CT LIVER IMAGE DIAGNOSIS
CLASSIFICATION SYSTEM

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Abstract: The CT liver image diagnosis classification system will automatically find, extract the liver boundary and finally further classify the CT (Computed Tomography) image. As result of the said system we can classify the liver images as normal & abnormal image. Here the image processing and Neural Network is used to classify the liver images. Tomography is a method of imaging a single plane or slice of an object resulting in tomogram. CT images have been widely used for liver disease diagnosis. It’s help doctors to improve their diagnosis. These images will be used in our work and then the further processing for classification is performed. With this computerized system we can give a helping hand to doctors with their experienced diagnosis. Also this will be used for educational purpose.

Here, firstly the CT Liver image are divided into 16x16 image blocks, then using normalized fractional Brownian motion we plot NFB feature curve which becomes base for detect of liver boundary. For detection of liver we require two stage algorithms, i.e. detect process and extract process called as detect before extract process (DBE) system. This system automatically detect liver boundary. This boundary is further refine by deformable active model. Finally liver is extract for CT image. A neural is use to classify liver with help of feature descriptors to distinguish between normal and abnormal liver. Feature descriptor are obtained by spatial co-occurrence matrix. Here we give feature descriptors as input to modified probabilistic neural network (MPNN) and output of MPNN is classified liver images.

Keywords—CT liver, Diagnosis, tomogram, brownian.

I. INTRODUCTION

An image may be defined as two dimensional function f(x,y) where x and y are plane co-ordinate and f is the amplitude .when the value of x,y and f are finite and discrete quantity we call this image as a digital image.digital image processing means to process digital images by means of digital computer.

Our project mainly consist two system
1. DBE – it stands for detect before extract DBE applies the concept of normalized fractional Brownian and is used to find the initial liver boundary the whole DBE system is decomposed into two stage :
   a. First stage is boundary detection
   b. Second stage is boundary extraction.
2. Neural network: - neural network are the group of neurons’ .neural network in conjunction with feature descriptor are used to classify two types of tumor.
   A. hepatoma and B. hemageoma

Feature descriptors are generated by co-occurrence matrices such as entropy, energy, etc.
3. Finally this feature is applied to MPNN and output is obtained as normal or abnormal liver.

II. Normalized fractional Brownian motion model:-

Keller replaced grey level by fractal dimension (FD). FD is used as an index to measure surface roughness .Brownian motion represent random walks which is used to model the random movement of practices suspended in a fluid.

The FD of the image is obtained from the formula fd=3-h where h is the slope of fractional Brownian motion curves .a smaller value of fd represent smooth surface and vice versa.

A. Normalized fractional Brownian motion model feature curves:-

When plot graphs take log (Δx) as x-axis and NFB as y-axis .the curve which result from this graph is known as NFB feature curve. NFB feature curve is used to classify three types of region in ct liver image .these region are as follows:-

1. Normal liver.
2. Abnormal liver.
3. Liver boundary.
From the curve, we can find that normal liver has smooth texture so slope of curve is small and abnormal liver has rough texture then slope is greater. Thus we can differentiate CT image according.

![NFB Feature Curve](image)

**Fig. 1 NFB feature curve**

### B. Detect before extract method for finding liver boundary:

Finding liver boundary is one of the most important things in medical diagnosis. Since liver is generally accompanied by other organs, it is difficult to extract liver from CT image so solution to this problem is the two stage algorithm i.e. detect before extract process.

In detect process initial liver is found by converting original image into binary valued NFB feature bit map. Then comes the extract process where obtain initial liver boundary is converted into original image. The second stage of the detect before extract strategy is a liver boundary extraction process which applies a deformable contour model to interpolate and refine the initial liver boundary obtained in the first stage so that an accurate delineation of the liver boundary can be extracted.

### III. Initial liver boundary detection:

First of all CT image is divided into MxN region (Rij). Then two average value is determined i.e. average grey level ($\bar{Gij}$) which is calculated as average of all pixel value of particular region (Rij) and other feature value (Fij) which is calculated from NFB feature curve.

If $0.1 \leq Fij \leq 0.3$ then it hepatoma or otherwise it is liver boundary. Each of the region is then classified into three classes i.e. normal, hepatoma & liver boundary. Then the class mean value of each normal and hepatoma is calculated using following formula:

$$\mu_{nl} = \frac{\sum Rij \in Cnl \bar{Gij}}{Nnl}$$

Where $Nnl =$ no. of total region for normal liver

$Nh =$ no. of total region for hepatoma class

Then a algorithm is used to generate NFB feature bit map i.e.

$$\eta^1 \in \bar{Gij} \in \mathbb{1}, \eta^2 \in \mathbb{2}$$

Where $\eta_1, \eta_2$ are tolerance threshold.

In this bit map “1” indicates part of liver while “0” indicate non-liver part as shown in fig 2. As there is narrow isthmus and hollow region around the liver there is some error in this bit map. This is eliminated using morphological operation, results in only the liver region is obtained shown in fig 3.

![Before Morphological Operation](image)

**Fig. 2 before morphological operation**

![After Morphological Operation](image)

**Fig. 3 after morphological operation**

This bit map is again converted back into grey level image by using method of interpolation and then by applying catmulls rom b-spline.

In interpolation a point b is called boundary point if any neighborhood centered at b contains at least one point with value 1 as well as one point with 0. It may be the case that a point satisfy the boundary condition but occur in
hollow inside the liver area hence this point is not considered for boundary point & will be removed by catmull rom b-spline an initial liver contour is obtained. This boundary more clear dilation process is applied .to make is contour may slightly deviate from the actual liver boundary the deformable model is suggested for further adjustment.

IV. Contour modification using a deformable active model:

The information about initial liver boundary contour given by b-spline provide a preliminary knowledge .it needs to be refined and modified to find the real and actual boundary .this done by using a deformable contour model. The constraints required for the deformable counter model are determined by

1. The NFB feature curves Fij of each pixel located at position (i,j).
2. The difference between the grey level of the pixel Gij and the average grey level µnl of normal liver region i.e. gradient value |Gij -µnl |

Implementation of process

To implementation this process ,sample pixels are selected from the initial liver contour with n-pixel apart .for each sample pixels a one dimensional search line segment centered and normal to liver contour after liver area surrounded by contour are further enhanced by histogram equalization.

V. CLASSIFICATION FOR LIVER TUMORS

Using CT liver images as a diagnostic tool becomes increasingly important in liver medical modalities. However, the effectiveness is largely reduced due to a lack of applicable image processing techniques. As a result, it still relies heavily on experienced and skillful doctors. In order to improve doctors’ diagnoses, a statistical texture classification system using a MPNN is suggested for classification of hepatoma and hemageoma.

The textures to be used for inputs of MPNN are fractal features and features generated by various spatial gray-level co-occurrence matrices (SGLCM)-based feature descriptors.

A. Spatial Gray-Level Co-Occurrence Matrices:

The texture filter functions provide a statistical view of texture based on the image histogram. These functions can provide useful information about the texture of an image but cannot provide information about shape.

Another statistical method that considers the spatial relationship of pixels is the gray level co-occurrence matrix (GLCM), also known as the gray level spatial dependence matrix. The toolbox provides functions to create a GLCM and derive statistical measurements from it.

B. Modified probabilistic neural network:-

MPNN is one of the most useful methods in pattern classification. Many neural networks have been studied in literature. PNN is Donald Specht’s term for kernel discriminant analysis .we can think of it as a normalized RBF network which there is hidden unit centered at every training case these RBF units are called “kernels” and are usually probability density function such as the Gaussian .Specht’s claim that a PNN trains 100,000 times faster than back propagation neural network. The main drawback of PNN is that like kernel methods in general it suffer badly from the curse of dimensionality PNN cannot ignore irrelevant input without major modification to the basic algorithm.

So, we use modified probabilistic neural network for pattern classification

VI. EXPERIMENTAL RESULTS

Image is divided into 16x16 pixels and NFB feature curve and corresponding bit map is obtained. Then liver boundary is obtained by detect before extract process and this boundary is then is refine using catmull rom b-
Spatial grey level co occurrence matrices are obtained from liver images then it is given to modified probabilistic neural network system where liver is classified as normal or abnormal liver.

VII. CONCLUSION

We are going to develop a classification system based on the fractal geometry and MPNN .the system consist of an automatic liver contour extraction process an image enhancement algorithm and liver tumor classification network . During the process of extraction first we have to locate liver region and then extract the liver region .classification network is modified probabilistic neural network any component in the system can be replaced by a better system if there exists one.

REFERENCES