ANALYSIS OF CT LIVER IMAGES FOR TUMOUR DIAGNOSIS BASED ON CLUSTERING
TECHNIQUE AND TEXTURE FEATURES

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Abstract

The CAD system employs automatic tumor segmentation, texture feature extraction and characterization into Normal malignant and benign tumors. The CT liver image will be classified automatically by probabilistic neural network and texture features. The liver segmentation process will be done by region growing method. The fuzzy c means clustering is used here for effective segmentation to diagnose the tumor part. The morphological process will be used to avoid distortion from background and smoothing the region.

I. Introduction

Automated classification and detection of tumors in different medical images is motivated by the necessity of high accuracy when dealing with a human life. Also, the computer assistance is demanded in medical institutions due to the fact that it could improve the results of humans in such a domain where the false negative cases must be at a very low rate. It has been proven that double reading of medical images could lead to better tumor detection. But the cost implied in double reading is very high, that’s why good software to assist humans in medical institutions is of great interest nowadays. Conventional methods of monitoring and diagnosing the diseases rely on detecting the presence of particular features by a human observer. Due to large number of patients in intensive care units and the need for continuous observation of such conditions, several techniques for automated diagnostic systems have been developed in recent years to attempt to solve this problem. Such techniques work by transforming the mostly qualitative diagnostic criteria into a more objective quantitative feature classification problem [1], [2], [3].
In this project the automated classification of brain magnetic resonance images by using some prior knowledge like pixel intensity and some anatomical features is proposed. Currently there are no methods widely accepted therefore automatic and reliable methods for tumor detection are of great need and interest. The application of PNN in the classification of data for CT images problems are not fully utilized yet. These included the clustering and classification techniques especially for CT images problems with huge scale of data and consuming times and energy if done manually. Thus, fully understanding the recognition, classification or clustering techniques is essential to the developments of Neural Network systems particularly in medicine problems [4], [5].

II. Proposed Methodology

A description of the derivation of the PNN classifier was given. PNNs had been used for classification problems. The PNN classifier presented good accuracy, very small training time, robustness to weight changes, and negligible retraining time. There are 6 stages involved in the proposed model which are starting from the data input to output. The first stage is should be the image processing system. Basically in image processing system, image acquisition and image enhancement are the steps that have to do. In this paper, these two steps are skipped and all the images are collected from available resource. The proposed model requires converting the image into a format capable of being manipulated by the computer. The MR images are converted into matrices form by using MATLAB. Then, the PNN is used to classify the MR images. Lastly, performance based on the result will be analyzed at the end of the development phase.

![Block Diagram](image-url)

**Fig. 1 Block Diagram.**
Region growing approach

Region growing technique segments image pixels that belong to an object into regions. Segmentation is performed based on some predefined criteria. Two pixels can be grouped together if they have the same intensity characteristics or if they are close to each other. It is assumed that pixels that are close to each other and have similar intensity values are likely to belong to the same object. The simplest form of the segmentation can be achieved through thresholding and component labeling. Another method is to find region boundaries using edge detection. Segmentation process, then, uses region boundary information to extract the regions. The main disadvantage of region growing approach is that it often requires a seed point as the starting point of the segmentation process. This requires user interaction. Due to the variations in image intensities and noise, region growing can result in holes and over segmentation. Thus, it sometimes requires post-processing of the segmentation result.

Clustering

Clustering can be considered the most important unsupervised learning problem, so, it deals with finding a structure in a collection of unlabeled data. A cluster is therefore a collection of objects which are “similar” between them and are “dissimilar” to the objects belonging to other clusters.

Clustering algorithms may be classified as listed below

- Exclusive Clustering
- Overlapping Clustering
- Hierarchical Clustering
- Probabilistic Clustering

In the first case data are grouped in an exclusive way, so that if a certain datum belongs to a definite cluster then it could not be included in another cluster. On the contrary the second type, the overlapping clustering, uses fuzzy sets to cluster data, so that each point may belong to two or more clusters with different degrees of membership. In this case, data will be associated to an appropriate membership value. A hierarchical clustering algorithm is based on the union between the two nearest clusters. The beginning condition is realized by setting every datum as a cluster. After a few iterations it reaches the final clusters wanted.
III. Texture Analysis

Texture is that innate property of all surfaces that describes visual patterns, each having properties of homogeneity. It contains important information about the structural arrangement of the surface, such as; clouds, leaves, bricks, fabric, etc. It also describes the relationship of the surface to the surrounding environment. In short, it is a feature that describes the distinctive physical composition of a surface. Texture properties include Coarseness, Contrast, Directionality, Line-likeness, Regularity and roughness.

Texture is one of the most important defining features of an image. It is characterized by the spatial distribution of gray levels in a neighborhood [8]. In order to capture the spatial dependence of gray-level values, which contribute to the perception of texture, a two-dimensional dependence texture analysis matrix is taken into consideration. This two-dimensional matrix is obtained by decoding the image file; jpeg, bmp, etc.

Four normalization techniques were investigated to reduce the impact of lighting, which were applied before extracting colour features. In the end, we normalised each colour component by dividing each colour component by the average of the same component of the healthy skin of the same patient, because had best performance compared to the other normalization technique. After experimenting with the 5 different colour spaces, we choose the normalized RGB, because it gives lightly better results than the other colour spaces.

IV. Proposed Methodology

The training phase for kNN consists of simply storing all known instances and their class labels. A tabular representation can be used, or a specialized structure such as a kd-tree. If we want to tune the value of 'k' and/or perform feature selection, n-fold cross-validation can be used on the training dataset. The testing phase for a new instance ‘t’, given a known set ‘I’ is as follows:

1. Compute the distance between ‘t’ and each instance in ‘I’
2. Sort the distances in increasing numerical order and pick the first ‘k’ elements
3. Compute and return the most frequent class in the ‘k’ nearest neighbors, optionally weighting each instance's class by the inverse of its distance to ‘t’
V. Results

The following results were obtained for various Images Figures are the windows that contain the GUI you design with the Layout Editor. See the description of figure properties for information on what figure characteristics you can control.

**Run (BPMainclassify) program**

First step in the simulation process is running the code for the program.

**Input image and Multi wavelet Decomposition**

After running the program dialogue box will open to load the text image to compare with database.

**Malignant:**

Result shown is malignant. Malignant tumour is harmful to the human body.
Training with TRAINLM results

Training is a visual classifier of the test images

PNMainclassify program

Running the program for the PNM main classify

Benign

Result shown is benign. Benign tumour is not harmful to the human body.
Process completed

Total results: After the process is done

Input image result:
Multi wavelet decomposition

Multiwavelet decomposition is seen after classifying the tumour.

Segmented Tumor part result

Segmentation is done for the affected part of the liver to get the clear detection of the image.

Total results:
Segmented part is broken down into many lower resolution components. Region is shown and can be treated easily.

When tumour is not present.

Above are the images of affected part of the liver. In this detection of the classified tumour is segmented. Wavelet decomposition is processed and the exact small part is detected, which is affected. The result also shows the anatomy of the liver for the further study.

**Conclusion**

This project implemented on liver tumour diagnosis using clustering technique and it will be classified effectively based on neural network. Here, probabilistic neural network was used for classification based on unsupervised leaning using
wavelet statistical features and target vectors. The threshold was estimated from smoothing details of images accurately for effective breast cancer segmentation. These features are useful to train a neural network for an automatic classification process. Finally this system is very useful to diagnose the diseases from liver images for early detection.

References


2. Luyao Wang, Zhi Zhang, Jingjing Liu, Bo Jiang, Xiyao Duan, Qingguo Xie, Daoyu Hu, Zhen Li, "Classification of Hepatic Tissues from CT Images Based on Texture Features and Multiclass Support Vector Machines", Proceedings of the 6th International Symposium on Neural Networks: Advances in Neural Networks, pp 374-381, 2009.


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