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Less Complex Liver Cancer Detection System

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Abstract: The liver cancer detection is urgent need of today's medical field where doctor's decision on treatment can be speeded up. In CT images, liver cancer detection using variety of techniques can be done. In this paper we have shown less complex system and easy to implement approach for liver cancer detection using FCM based segmentation, HOG feature extraction and SVM based classifier for cancer detection. The system performance is evaluated using MATLAB based implementation and found better results.
Keywords: Liver cancer, CT images, FCM method, HOG features, SVM.

I. INTRODUCTION

Human body has Liver organ as one of the largest internal. It performs a multiplicity of life The sustaining functions and fundamentally affects every physiological process in the body. The liver is the second organ most normally involved by metastatic disease, being liver cancer one of the prominent causes of death worldwide. FOr the sake of proper diagnosis and the early detection liver tumor is consequential for the detection of liver tumor. There are variety of non invasive liver tumor detection methods in medical image processing. Liver tumor detection in terms of lession size and shape is done by variuos methods. This paper reviews many different liver tumor detection algorithms and methodologies utilized for liver tumor detection. In this paper a method for the detection liver tumor is proposed.

As per major death factors in the world liver cancer is major death factor. In other words, there may be cancers which start from somewhere else and end up in the liver - those are not (primary) liver cancers. Cancers that originate in the liver are known as primary liver cancers. Liver cancer comprises of malignant hepatic tumors (growths) in or on the liver. The hepatocellular carcinoma is a common type of liver cancer and is seen to affect mostly males compared to females. Early detection and accurate presentation of liver cancer is a significant issue in practical radiology. Liver lesions refer to those abnormal tissue cell. Due to disease tissue areas are affected resulting in lesion. Due to change in pixel intensity compared to non affected regions in CT scan images, these areas can be identified separately. Manual segmentation of these areas is difficult and time consuming while clinical diagnosis process [1]. Alternatively, automatic segmentation is very challenging task, due to numerous issues, including liver stretch over 150 slices in a CT image, poor intensity contrast between lesions and other nearby similar tissues and indefinite form of the lesions.

Segmentation of liver tumors is a significant prerequisite task afore any medical intervention. For providing proper treatment to the patients a precise and perfect examination of the lesions/tumors is necessary. Over an interval of time it track the progress of the therapy along with choice of the best treatment approach this process is very important. At the time of devlopment of surgical tools tumor area dentification plays important role. The segmentation process can guide the surgeon for the surgary. Accurate and early detection of the tumor is very important for the diagnosis and treatment of the disease.

A. Related Work

M V Sudhamani, et al [2] proposed that Segmentation of CT liver images helps to analyse the occurrence of hepatic tumor and classify the tumor from images. Here, to examine the neighbouring pixels of initial seed points and determine whether the pixel neighbours are considerable for adding to the region or not is done by using region growing technique. The procedure is iterative and seed point is selected interactively in the suspected region. For segmenting the region of interest the watershed segmentation along with region grwing is used. Grey Level Co-occurrence Matrix (GLCM) is used to extract textural features of the segmented region. The support vector machine (SVM) based classifier is used to classify these features. A semiautomated approach is used for the liver segmentation. The results obtained through experimentation show less errors in the liver segmentation. Also benign and malign class of tumor stages are obtained.

L. Ali et al [3] proposed intelligent CDS framework will automate real-time image enhancement, segmentation, disease classification and progression in order to enable efficient diagnosis of cancer patients at early stages. The CDS framework is motivated by the human interpretation of US images from the image acquisition stage to cancer progression prediction.

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Specifically, the framework is composed of a number of stages where images are first acquired from an imaging source and pre-processed before running through an image enhancement algorithm. The detection of cancer and its segmentation is considered as the second stage in which different image segmentation techniques are utilized to partition and extract objects from the enhanced image. The third stage involves disease classification of segmented objects, in which the meanings of an investigated object are matched with the disease dictionary defined by physicians and radiologists. In the final stage; cancer progression, an array of US images is used to evaluate and predict the future stages of the disease. For experiment purposes, authors applied the framework and Classifiers to liver cancer dataset to 200 patients. Class distributions are 120 benign and 80 malignant in this dataset. [3] Classifiers performance is measured by introducing WEKA Explorer where several classifiers such as Bayesian Logistic regression, Multi-Layer Perception, KNN, J48graft and SVM classifier were tested on LESH features. SVM produced 95.29% accuracy results and performed better among the machine learning algorithms tested.

B. Propose Work

The proposed work consists of various stages of processing as shown in figure 1.

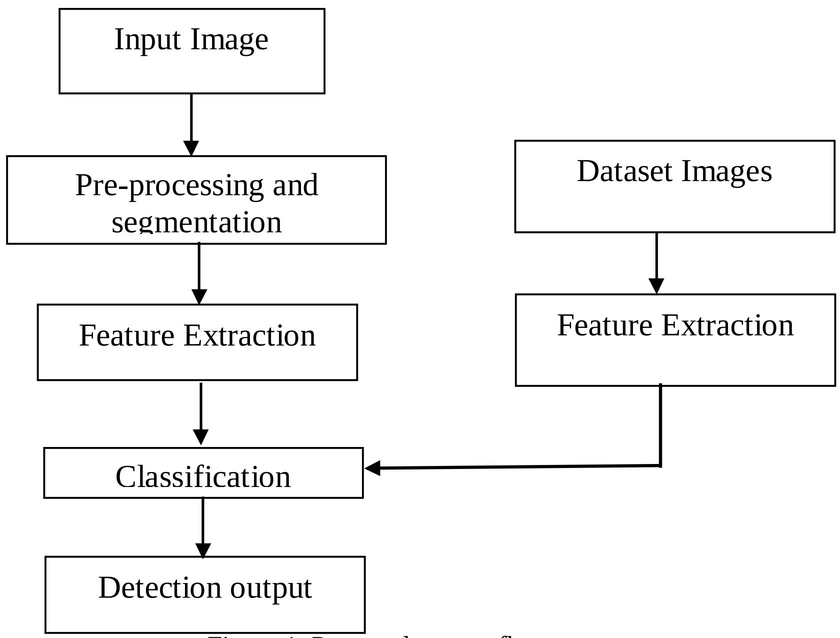

Figure 1: Proposed system flow

The steps involved in the processing are consist of taking CT input image of abdominal region in 2D form. The image is first pre-processed using Gaussian noise removal filter along with Weiner filter to preserve the sharpness.

Then image segmentation consist of liver area segmentation process using fuzzy c means based segmentation approach. The segmented area is then enhanced with adaptive histogram equalization for enhancing and getting even light intensity distribution over liver area.

The Fuzzy C-Means algorithm is an unsupervised fuzzyclustering algorithm. Conventional clustering algorithmfinds “hard partition” of a given dataset based on certaincriteria that evaluate the goodness of partition. By “hardpartition” we mean that each datum belong to exactly onecluster of the partition. While the soft clustering algorithmfinds “soft partition” of a given dataset. In “soft partition”datum can partially belong to multiple clusters. A softpartition is not necessarily a fuzzy partition, since the inputspace can be larger than the dataset. However, most softclustering algorithms do generate a soft partition that also forms fuzzy partition.

The feature extraction is done using HOG based feature extraction approach. Based on the distribution of intensity gradients and edge directions local object appearance along with shape within image are extracted by suing HOG features. Firstly image is divided in small connected pixels called as cells. Within each cell, for pixels, a histogram of gradient directions is compiled. By concatenation process of these histograms, descriptors are obtained. By considering the large region of the image as the block and according to this remaining pixels can be contrast normalized which results in improvement of accuracy. The effect of shadows and illumination changes is identified in a better manner by this normalization process.

The photomatric and geometric transformations are non effective for HOG features except for object orientation and hence advantageous while considering. Such changes would only appear in larger spatial regions. Moreover, as Dalal and Triggs discovered [7], coarse spatial sampling, fine orientation sampling, and strong local photometric normalization permits the individual body movement of pedestrians to be ignored so long as they maintain a roughly upright position.

II. RESULTS AND ANALYSIS

The proposed work is implemented using image processing toolbox in MATLAB. The image input and its output at respective stages is shown in figure 2.

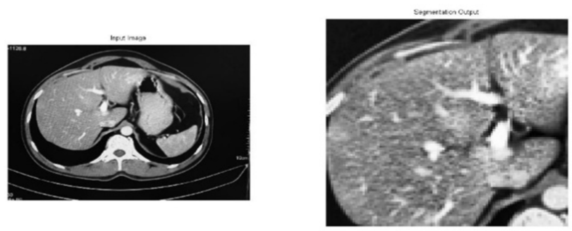

Figure 2: Image processing output.

For the sake of detailed analysis, we have implemented detection of benign or malignant stage of cancer or the output can be normal that is without cancer.

The performance evaluation is done using confusion matrix based analysis for test dataset. For training of SVM we have used 105 images dataset and for testing purpose we have used 20 images. The ground truth of test images is used to evaluate the performance of the images. The performance evaluation is as shown in the table 1.

Table 1: Performance of proposed system

Dataset	Specificity	Sensitivity	Accuracy
TD1	1	0.875	92%
TD2	1	0.928	84%
TD3	1	0.933	92%
TD4	1	0.846	84%
Average	1	0.895	88%

Based on the performance average accuracy of the system is 88% which is at acceptable level.

III. CONCLUSION

In this paper we have proposed the liver cancer detection system. The FCM based approach for liver area segmentation is fast in processing and less in complexity along with accurate liver region extraction capability. HOG features are sufficient to get temporal features of the liver region which gives better accuracy while detecting the cancer. SVM based classifier gives sufficiently good results and up to acceptable level.

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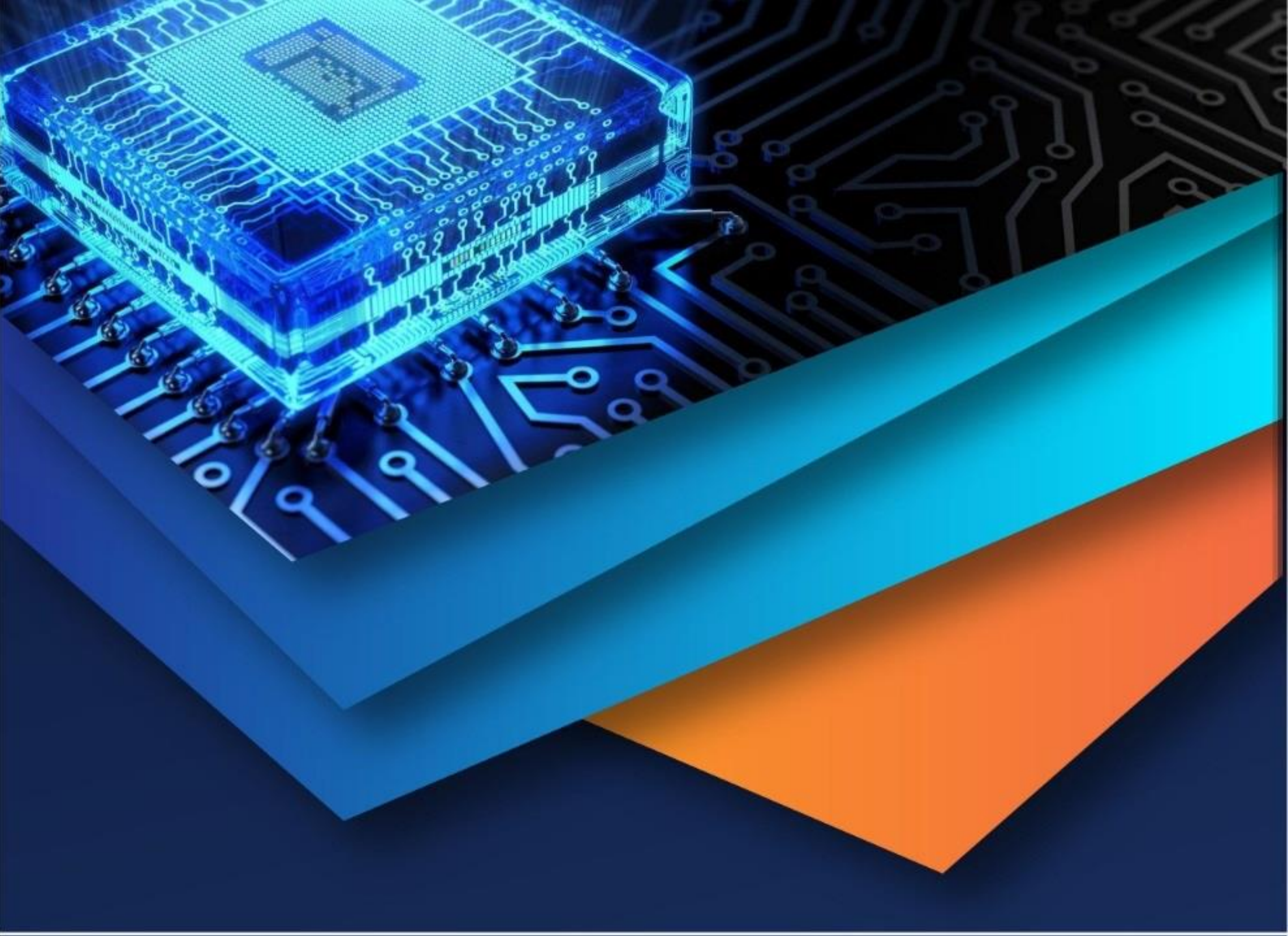

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