Digital Image Processing

Presentation

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Problem Statement

Detection of liver cancer using Image processing techniques.

- Worldwide cancer is the fifth reason for death therefore detection and treatment of cancer having great significance because of widespread episodes of diseases, recurrence after treatment and high death rate.

- There are different types of cancer in which liver cancer is at third position for death factor. This cancer is also known as hepatic cancer. This type of cancer is starting from the liver and then growing further if the not diagnosed early.

- The cancer which is started from some other organ and travels to liver is not treated as liver cancer. Liver cancer is consisting of the malignant hepatic growths called tumours over liver or inside liver.

Problem Statement

Detection of liver cancer using Image processing techniques.

- Therefore,early detection of liver cancer is challenging task in practical radiology. There are number of computer aided diagnostic methods designed using image processing terminologies for early detection accurately.

- Early stage detection of liver cancer helps to prevent it completely through the proper treatment. The major issues with image processing based techniques are efficiency, processing time and accuracy of detection. Designing time efficient, highly accurate and simple method for detection is main research problem.

- We even aim to develop a Web based or an App based GUI to simplify the same.

- The base paper for the same above is can be found @https://github.com/raghavddps2/5th-Sem/DIP Project

Objectives

Detection of liver cancer using Image processing techniques.

- Considering the problem formulated and the objectives of the paper is de-noise the image and find ROI. For checking the data sets of the patient, in case of cancer in liver, its size, volume, and shape; structure of its vessels; and location(s) are important.

- Hence the objective of this dissertation presents a technique that can be used to de-noise the image and to calculate the region of interest. To achieve this objective it is required to develop a technique that can analyze the data set of the patient before its treatment.

- The analysis and comparison is done on the basis of area of tumor, time taken for analysis, no of iterations of genetic algorithm which are fixed in both techniques, pixel difference. The objective thus defines to implement a technique that can analyze the data set and provide results on basis of area of tumor, taking lesser time as compared to the existing technique. The main objective includes:

Objectives

Detection of liver cancer using Image processing techniques.

Thus the objectives of the paper include:

- Acquire an image and perform pre-processing, that includes de-noising
- Find Region of Interest (ROI) and perform segmentation with algorithm to be proposed.
- Compare performance of proposed algorithm with existing technique, on the bases of area of tumor, time taken for analysis and no of iterations of genetic algorithm.

Literature Survey

Paper 1

Efficient Image processing based Liver Cancer Detection Method

To examine the neighboring pixels of initial seed points and determine whether the pixel neighbors should be added to the region or not they used the region growing technique.

H.M V Sudhamani, G T Raju proposed that segmentation of CT liver images helps to analyze the occurrence of hepatic tumor and classify the tumor from images.

The procedure is iterative and seed point is selected interactively in the suspected region. The watershed segmentation method is used to segment the contour, which is generated by the region growing.

The texture features for the segmented region are extracted through Gray Level Co-occurrence Matrix (GLCM). These features are used to classify the tumor as benign or malignant using Support Vector Machine (SVM) approach.

In this paper, a semi-Automated system has been presented which is robust, allows radiologist and surgeons to have easy and convenient access to organ measurements and visualization. Experimental results shows that liver segmentation errors are reduced significantly and all tumors are segmented from liver and are classified as benign or malignant.

Paper 2

Liver Tumour detection for CT images using Image Processing Techniques.

Yasser M. Kadah, et al. represented Gray level parameters like mean and first percentile.

second order Gray level parameters like Contrast, Angular Second Moment, Entropy and Correlation, and trained the Functional Link Neural Network for diagnosis of diffuse liver diseases like fatty and cirrhosis using ultrasonic images.

It showed that very good diagnostic rates can be obtained using unconventional classifiers trained on actual patient data.

Paper 3

Efficient Image Processing Based Liver Cancer Detection method.

- In this paper it is stated that segmentation is based on contourlet transform and watershed algorithm. A medical image usually contains a region of interest which holds the important diagnostic information.
- Due to irregular shapes of human organs, different imaging equipments the medical images have low resolution, low contrast and large noise.
- The new algorithm contains three steps which are: contourlet transformation of original image, obtained low frequency image is divided using watershed algorithm and then reverting the low frequency image into high frequency by using contour-let inverse transform.
- A watershed is a basin-like landform defined by highpoint and ridgelines that go down into lower elevation and stream valleys. Simple direct projection in vertical and horizontal direction leads into blur edges and loss of information; to overcome this problem contour let inverse transformation is used.

Paper 4

The evaluation of datasets with CT images using Image processing techniques.

Movsas et al. represents the results of a different Patterns of Care Study (PCS) investigating the treatment patterns for patients with lung cancer in 1998.

While 42,335 patient records were reviewed, this study included only 72 patients with LS-SCLC. It is important to note in this study that less than 5% of the patients did not receive both radiotherapy and chemotherapy.

While they cannot state that every patient within their analysis treated with radiotherapy also received chemotherapy in the later years, their assumption that such is did occur would appear valid.

Furthermore, PCS does not report survival analysis which is contained in their analysis of the SEER database.

Paper 5

Efficient Image processing based Liver Cancer Detection Method

- In this paper liver segmentation stating that a few prevailing segmentation techniques are Region Growing, Threshold based, Level Set method, Statistical model, Active Contour, Clustering algorithm, Histogram Based approach and Gray level methods are discussed.
- The Region Growing based approach starts with the provision of a small region as a seed point and proceeds with the addition of neighboring pixels. Thresholding based approach is implemented using global thresholding, to select the global threshold value is the main drawback of this method.
- Level set method adjusts the segmentation using a speed function obtained from a pixel classification algorithm. Model based approach utilizes the statistical shape model and it has the best performance among all the approaches.
- Histogram based approach is fully automatic segmentation by eliminating neighboring abdominal organs. Gray level based approach starts with a single user-defined pixel seed inside the liver then the mean and the variance of the rectangular neighborhood around the pixel is computed. Clustering based approach combines the K-means and is the simplest unsupervised learning algorithm.

Proposed System

Proposed System

The proposed system for the tumour identification is as follows.

Otsu's Method.

We apply the Otsu's technique for the enhancement of the image. The real demo will look like this.

Watershed Segmentation

We apply the watershed segmentation technique on the image obtained by otsu's enhancement .

Active contour model

As per the instructions to try something of our own, we used the Active contour model to improve the segmented image.

System Design

System Design

Image Input

Take the input image for further processing. This is the image of the MRI of the liver. It is on this image that we have to classify whether tumour is present or not.

Image Enhancement

We try to enhance the original image by applying the Otsu's method on the image. The result gives minimum combines spread and maximum inter class variance.

Image Segmentation

Watershed algorithm is applied using OpenCV and further MATLAB, to segment the image easily. This can be compared with the region growing technique. We aim to apply the genetic algorithm as well.

Feature Extraction

We extract various features from the image using techniques like Principal component analysis and so on..

Image classification

This is based on applying the K-Means clustering and Haar Wavelet transform to detect whether the cell is benign or malignant

Result Obtained

We then superimpose the extracted features in case of Malignant, so that the tumour can be identified or visualized easily.

Software Details

Software Details

Following will the software details for the same.

Software Details.

1. Python OpenCV
2. MATLAB
3. Python Flask (Later Implementation)
4. Google cloud (For training the model)
5. Any web based service for hosting.(AWS ambda, GCloud Later implementation))

Dataset Source

Dataset details....

The datasets are obtained from google and the sources below.

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3462338/
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5901158/
3. https://www.medscape.org/noscan/slideshow/757240
4. https://pdfs.semanticscholar.org/50d1/9cb312b91a7f9be0112e96dbb380ea5f5790.pdf

Conclusions...

Conclusion....

Following are the conclusions of the project.

1. Different MRI Images were acquired from the internet, basic Otsu preprocessing technique was used.
2. For segmentation, Marker-Controlled Watershed segmentation was used and it was observed that segmentation was done properly and the areas were identified accurately for most of the images.
3. For the accuracy part
   a. For the base paper, the accuracy obtained comes out to be 74.93 %
   b. According to other paper, we used active contour method(Implemented in project) and accuracy comes out to be 85.99%

Drawbacks of current paper

Drawbacks....

Following are the drawbacks of the current implementation.

1. The current Image enhancement methods have some noise still left while enhancing the image. Better enhancement methods can be used
2. The current segmentation methods do not yield accuracy as equivalent to the active contour model.
3. The dataset source is not very reliable. Better open datasets can be obtained for better training and feature extraction in future.
4. No segmentation enhancing methods are used in the current implementation of the paper.

Future Enhancements

Morphological Erosion

Image erosion in this step is required to remove noisy undesirable parts appearing in the segmented image. Image erosion is applied on the image based on a structuring element object or an array of structuring element objects.

Internal liver tissues

In the future this work can be developed to solve leak problem in some cases where liver contour is not clear due to hepatomegaly, also the work can be extended in order to differentiate between internal liver tissues, the hepatic tumor lesions, and vessels

Gui based Application

The current project can be converted into a proper GUI based application. It can be either an android or a web application, so that it is handy for any normal user to detect liver cancers.

References/Bibliography

References / Bibliography

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THANK YOU!

Any Questions?