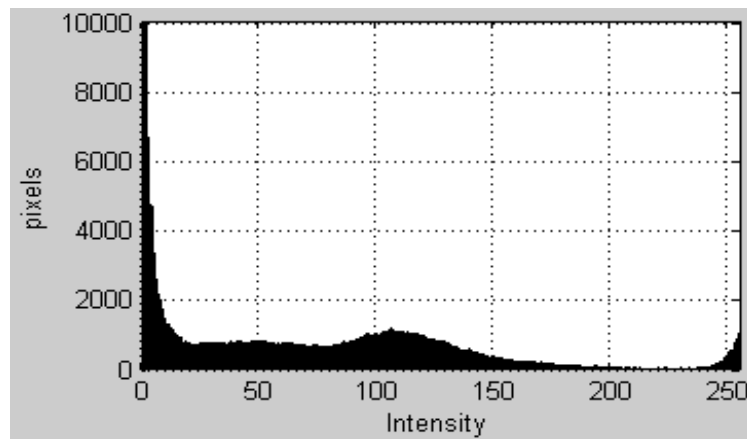
### 3. EXPERIMENTAL RESULT ANALYSIS

This section discusses the experimental results of Histogram Based Analysis.

*Step 1. Original Gray Scale Image and its Histogram*



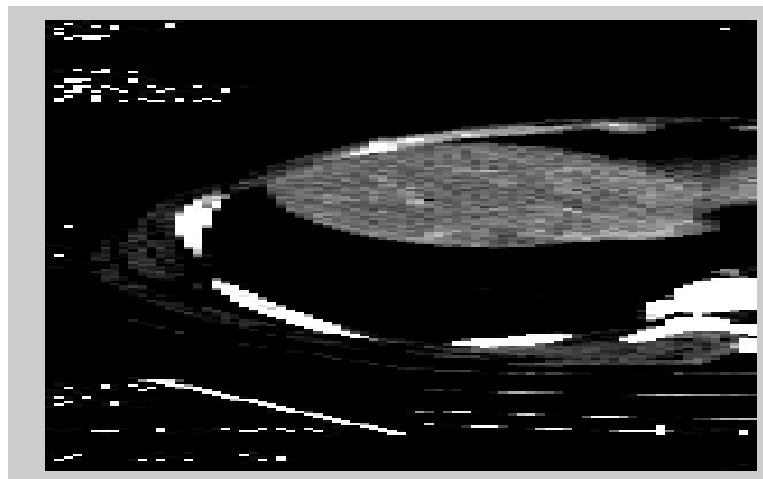
**Fig 2: Original Gray Scale Image**



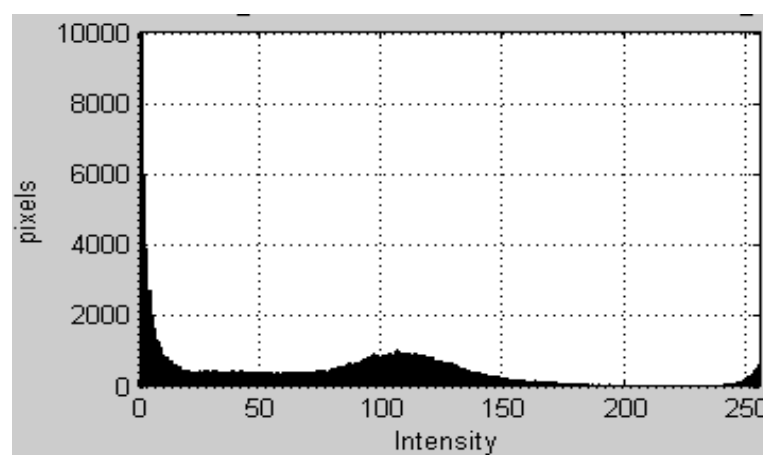
**Fig 3: Histogram of Original Gray Scale Image**

The Fig 2 and Fig 3 shows input gray scale image and its histogram. The intensity of the input image varies from 0-255.

*Step 2. Left Half of Input Image and its Histogram.*



**Fig 4: Left Half of Input Image**

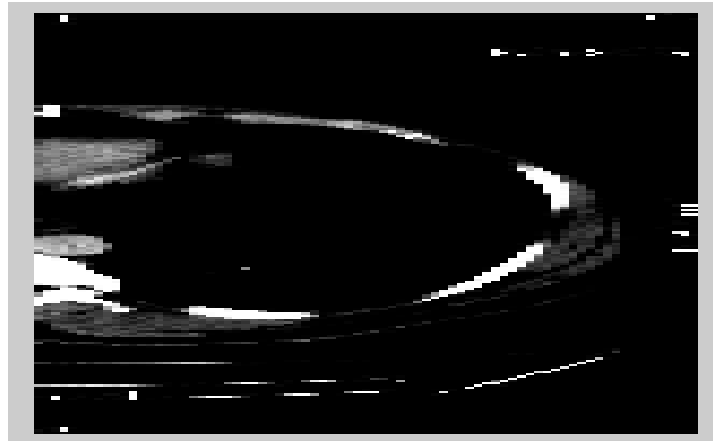


**Fig 5: Histogram of Left Half of Input Image**

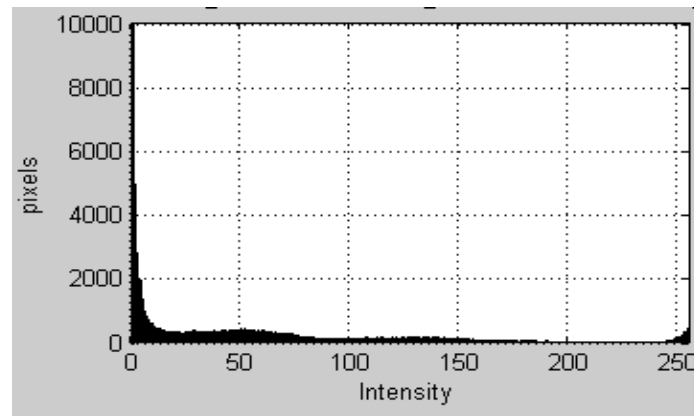
The Fig 4 and Fig 5 shows Left half of input image and its histogram. The graph shows the intensity in x-axis and pixels in y-axis of the left half of input image.

*Step 3. Right Half of Input Image and its Histogram.*

The Fig 6 and Fig 7 shows Right half of input image and its histogram. The graph shows the intensity in x-axis and pixels in y-axis of the right half of input image.

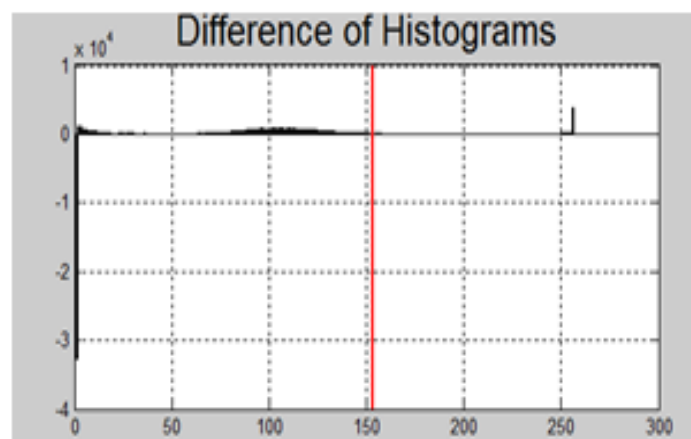


**Fig 6: Right Half of Input Image**



**Fig 7: Histogram of Right Half of Input Image**

*Step 4. Difference of Histogram and its Image*



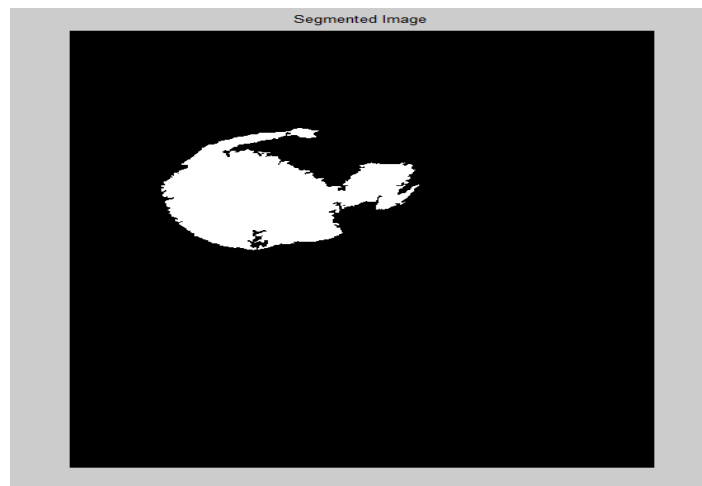
**Fig 8: Histogram of Image obtained after Histogram Difference**



**Fig 9: Above Threshold Image**

The Fig 8 and Fig 9 shows Difference of histograms and Image obtained after histogram difference. Threshold value above 135 is taken as cancer region.

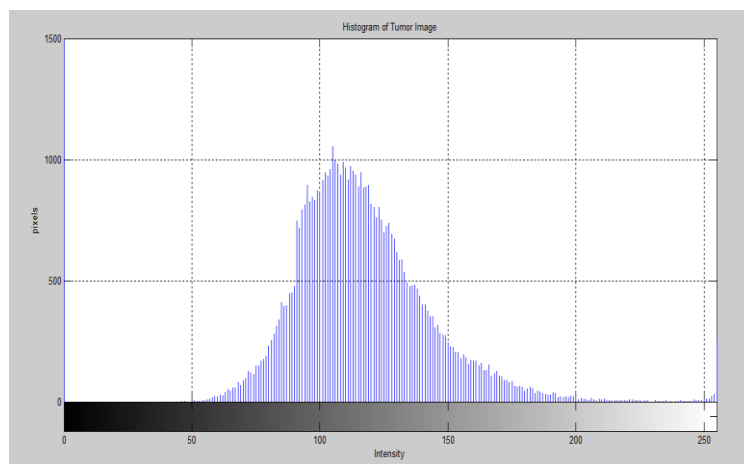
*Step 5. Segmented Image*



**Fig 10: Segmented Image**

The Fig 10 shows segmented image i.e the cancer region.

*Step 6. Histogram of Cancer Image*



**Fig 11. Histogram of Cancer Image**

The Fig 11 shows the Histogram of cancer image.

**Table 1. Area in Pixels, Accuracy & Correlation of Histogram Based Analysis for Ground Truth = 57946**

Technique Used	Area in Pixels	Accuracy	Correlation
Histogram	54158	93.46%	0.9096

The Table 1 shows the area in pixels for Histogram based technique. The accuracy obtained for Histogram based technique is 93.46% as shown in Table 1 with ground truth value 57946. This shows histogram technique demonstrates relatively higher accuracy than other techniques. The correlation obtained for histogram technique is 0.9096.

#### 4. CONCLUSION

The Histogram based analysis technique is successful in detecting the cancer candidate regions in CT images automatically. The proposed method can detect cancer regions of both large and small sizes more accurately. The histogram based analysis demonstrates improved accuracy of 93.46% with correlation 0.9096 for ground truth value of 57946. As the challenges for the future, improvement of the detection rate is considered. In order to improve the work consider large morphology variations of cancer.

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