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Advanced Computerized Scheme for Detection of Lung Nodules by Incorporating VDE Image

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Abstract: The detection of the lung nodules can be found out by introducing Computer Aided Diagnosis (CAD) scheme. Most of lung nodules that are missed by radiologists as well as computer-aided detection (CADe) schemes overlap with ribs or clavicles in (CXRs). Computed tomography is used to detect the lung nodules but it's costlier. The proposed method uses the X-Rays, are preferred due to cost effective, low radiation dose and effective diagnostic tool. Computerized Detection Scheme system detected nodule candidates on VDE images by use of lung segmentation and morphological filtering techniques. Segmentation of lung regions based on our M-ASM and nodules at the lung borders by using coarse to fine segmentation techniques and watershed segmentation algorithm. The classification and feature analysis of the nodule candidates into nodules or non nodules by use of non linear Support Vector Machine (SVM) with Gaussian kernel classifier. By implementing this work, experimental results show that the different rib contrast parameter, smoothness and entropy are compared with conventional method.

Keywords: Chest radiography (CXR), computer-aided diagnosis (CAD), lung nodule detection, virtual dual energy (VDE).

I. INTRODUCTION

Lung cancer is currently the second most common cancer in both men and women and is the top cause of all cancer deaths. There is a direct link of tobacco smoking and other impurity and dirty exposures to lung cancer making it the leading preventable cause of death. Every year, more than eight million people worldwide die from chest diseases. For detection of lung cancer, various radiography techniques such as CXR, CT, MRI and PET are used.

Chest radiography (chest X-ray: CXR) is by far the most commonly used diagnostic imaging technique for identifying chest diseases such as lung cancer, tuberculosis, pneumonia, and pulmonary emphysema. CXRs are regularly used for detecting lung cancer as there is support that early detection of the disease can result in a more hopeful diagnosis.

However, chest radiographs (CXRs) are used in our paper because it is the most cost-effective technique when compared to other radiography techniques. Because CXRs are so widely used, growth in the detection of lung nodules in CXRs could have a significant impact on early detection of lung cancer.

Generally the detection of lung nodule system consists of three major steps involved. First, lung segmentation is pre-processing step for enhancement. Then, Segmentation of lung fields based on our multi-segment active shape model (M-ASM) and a background-trend correction was applied to the segmented lung field. Second, two stage nodule enhancement and nodule candidate detection. Segmentation of nodule candidates by use of our clustering watershed algorithm; and Third, Feature analysis and classification of the nodule candidates into nodules or non-nodules by use of a nonlinear support vector machine (SVM) classifier.

II. PROPOSED SYSTEM

The hardcopy of images are converted into the soft copy of images with the help of high resolution scanner.

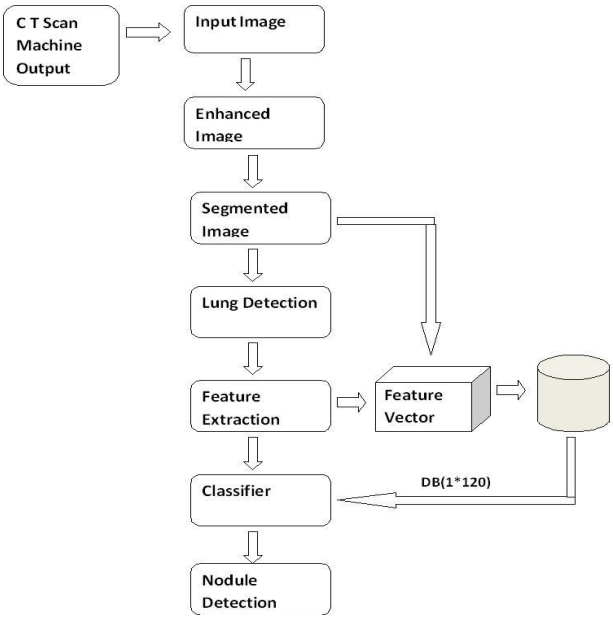

Fig: Blocked diagram of system

These scanned images are stored in the storage drive location for additional analysis and processing it. These Scanned images are imported into the computerized detection scheme system. Computerized detection scheme system performs two main tasks namely detection and classification. Detection is further classified as image acquisition, enhancement and segmentation. In image acquisition all the scanned images are resized into the

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Standard size, As the Computerized detection scheme system algorithm are developed for specific size image. Enhancement process of scanned image is required before applying any segmentation and feature extraction algorithm. During the scanning process and storing process of X-ray image, a lot of unrelated information (noise) is added. For removing unrelated information and for enhancing the X-ray image, Total variation De-noise, Wiener filter, Gaussian smoothing pre processing techniques is employed.

i) Input Image

The images collected from cancer hospital in the form of DICOM (Digital Image Communications in Medicine) image format which are of cancerous and non-cancerous patients. It is not just the image or file format. DICOM image provides all necessary tools for diagnostically accurate representation and processing of medical imaging data.

ii)Image Enhancement

Enhancement technique enhances the contrast of images. The contrast enhancement can limit in order to avoid the noise which is present in an image. We will use histogram equalization to improve the contrast of images by transforming the values in an intensity of an image. So that the histogram of the output image approximately matches a specified histogram.

iii)Segmentation

In the image segmentation the CT image is sub-divided into small regions. Segmentation distinguishes the nodule from background part of the lung CT images

iv)Features Extraction:

Feature extraction is essential and very important step to extract region of interest (ROI). In our project implementation the nodule size, structure, volume and nodule spine values are considered as feature value. The fig.8 in above segmented method shows different nodule size, structure, and volume. The spine values are pre-calculated by using gradient magnitude method in our segmentation method. By using these two images feature values are calculated and are given as input to the feature vector of 1*120 sizes. The following diagram shows vector of size 1*120 of feature values.

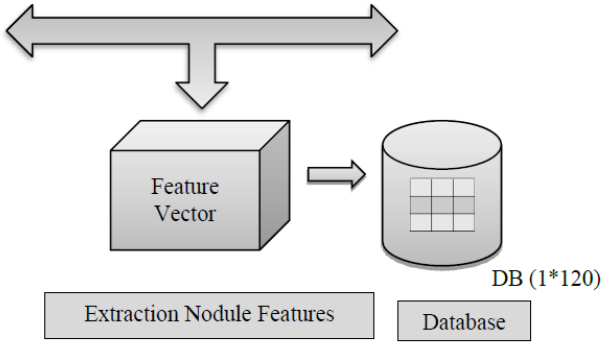

Fig. Feature Extraction

v)Classification and Recognition

The Support Vector Machine (SVM) classifiers differentiate the non-cancerous (Benign) from cancerous (Malignant) lung nodules. It constructs a hyper plane in a high dimensional space, which can be used for classification. The good separation is achieved by the hyper plane that has the largest distance to the nearest training data point of any class. In general larger the margin lowers the generalization error of the classifier. The feature vector is given as input to the classifier. This method differentiates and identifies the non-cancerous (Benign) and cancerous (Malignant) lung nodules. Classification and recognition randomly divide database into 70% of the database for training and 30% for testing .Both subset have the random samples from the same distribution. In training data, where each row corresponds to an observation or replicate, and each column corresponds to a feature or variable. The classifier train on the training set applies it to the testing set and then measure performance by comparing the predicted labels and give decision as cancerous and non-cancerous.

III. ALGORITHM OF PROPOSED SYSTEM

Steps are as follows

Step: 1 by selecting input Image from database the segmentation of Lung Using Region growing Algorithm.

Step: 2 virtual dual energy images created by using MTANN technique

Step: 3nodule enhancement and nodule candidate detection is firstly possible by segmentation of image

Step: 4 exact lung region will be detected by showing portion on image.

Step5: Image Feature Extraction using DWT

Step6: Classification of nodule candidates into nodules and non nodules by of Support Vector Machine.

Step: 7 finally the Nodule detected.

IV. EXPERIMENTAL RESULT

Graphical User Interface or GUI is a part of MATLAB, a type of display format that enables the user to choose commands, start programs, and see lists of files and other options by pointing to pictorial representations (icons) and lists of menu items on the screen. By opening one of the image which are stored in database and by processing with GVF we get lung image with exact lung part.

For nodule detection first we have three GUI buttons are as get lung, load image and process. First we have to load image from given database and then process.

After processing the small circle doted part are shown on the image which are nothing but nodule.

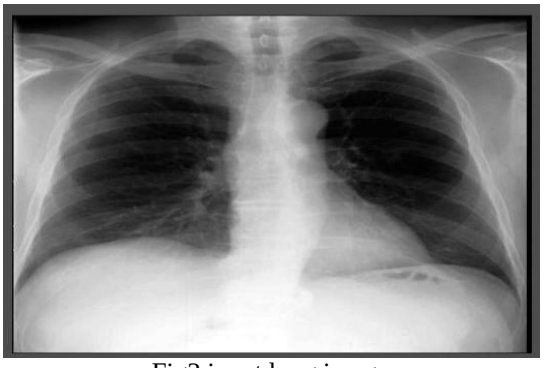

Fig2 input lung image

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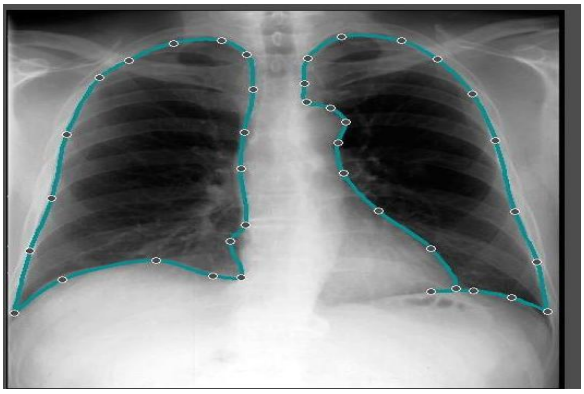

Fig 3: exact lung portion

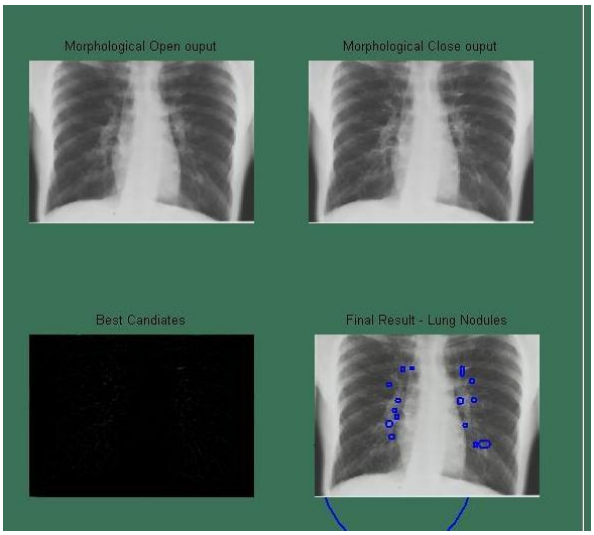

Fig 4: nodule detection

In fig 2 the input image show that there no any distortion on image. And fig 3 show the exact lung region which will help to pulmonologist.

Fig 4 shows the four window which are as morphological open output, morphological close output, best candidate and finally nodule detection on image which shows by blue colour circle

TABLE: Showing extracted gray level, contrast, smoothness value of five sample images of the database.

Sample	Gray level	Contrast	smoothness
1	11 207.183	26.074	0.01
2	22 195.4904	12.625	0.002
3	333 225.0012	23.418	0.008
4	44 208.6627	11.287	0.002
5	5 228.5311	19.752	0.006

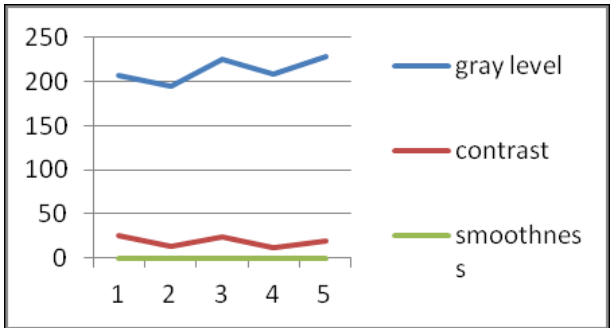

Fig. 6. Showing Graphical representation of extracted features- Gray level, Contrast and Smoothness of five samples.

R=0 for constant intensity of the region. Skewness otherwise called third moment is equal to 0 for symmetric histograms, positive by histograms skewed about the mean.

V. CONCLUSION

In this work a supervised CAD scheme with VDE technique has been proposed. This will assist the radiologist to improve the accuracy and sensitivity. Through analysis different types of nodules can be specified and proper treatment can be mentioned by the radiologist for patients. With effective classification of nodules, the false positive results caused due to the overlapping of ribs and clavicles have been reduced. This cost effective method of detecting lung nodule is highly effective in terms of low radiation dose and no special equipment required. Just software implementation proves 0% accuracy of this system. By varying the contrast, more subtle can also be detected which improves the efficiency of the system. As future enhancement the performance of this system can be improved and can be used as a primary cancer detection tool at lower cost.

VI. FUTURE SCOPE

We developed an advanced computerized scheme for lung cancer detection by incorporating VDE image and we can use FFNN in future for the system for the improvement of sensitivity. The performance can be increase by using this FFNN technique and we can count the nodule in the image in future.

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