Detection of Liver Lesion using ROBUST Machine Learning Technique

Sowmya Sundari L K, Nirmala S Guptha,Shruthi G, Thanuja K,Anitha K

Abstract: In the present era, Computer Aided Diagnosis (CAD) is very useful for the detection of a liver tumor. This type of study and categorization system can moderate an unnecessary biopsy. The proposed method for the detection of liver cancer clusters in liver images using Gabor features and shape features. The mentioned regions are categorized by the SVM classifier utilizing the most prevailing features selected from the above features. In our project, we have proposed a systematic approach of analyzing a liver under cancer positive environment. We have proposed a technique for tumor identification and segmentation using image smoothing and refining methods. When we use CT images for the detection of liver tumor manual interaction is not necessary, since it works automatically. The projected method needs to learn a few model parameters such as tumor part, non-tumor part, and segment liver regions. The complete system is divided into the training part and testing part respectively and this system is based mainly on SVM. The input liver image undergoes for the preprocessing step and image segmentation. Preprocessing includes many steps like the resizing of an image, improve the clarity of the image, conversion form colored image into grayscale. After these necessary features are collected from the resulting image. These collected features are then fed to the SVM for training. These collected features are compared with examination results by the SVM Classifier with the existing trained features using RBF kernel. Contingent upon the correlation result, the classifier gives the outcome.

I. INTRODUCTION

Among all the different cancer types, the death rate caused by the liver cancer is more in the world. Though the tumor is curable if it is detected in the early stage, still liver surgery is the most difficult fields in surgery. The severity of the disease decides the treatment of liver tumors and it also depends on patients overall health conditions. If the tumor is not identifiable outside the liver, local treatment is more suitable [9]. Though we understand well about liver anatomy and pathology of patients, it is always challenging for surgeons

to perform liver surgery. CT, MRI and US results will help the surgeons to take the decision about surgery. To know the liver tumors sizes and locations in pre-surgical planning is necessary.

Diseases to crop may affect the production and profit of the crop. Fungal, bacterial and spots are the main crop disease. Ethical practices used to detect disease but the large consumption of pesticide harmful leads decrease in fertility of the soil. In order to increase the fertility of the soil and identification of leaf disease modern methods are used.

In this paper we have designed an application for detecting the leaf disease by using the modern techniques such as machine learning and the image processing. This technique used to detect the category of the leaf disease.

Image processing is analysis and manipulation of a digitalized image, in order to improve its quality. Remote sensing, machine/ robot vision and color processing are various application technologies in Image processing. This simpleapplication helps in identification of the leaf disease and also a perfect solution in curing the leaf.

II. RELATED WORK

“Detection of metastatic liver tumor in multi-phaseCT images by using a spherical gray-level differentiation searching filter”. According to Xuejun Zhang[1] from the liver CT scan images to detect metastatic livertumor we extract and register two liver border maps on un-improves and portal venous phasepictures using phase only correlation method (POC). By subtracting the edge and the grey mapliver gray map is obtained for this they also refer from the SGDS filter. The results obtained bythis prove that P-O-C is a strong process if filter is efficient in detecting circular shape tumors onCT images.

AUTOMATIC DETECTION OF LIVER TUMORS-According to Daniel Pescia [2] in order to deal with challenges like the effect ofcontaminated voxel on the tumor and changes in the observed CT scan which we will face whiledetecting the tumor in CT images the automatic liver detection method will use machine learningtechniques to determine the best feature and the hyper plane that use these features todifferentiate between tumoral voxel and normal voxels of healthy tissues. It is giving verypromising results. In this section, the author describes the previous research works in the form of title, problem statement, objectives, not repeat the information discussed in Introduction [2]. According to Xuejun Zhang[11] from the liver CT scan images to detect metastatic liver tumor we extract and register two liver border maps on un-improves and portal venous phase pictures using phase only correlation method (POC). By subtracting the edge and the grey map liver gray map is obtained for this they also refer from the SGDS filter.

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The results obtained by this prove that P-O-C is a strong process if filter is efficient in detecting circular shape tumors on CT images.

According to Daniel Pescia[12] in order to deal with challenges like the effect of contaminated voxel on the tumor and changes in the observed CT scan which we will face while detecting the tumor in CT images the automatic liver detection method will use machine learning techniques to determine the best feature and the hyper plane that use these features to differentiate between tumoral voxel and normal voxels of healthy tissues. It is giving very promising results.

Chia hung [13] says that to deal with the challenges which we face during detection of tumor in CT liver images. This challenge like the number of contaminated voxels has direct effect on the nature of tumor. He is proposing the use of advanced non-linear machine learning technique to determine optimal features and the hyper planes which use the specified these features to differentiate between the tumor voxel and voxel of healthy tissues. The proposed method has given a promising classification results.

According to Joni-Kristian[14] Gabor filters has it applications in vision and image analysis. The reason for its success is its practical applications like face detection and recognition, finger print matching etc., Gabor feature performance in these applications is at top level. Apart from this it has many practical and computational future applications.

I. ARCHITECTURE

System architecture of the proposed method

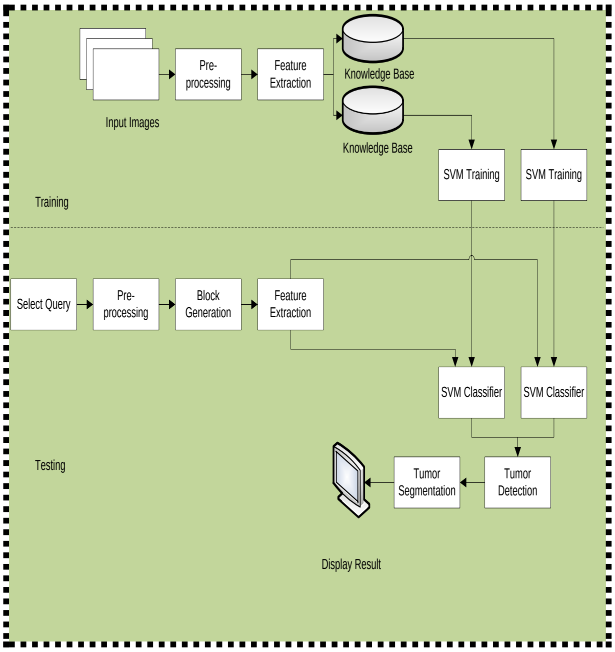

Figure 1: System architecture of a project

The whole system design for the tumor detection is shown in Figure 1, and the flow diagram of proposed system is shown in Figure 2. The system has two stages- Training & testing. Support vector machine classifier is the core of the proposed system.Input to the system is the image of the liver which is segmented and then enhanced. This enhanced image is then used for feature extraction. The extracted featured are input to SVM classified for training. In the testing phase, new or unseen images are passed to the classifier. The extracted features and the results of testing phase are compared with the trained feature.

Following preprocessing is done on the image before the features are extracted and classification is performed as shown in figure 1-

- ✓ RGB image is transformed into a gray scale to reduce the processing time..
- ✓ Image is resized.
- ✓ Noise filtering is done on the input image.

II. METHODOLOGY

Our method need to learn some model parameters such as tumor part, non-tumor part andsegment liver regions. It has two phases like training and testing respectively, both phases Include pre-processing of original liver images. Pre-processing of liver image includes manyprocessing steps like resizing of an image in to 512X512, translation of colored image in to grayscale image, contrast enhancement for the image for improving the clarity and removal of noise Using median. Features are extracted by Gabour feature extraction and edge direct histogram inthat we are using canny edge detection algorithm. To achieve high accuracy in classification, byextracting features Gray level co-occurrence matrix (GLCM) and Texture analysis of image.Tumor detection is done by using SVM based machine learning algorithm which uses RBF kernel.

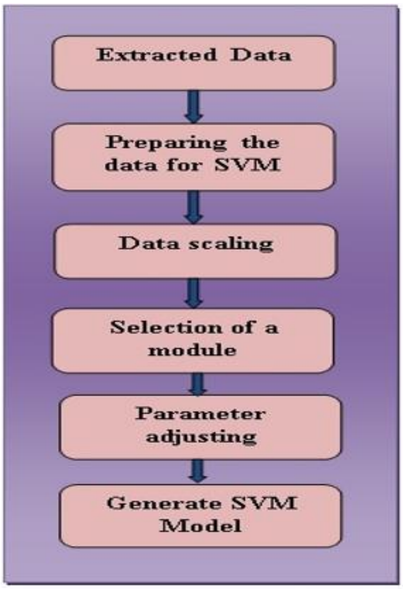

Figure 2: System architecture of the proposed method

In the flow diagram as shown in figure.2 here we demonstrate the complete overview on data flow and module analysis. This process is structured in 6 successive modules, the first module is dedicated for data acquisition and extraction. In this module data compatibility and manual observations with the basic assumption are made. The Second module is preparation of SVM data structures.

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In this module the data is preprocessed and restructured accordingly. The successive step followed is data scaling. This module is featured with data smoothing, noise removal, ROI extraction and segmentation [8].
Fig. 1 shows the block diagram of training phase.This phase receives as input a set of features for each portion of the image.Following paragraphs describe the functioning of the system. A data flow diagram gives the relationship among and between the different components in a system, DFDs are very important for designing a system. It tells how input data is processed to output result through functional steps.

Our proposed system design consists of two phases like training and testing phase, before testing we need to perform training. In training phase small patches of liver are taken, pre-processing of an image can be done to filter out the noise, then features are extracted. features are then stored in knowledge base are given to SVM training. In testing phase the images we are going to test are given as input images, and then perform pre-processing of a query image. After pre-processing segmentation algorithm is applied, features are extracted. The features are stored in knowledge base are given to the SVM classifier it compares these features with the features stored in the SVM training, based on the decision value of SVM classifier detects the liver tumor part[10].

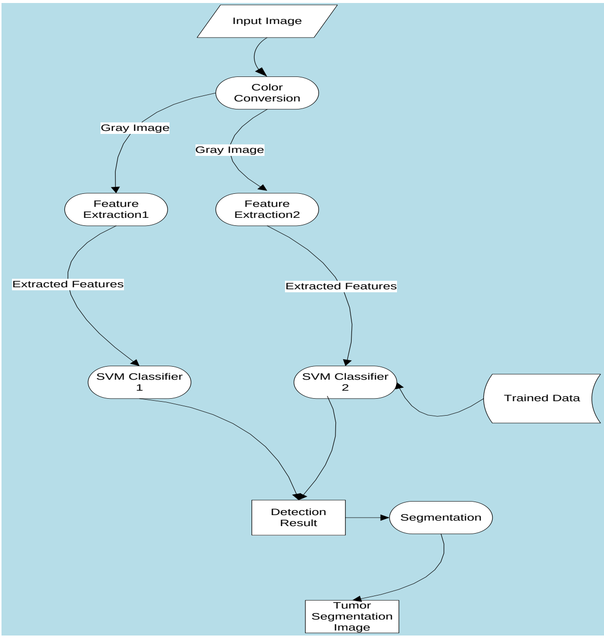

Figure 3: Data flow diagram of the model

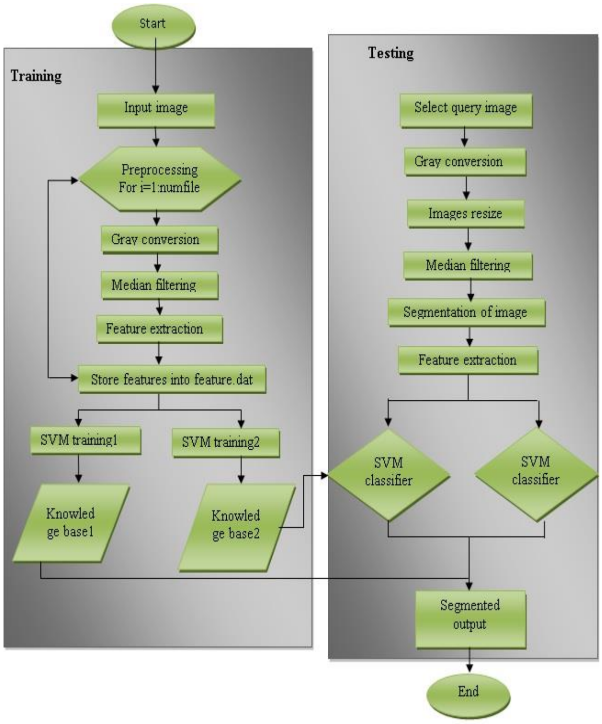

Figure 4: Flow diagram of the proposed method

III. IMPLEMENTATION

Implementation consists of varies methods, terminologies, software's tools and terminologies used in design and development of the proposed module with various modules and steps.

Pre-processing

Pre-processing is an initial step in implementation. The pre-processing improves of image data to suppress distortion and improves features which helps in further processing. In this stage the liver CT images which are taken from the portal venous phase should be preprocessed. This in necessary because we are capturing the image from the live human body which contains blood movement, fluid movement, fat, bones etc. from the CT scan the intensity of liver and tumor region within the range of [-50, 250] HU are only taken. We have considered the Largest connected region as the region of highest importance for later processing.

Image Resizing

Since CT images are captured from different devices they are in different sizes hence we do image resizing. To resize a picture, utilize the imresize function. When you resize a picture, you indicate the picture to be resized and the amplification variable [8]. To augment a picture, determine an amplification component more noteworthy than 1. To decrease a picture, indicate an amplification element somewhere around 0 and 1. We resize image into 256 X 256
grayImg=imresize(grayImg,[256 256]);

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Contrast Enhancement

Tumor recognition relies on upon contrast of liver CT pictures, contrast of the picture is necessary. Histogram of liver CT pictures having high and low contrast. In the event that the contrast of image is high then the tumor different intensity range with the liver and the tumor can be identified effortlessly by intensity threshold, if the contrast of liver CT picture is low then tumor is same intensity as the liver and it is hard to identify the tumor from the liver volume, thicknessestimation of all items is in the same range so we have to upgrade the contrast of CT image [7].

The location of tumor may be difficult because of low contrast between unhealthy tissues and typical tissues. Contrast upgrade should be possible to highlight particular tissues and to enhance the clarity of the liver CT images.Histogram equalization is applied to contrast improvement of CT images.

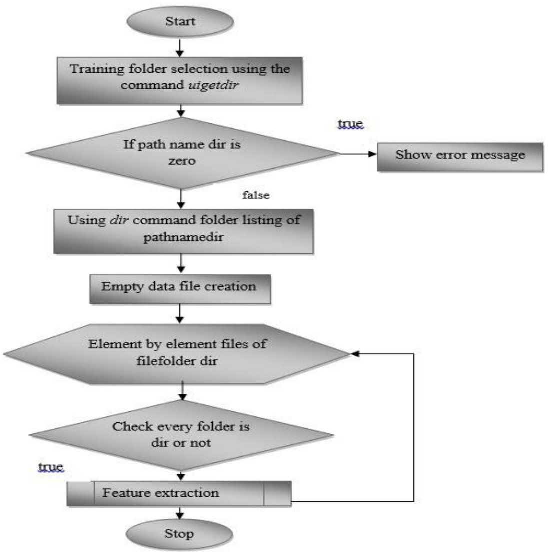

Figure 5: flow chart of feature extraction

SVM classifier

SVM is one of the finest classifying techniques. Because of its high accuracy results itwill be used in various other disciplines also. It is very flexible in dealing with real wordproblems. To get the desired results it is very important to know about how it works. Thistechnique always splits data into training and testing sets. It is actually belongs to a method ofkernels[10].

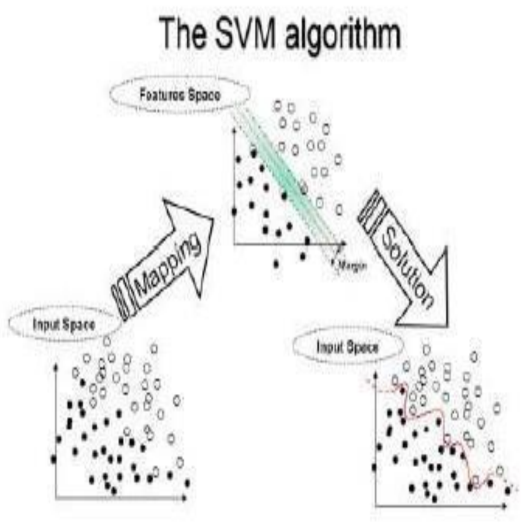

Figure 6: Working of SVM Classification method

RBF-kernel

It is one of the most frequently used kernel function in various learning algorithms. It has twomodels x and x' which is defined as

K (z, z') = exp -√||z-z'||

2 σ 2

In the above formula ||z-z'||2 is the squared Euclidean distance between the two feature vectors.

σ is the parameter.The similar equation is

K (z, z') = EXP (Γ || z - z' ||2)

The value of the RBF kernel reduces along with the distance and always it will be in between 0& 1

IV RESULTS AND DISCUSSION

After testing the proposed method on input image dataset with 12 CT images ofdifferent patients captured from the portal venous phase containing each image of dimension512X512 pixels and the resolution of pixel is 0.7013 mm in the directions of x and y coordinates. The liver tumorsare manually outlined and extracted in the liver CT images.

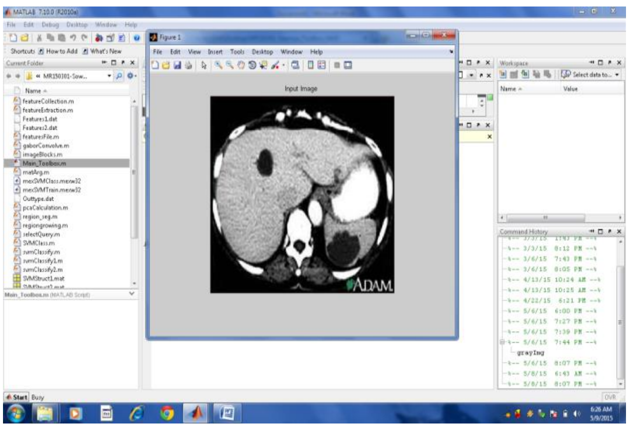

Figure 7 : Input Image for Liver Tumor Detection

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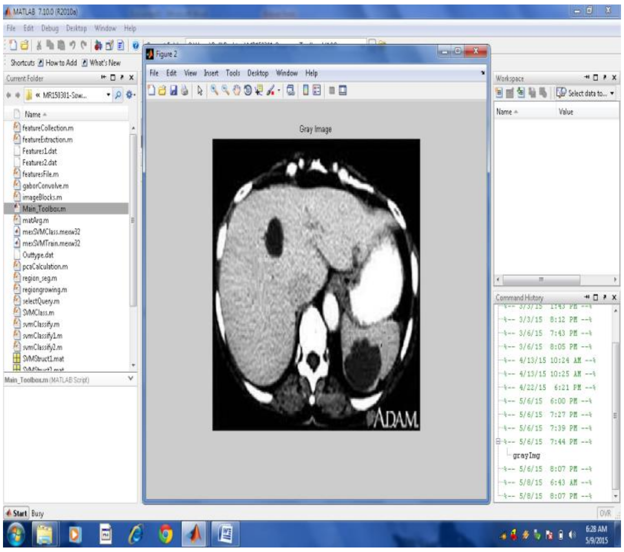

Figure 8: Gray Scale Converted Image

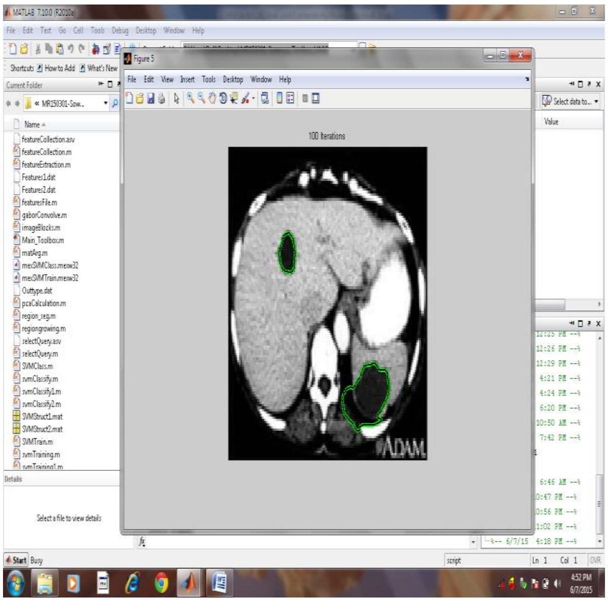

Figure 9: Final result showing tumor part in the CT image

VI. CONCLUSION AND FUTURE SCOPE

Liver cancer is most vital and fastest spreading cancer in a human body with an averageration of 3.5 times faster than any other types of cancer. Since liver is acid factor for humandigestive system, it is also responsible in absorption of many toxic substances leading to livercancer. We are presentingSVM methodology for classification of irregularity in CT liverimages. Gabour filters are used for feature extraction are used as good device for featureextraction. This project has proved the efficacy of our method in automatic detection and characterization of tumors in input images.

In our project we have focused on liver lesion extraction and detection using a hybridtechnique of image calibration and refining with spectrum analysis. Spectrum analysis is done toachieve intermediate thresholding values of the scale for lesion analysis and detection. ThisThishybrid approach helps the user to easy the computation and hence accurate detection of cancerlumps is achieved.In the future work, we wish to employ the advanced methods to improve the accuracy of early detection of cancer. We would also like to use advanced segmentation techniques to remove pectoral muscle and text noise from input.

In future, this work can be enhanced in estimating the level and stagesof cancer forinstance report generation and summarization for consultation of the patient. It can also be Extended in analyzing the pattern of lesions and their ratio

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