LIVER TUMOUR DETECTION WITH COMPUTATIONAL GEOMETRIC TECHNIQUES

A Project Report

submitted by

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Introduction

Cancer is a group of tissues involving abnormal cell growth with the potential to invade or spread to other parts of the body. There are many types of cancer. Among them liver cancer is difficult to cure. The liver's complex network of blood vessels and bile ducts makes surgery difficult to detect the cancer cells.

CT scan is an effective method to detect the cancer cell in internal organs. It gives a grayscale image. Usually, liver is in light grey colour and wherever there is bright grey colour over the liver, it is consider as a tumour tissue. Depending on the CT scan image, the treatment is given to patient to cure the cancer. In the CT scan picture, boundary of the tumour is not clear enough which leads to inaccuracy in determining the tumour accurately. A better CT scan image is desired which will give as a better picture in order to detect the tumour.

CT scan sends X-ray beams through the body as it moves through an arc taking many pictures to produce cross-sectional images of specific area of an organ. CT scan sees different levels of density and tissue inside a solid organ, and can provide detailed information about the body including head, chest, skeletal system, reproductive system, bladders and gastrointestinal tract. MRI scans use powerful magnetic field and radio frequency pulses to produce detailed picture of organ, soft tissue, bone and their internal body structure.

Motivation

Liver cancer tissue images are obtained from CT scan which shows the tumour in greyscale. The edge of the tissue is very irregular and is not clearly visible in the images due to humanoid cell defect. Hence, the coordinates of the perimeter of cancer tissue is not known. This can lead to partial treatment of the cancer and could become fatal. In order to treat the cancer fully, the exact coordinates of the cancer tissue should be available. Hence, the region segmentation method is used to generate the voronoi cells and with several iterations, clusters are generated with a clear picture of the location of the cancer tissue.

Objective

The objectives of this project are

- Developing an algorithm to convert the given grayscale image into binary image without tuning the intensity levels
- an algorithm to detect the cancer tissues by region segmentation using voronoi cells of binary image
- Compare the algorithm with existing medical analysis techniques and inferring the results.

Methodology

CT scan images are obtained as greyscale images. Statistical experiment on CT scan images resulted in differentiation between tumour and liver cells. Pixels, whose intensity is greater than 200 are liver cells and intensity between 140 and 190, are tumour. These images are converted to monochrome images by normalisation. All the pixels in the greyscale image are divided by the maximum pixel of that image. This will result in the pixel of each point to be between 0 and 1. Pixels which have intensity above 0.78 are considered as black pixels and below 0.78 are considered as white pixels.

For a given set of point p = p1, p2, p3âĂęâĂę pn (seed point) in the two dimensional Euclidean plane. Make partitions in the plane by assigning every point in the plane to the nearest seed point. Every point in the Euclidean dimension point is assign to p(i) called voronoi region v(pi) . v(pi) consist set of close point to p(i) as to any other seed.

Voronoi cells are generated from randomly generated seed points on the test image. From the generated voronoi cell using convex hull algorithm, we get the data of each individual cell by cropping the respective cell from the image and calculate histogram of cell this process is carry on till we get data and histogram of every cell. From the histogram we can calculate total distribution of white pixels of a cell. The voronoi for 10 seed points is generated in MATLAB and can be seen below.

The histograms of each voronoi cell are taken and percentage of white pixels is calculated. If the percentage of white pixels is below 1%. it is classified as inner cell and

greater than 99%are classified as outer cells. Remaining cells are classified as boundary cells. Midpoints of the boundary cells are calculated and are added to the existing seed points to generate a new voronoi cell. The iterations are repeated to get satisfactory results for the user.

If the results are not satisfactory, we calculate all the midpoints of boundary cell edges and add those points to the existing seed point and generate a new voronoi diagram with new seed point .This iterations are made till the requirements are met.

Results

The above method is coded in MATLAB and the number of iterations is set to 5. Images obtained after the iteration processes are captured. The input image, image after first iteration and last iteration are shown below for 2 images, one random image and a liver tissue.

Figure 1: Input Flower image

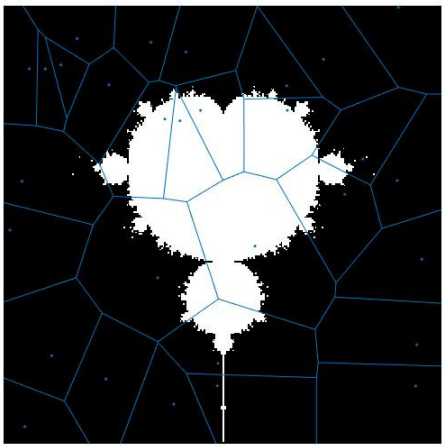

Figure 2: After 1st Iteration.

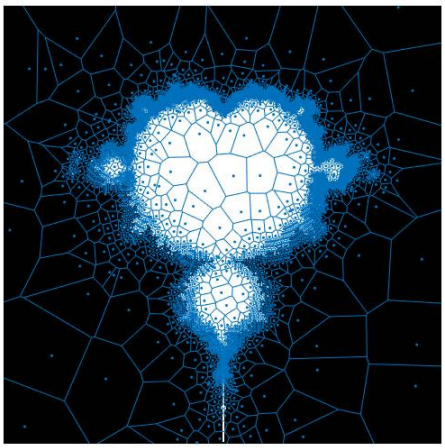

Figure 3: After 5th Iteration.

Figure 4: Liver.

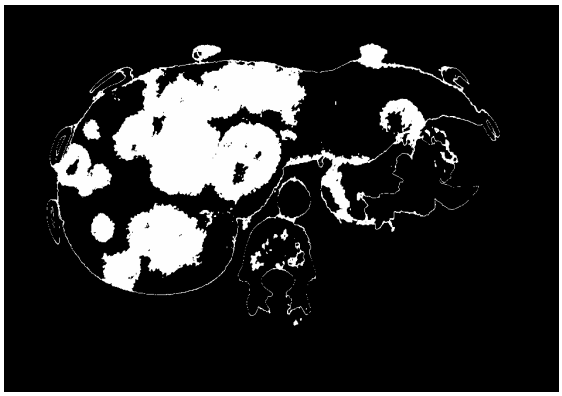

Figure 5: black and white.

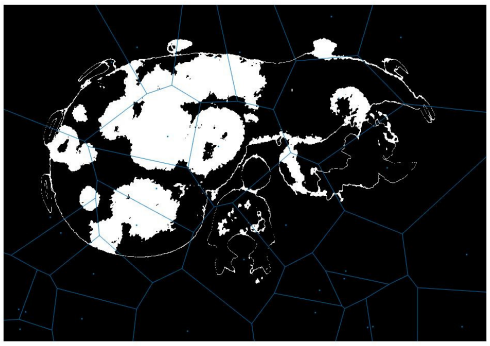

Figure 6: After 1st Iteration.

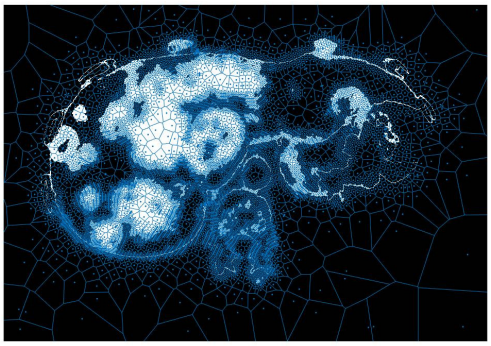

Figure 7: After 5th Iteration.

Conclusions

[h] From statistical experiment, intensity of tumour is between 140 and 190. On adding up new seed point to the existing seed point only neighbour cell to new seed point of voronoi diagram is affected. The existing MATLAB libraries will not give the desired results if the vertices of voronoi cell are infinite. When Image is imported coordinates system of the image is inverted. This algorithm can extend to (RGB) images to detect the boundaries of objects.