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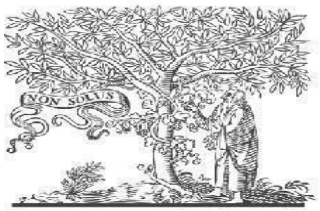

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Neural Network based Tumor Detection and Segmentation

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Abstract - Many areas of biomedical research, such as tumour identification, automatically estimating the capacity of a heart chamber, and screening lung scans for suspected disorders, have benefited greatly from advances in image processing techniques. Different methods for the automated detection of liver tumours include picture capture, segmentation, classification using a neural network and optimization, and the identification of the tumor's specific kind. Most frequent segmentation methods are region-based, threshold-based and level-set techniques. This study uses a region-based strategy to segment liver tumours. According to established criteria, region-based techniques divide an image into distinct parts, whereas edge detection methods divide an image into distinct parts by looking for quick changes in intensity at the edges.

Keywords— Particle Swarm Optimization (PSO), Seeker Optimization algorithm (SOA.

I. INTRODUCTION

There are billions of cells in the human body. In a healthy body, cells develop, divide, and die in a predictable pattern. When cells in a particular area of the body begin to multiply uncontrollably, cancer has begun. All forms of cancer are caused by aberrant cell development, and this growth is out of control. One in five men and one in seven women will get liver cancer at some point throughout their lives. Eastern and South-Eastern Asia, as well as Africa's Middle and Western areas, have the highest prevalence of the disease. In developed areas, the incidence in males is much greater than in other developed regions, save in Southern Europe [2]. The liver is both the body's biggest gland and its largest organ. The liver is a large, meaty organ located underneath the right lung on the right side of the abdomen. The liver is an eight and a half-inch long, dark crimson, wedge-shaped gland with a mass of 1.4-1.6 kg. You can see the right and left sides of it in the form of pyramids. The liver receives around 1.5 litres of blood each minute. Approximately 13 percent of the body's blood supply is stored in the liver. The hepatic artery carries oxygen-rich blood from the heart to the liver, whereas the portal vein brings nutrient-rich blood from the intestines to the liver. The portal circulation system transports blood from the stomach, spleen, and intestines to the liver through the portal vein. The hepatic vein delivers blood from the liver to the right side of the heart after it has been processed by the liver for nutrients and toxins. In order for the liver to get oxygenated blood, it is dependent on this artery, which runs straight from the heart. In 2013, an estimated 30,640 new cases of liver cancer are predicted to be diagnosed in the United States. Hepatocellular carcinoma (HCC) is the most common kind of liver cancer, accounting for more than 80% of all cases. Men are three times as likely than women to have liver cancer. Men's rates rose by 3.7% each year from 2005 to 2009, while women's rates rose by 3.0% per year. A compound annual growth rate of 4.1 percent was seen

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between 1998 and 2005, however this reduced to 1.4 percent between 2005 and 2008. From 2005 to 2008, the general growth patterns in MRI and nuclear medicine flattened substantially, while CT, ultrasound, and echocardiography somewhat decreased. The indirect estimate of 635000 cancer-related fatalities in India in 2008, based on a nationwide representative survey by Rajesh Dikshit, Prakash Gupta et al [3], represents around 8 percent of all estimated worldwide cancer deaths and approximately 6 percent of all deaths in India.

II. METHODOLOGY

First, put the patient's CT scan picture into the programme for the best possible liver tumour identification. After that, the CT scan picture is processed in order to remove noise. The picture is further improved in order to provide a higher-quality image for tumour identification. The segmentation procedure is the next phase. The ROI technique is used in this study to segment the population. The liver is segmented from the abdomen, and the tumour is segmented from the liver. In order to train the neurons in order to extract the kind of tumour, optimization methods such as PSO and SOA are utilised. According to the diagram below, an optimal liver tumour detector is being developed

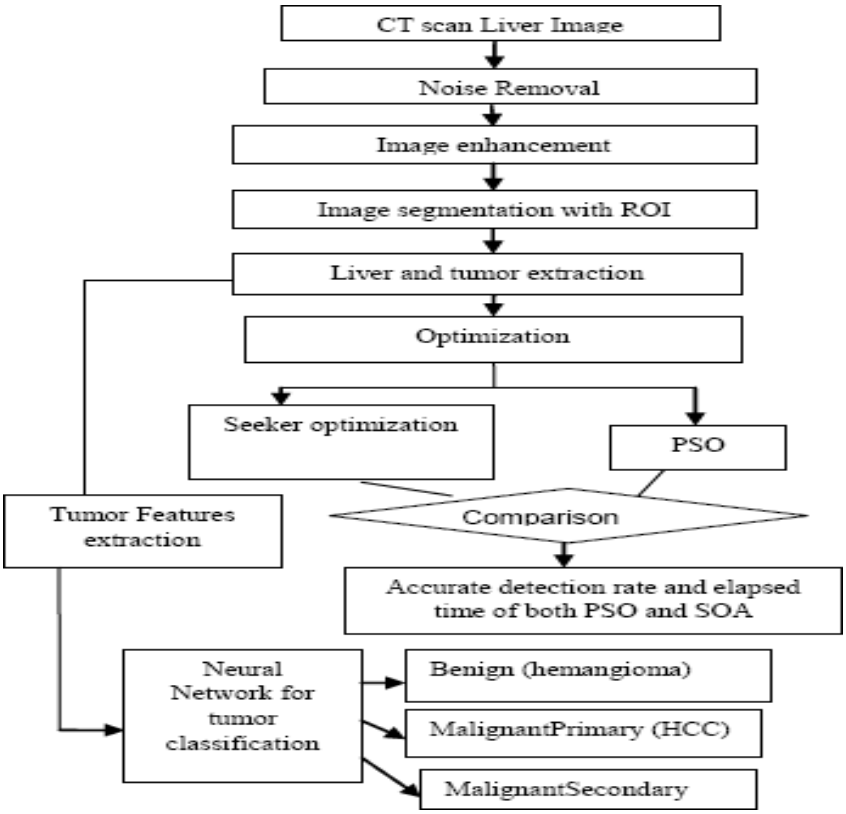

Figure 1: Flowchart

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III. SEGMENTATION

Division of a digital picture into several segments is achieved by the use of segmentation techniques. The segmentation of intensity is based on one of two fundamental features of intensity: similarity and discontinuity [4]. Detecting Similarities is the process of dividing a picture into parts that are similar according to a set of established criteria. Image segmentation methods such as thresholding, region expanding, region splitting, and merging are examples of similarity detection. In image segmentation techniques such as edge detection, the term "detecting discontinuities" refers to the process of splitting a picture based on sudden changes in intensity. In this thesis work, liver tumour segmentation is accomplished via the use of a region-based technique. In contrast to region-based methods, which divide an image into regions that are similar based on a set of predefined criteria, other segmentation approaches, such as edge detection methods, divide an image into regions that are distinct based on rapid changes in intensity near the edges of the image. The region-based segmentation technique achieves excellent results on contrast-enhanced pictures and is resistant to noise contamination. Methods for generating areas that have the same qualities can appropriately separate the regions that have the same features. Attempts are made to group pixels with comparable features together in areas using region-based segmentation techniques. Traditionally, these are strategies for doing global hypothesis testing. Processes may be initiated at the pixel level or at an intermediate level of abstraction. It is critical to generate and filter high-confidence seed areas from poor seed regions. When it comes to area-based strategies, there are two approaches: region growth and region splitting. The evaluated sets are very tiny at the beginning of the segmentation process when using the region growth approaches. In order to recover, the iterative process of region expanding must be repeated many more times.

In image processing, region growth refers to processes that divide large groupings of pixels in a single picture into smaller subregions or bigger regions depending on certain criteria. The process of region growth may be broken down into four steps: i. Select a collection of seed pixels from the original picture; ii.

ii. Choose a set of resemblance criteria, such as grey level intensity or colour, and set up a stopping rule for each of the criteria.

iii. Expand areas by attaching to each seed those surrounding pixels that have predetermined qualities that are comparable to the properties of the seeds.

iv. Discontinue area expansion when there are no more pixels that meet the criteria for inclusion in that region [5].

When compared to the edge detection approach, segmentation methods based on region are more straightforward and less susceptible to errors due to noise. Edge-based approaches divide an image into areas that are similar to one another based on fast changes in intensity near edges, while region-based methods divide an image into regions that are similar to one another based on a set of predetermined criteria.

IV. CONCLUSION

Region-based segmentation is utilised in this thesis to segregate the liver and tumour from an abdominal CT scan picture using a region-based segmentation technique. The outcomes of the PSO and SOA optimization techniques are compared in order to get the best possible identification of liver tumours. In the PSO study, the detection and classification accuracy was 93.3 percent, while the SOA study had a detection and classification accuracy of 60

percent. In terms of the amount of time it took to complete the training procedure, SOA took 48.744537 seconds and PSO took 42.429959 minutes. In compared to SOA, PSO produces superior results in terms of detection and classification accuracy, as well as the amount of time required for the training process. Particle Swarm Optimization has been employed in the diagnosis of brain tumours in the past, and it produces results in 92.3 percent of cases when MRI pictures of the brain are used. SOA has been employed widely in the mathematical study of issues throughout the last several decades. As a result, the SOA and PSO algorithms were employed in this thesis work to train the neuron, and it is feasible to classify liver tumours using the trained neurons.

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