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Filtering Approach for Detection of Lung Nodule Using X-ray

Nilakshi Maruti Mule, Prashant Mane, Premkumar Yadu Mohite

M.E. Student, Dept. of Computer Engg., Zeal Education Society's DCOER, Narhe, Pune, Maharashtra, India

Asst. Professor, Dept. of Information Technology, Zeal Education Society's DCOER Narhe Pune, Maharashtra, India

U. G. Student, Dept. of Electronic & Telecommunication, DACOE, Karad, Maharashtra, India

ABSTRACT: Lung tumor is one of the most serious cancers in the world. Longevity from lung cancer is directly related to its rise at its exposure. The earlier the exposure is, the higher the chances of successful treatment. Lung image has been used for detecting lung cancer for a long time. The initial exposure and analysis of cancerous nodules in chest X-ray image are among the most required scientific tasks performed by radiologists. In this paper, processing the X-ray images using various image processing algorithms like Gray scale algorithm, Thresholding algorithms, Histogram Operation and various other techniques. Input X-ray image filtered two times first we use spherical kernel for nodule-enhanced image, and second median filter is used to obtain a tumor suppressed image. Blob detection then obtained by subtraction of the two filtered images. The previous work on computer aided identification of tumor images in chest radiograph depends mainly on edge identification & enhancement. Previous work was not able to identify small tumors of size 1cm or less in diameter. I am going to present a tool that will take the X-ray images of lungs as an input and will give the details of the physical appearance of the lung cancer nodule as the output. This output detail will include any irregularity or abnormality if found. This will help a medical practitioner for better diagnosis. This tool will also help to reduce the time and burden in the routine medical checkups in industries.

KEYWORDS: Chest X-ray, Tumour, Gray scale, Histogram, Thresholding, Blob Detection

I. INTRODUCTION

The previous work on computer aided identification of tumour images in chest radiograph depends mainly on edge identification & enhancement. Previous work was not able to identify small tumours of size 1cm or less in diameter satisfactorily, and encountered difficulties in marking the rib contours of the tumour edges, particularly in the neighbourhood of rib contours. After that we abused dynamic programming (DP) and directional edge arrays to achieve significant improvements in our ability to detect the full contours of tumours. This paper describes how we achieve a capability to detect cancerous tumours as small as 1 cm in diameter and to determine the shape of these tumours even in the neighbourhood of sharply defined rib contours. We are proposing our research toward a collective man-machine system to assist radiologists and paramedical aids in the analysis of radiographs. The separation is "tumour-directed" in the sense that its aim is the display of likely tumour sites on each radiograph. These locations are presented to radiologist users along with a suggested diagnosis. The cost for current Computer Tomography scanning is costly so middle class families cannot afford for it. This cost is only for the identification of lung cancer. The main importance of our paper is that the cost that is required for detecting the nodule is get reduced totally with the help of detection algorithms and X-ray image as a input.

II. RELATED WORK

In 2013 Shang Chen and Suzuki was develop a CADe scheme with improved sensitivity and specificity by using of "virtual dual energy" (VDE) CXRs where ribs and clavicles are contained with massive-training artificial neural networks (MTANNs). To reduce rib-induced FPs and detect nodules overlapping with ribs, it incorporated the VDE technology in their CADe scheme. The VDE technology suppressed rib and clavicle obscurity in CXRs while

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maintaining soft-tissue opacity by use of the MTANN technique that had been trained with real dual-energy imaging. In this scheme detected tumour on VDE images by use of a morphology filtering technique. Sixty morphology and gray-level-based features were extracted from each candidate from both original and VDE CXRs [1]. A non aligned support vector classifier was employed for classification of the tumour. In 2013 Catherine and Sam gives the idea about image quality and accuracy is the core factors of this research, image quality assessment as analysis that deal with large size images, subsequent FCM is very slow [7]. In 2012 David Baber, Joseph and David Harwood presents efficient and portable implementations of a useful image enhancement process, the Symmetric Neighbourhood Filter (SNF), and an image segmentation technique which makes use of the SNF and a orient of the regular connected components algorithm which they call S-Connected Components[6] . In 2014 Ada and Ranjeet Kaur gives idea about a hybrid technique based on feature extraction Principal Component Analysis is presented for lung detection in CT scan images [7]. In 2014 Maxine Tan and Rudi was Analysed the performance of a novel Feature deselective neuroevaluation method. It combines the feature selection and classification well as improvement are depending on the enhancement stage where low pre-processing techniques is used based on Gabor filter within Gaussian rules[3]. In 2013 Bhubaneswar and Aruna Propose a new image based feature extraction technique for classification of lung CT images [2]. In 2012 S.Rahimi and Zargham proposed a parallel Fuzzy C-Mean (FCM) algorithm for image segmentation. The sequential FCM algorithm is compotation intensive and has important memory requirements. For many operation such as medical image segmentation and earthly image [5].

III. MOTIVATION

The existing system took long time for the diagnosis of nodules. Therefore, it was difficult to detect lung cancer in very first stage. Also for middle class families, it is difficult to use CT scan technique as it is very costly. In the proposed system by using X-ray image we can easily detect the nodule at very first stage. This system is affordable to everyone as its cost is less.

IV. SCOPE

The scope of paper is that the system should rely completely on this paper for lung cancer detection. The future requirement for CT scanning should get avoided with this paper. This way has possible for further development because of this simplicity that will motivate to find nodules from the X-ray image. The developed nodule detection system is expected to provide valuable analysis of the nodules for the physicians. The work can further be extended by including more feature extraction and detection methods for identifying lung nodule.

V. PRE-PROCESSING

A pre-processing action is an action on the compute image that 1) facilitates subsequent processing and 2) back out the data structure of the image unchanged. The pre-processing action is used by our system consist of gray scale, thresholding and histogram. Input of our project is x-ray images which is accessed by scanning and collected from private hospital and browsing the CA lung images from internet. Those images are stored into the JPEG format with 512x512x256 size. That x-ray images are raw input of our project. The processing step for the system is shown in (Fig. 1) below. The processing step has three basic steps of the Image Pre-processing, Finding Nodule and Classifying Nodules. In pre-processing it performs the consolidation and high emphasis filtering. In nodule finding it extract the lung region and boundary of lung. In classifier technique it uses nearest neighbour technique for identifying it is cancerous or not.

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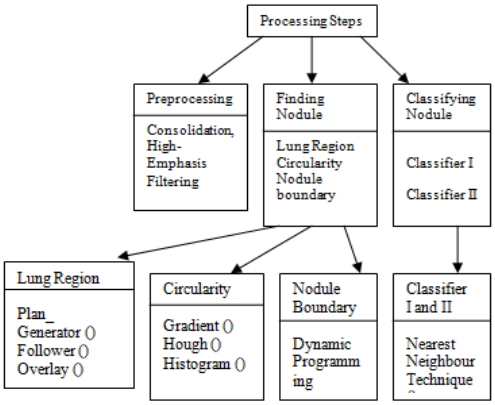

Fig. 1. Pre-Processing Step

VI. BLOB DETECTION

In tumour finding process we extract lung region from rest of the radiograph. Once we extract lung region our next task is that identify the specific portion of the lung which contains the tumour nodule. For identifying that we use the circularity finder technique. Summary of the blob detection is as shown in (Fig. 2.)

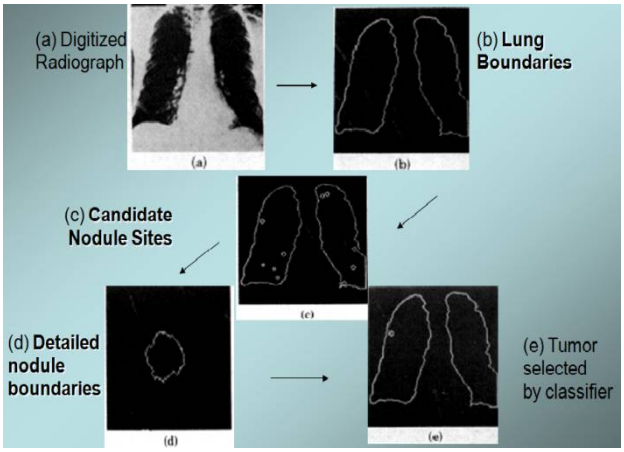

Fig. 2. Summary of Blob Detection

VII. LUNG REGION ANALYSIS

For lung region analysis the image is segmentation is performed that separates the cancerous nodule from the lung that produce the characterization of the tumour. In segmentation of lung region it is essential to remove the shoulder bones from the x-ray image. This lung region appearance is done by manually by calculating the pixel of the ribs. Lung region are separated from the rest of the image portion by multiplying appearance with the spherical kernel and median filtered image. For this separation pre-processing image is passed through low pass filter that is 64x32 pixels which is shown in (Fig.3).

VIII. LUNG TUMOUR ANALYSIS

In pre-processing we apply thresholding technique in original image for separation of lung boundary. Then we use histogram for separation of tumour. In some cases it seen that except tumour other lung region area in having gray

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scale. In Fig. 3 it is shown that when we filter image with 256x224 pixel then the some part of tumour or ghosts image is identified and remaining part of the lung is gray scale. After pre-processing we applied the spatially filtering for identifying the appearance of the nodule.

IX. FEATURES SEPARATION

After identifying the appearance of the nodule we calculate the area, diameter, perimeter and irregularity of the lung nodule. We give "1" and "0" value for calculating the pixels of that nodule part. In feature selection we identify the shape of nodule because tumour nodule has the irregularity of the shape. In that we calculate the size also using that pixel patterns. After tumour analysis we select only that part of lung which contains the nodule and then we apply the separation process. In fig.3 it shows that when we filter original image with 64x32 pixels then it shows lung boundary and darks the ribs after that we pass that image with 256x224 pixels then it shows the appearance of the image. Again for calculating shape of nodule we filter that image with maximum pixels that is 1024x896 then it clearly shows the nodule position and shape after that we apply feature separation technique for separation of that nodule part from the lung and shows the exact shape of the tumour which is shown in fig. 4.

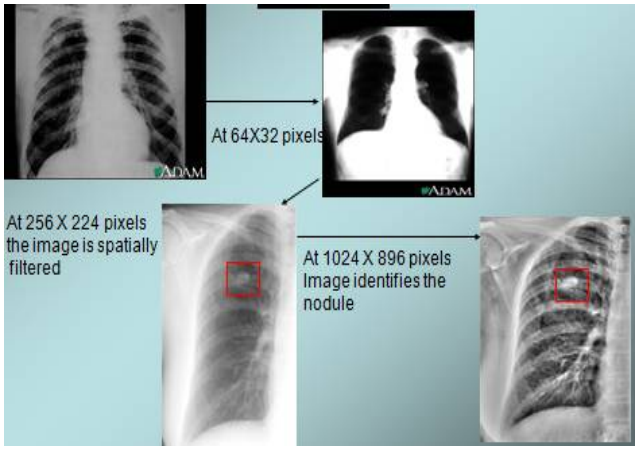

Fig. 3 Nodule identified

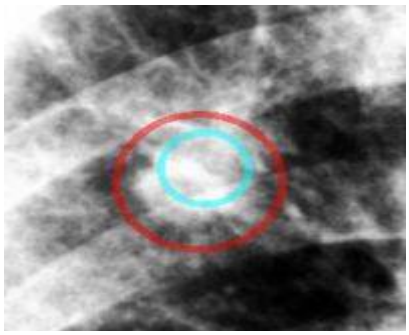

Fig.4. Feature selection

X. CONCLUSION

The identification of lung cancer using X-Ray is a complex task that consists of several subtasks. In identifying the boundary of lung and the boundary of nodule is important task because it gives the nodule size which is one of the main tasks of paper that nodule size is less than 1 cm. After identifying the boundary or it determine appearance of these

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tumours even in the neighbourhood of sharply defined rib contours, it identify that present nodule is cancerous or non cancerous. This is useful mainly for the doctors so as to help them in their predictions in detection of lung cancer and also to those industries that are at higher risk of cancer like textiles, coal mines and fiber industries.

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