MULTILEVEL PATCH-BASED CONTEXT ANALYSIS FOR CLASSIFICATION OF LUNG NODULE

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ABSTRACT

A novel method is proposed for the classification of lung nodule which induces cancer and development.. A Low Dose Computed Tomography(LDCT) scanned images are taken for this approach.The four types of lung nodules are offered here, namely Well-circumscribed, Vascularized, Juxta-pleural and Pleural-tail.This paper has three main procedures by combining the anatomical structures and nodules. The amplification of the input image gives the required process of the segmentation.Adaptive patch-based division is helped for multilevel partition, SVM(Support Vector Machine) classifier is used for the classification process.Texture, Intensity and gradient details of the image are derived form a feature set.SIFT(Scale-Invariant Feature Transform) descriptor is used in the feature set for getting the information of the given image. Probabilistic estimation is applied for the classification and analysis procedures. In the classification process texture information is more important for the nodules.Concentric level partition gives the better classification rate than the other methods.

Keywords: Nodules, Patches, Quickshift, Sift, Superpixel.

I INTRODUCTION

A malignant cell presented in lungs is cause for lung cancer. Identification of the lung nodule is the required process for the treatment of the lung cancer. Around the world 20% of cancer related deaths occur due to the Lung cancer. Lung nodules are very small compare than the lungs.We have to classify the nodules for the medical treatments. The approach from Diciotti*et al.* is the most popular classification and it differentiate nodules into four types: well-circumscribed (W) with the nodule located centrally in the lung without any connection to vasculature, vascularized (V) with the nodule located centrally in the lung but closely connected to neighboring vessels, juxta-pleural (J) with a large portion of the nodule connected to the pleural surface and pleural-tail (P) with the nodule near the pleural surface connected by a thin tail.

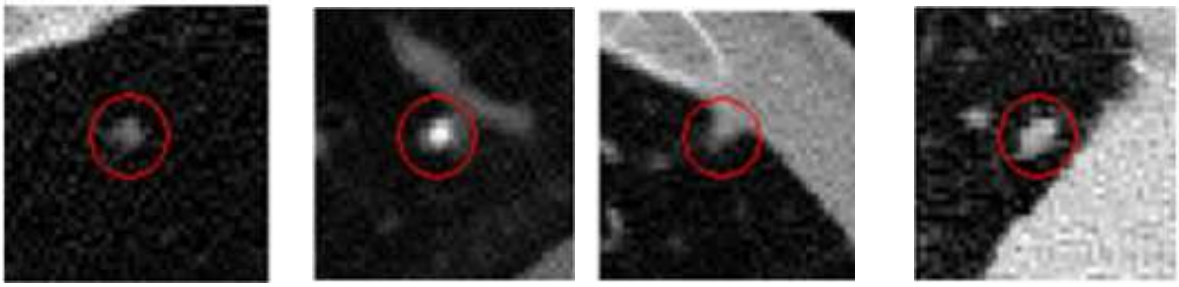


Fig 1 A. Well-circumscribed Lung nodule **B. Vascularized Lung Nodule** **C. Juxta-pleural Lung nodule** **D. Pleural-tail Lung nodule**

CT scanned images are used for this paper and this CT images will give the information of nodules and surrounding anatomical structures. Due to the small size of the nodule the CT scan is used and classification of the nodules is helpful for the diagnosis process. Here these types of nodules presented in the lungs are have to detect for the clinical process.CT images are used for the lung cancer because it gives high resolution images and good acquisition. And also used for detection of small lung nodules.The four types of lung nodules are taken for the novel classification technique. This proposed technique has three important processes. The input images are taken from the publically available data through the internet from ELCAP(Earlier Lung Cancer Program)

II EXISTING METHODS

In the classification process the SVM classifier is widely used. Yan Song approaches the novel classification method for lung nodules. The four types of nodules are classified with the graph construction process. In the optimized graph model global and region based terms are involved and labeling is introduced. Parenchyma, vessel, pleura and pleural-tail are the anatomical parts of the lungs. The foreground is for nodule and background is for the parenchyma and vessel and pleural wall. Patch-based method is used for partitioning the given input image into multiple and order less small images. In feature extraction, filter based approaches are also used. The clustering is used in superpixel image formulation and this is used for classification. Quick shift also used asit is the fastest approach compare with the other methods.

The problem in the classification process is to classify the overlapped nodule in the anatomical parts of lungs. Here Fan Zhang introduced the improved classification method for overlapping nodes. Here it deals with the Clique Percolation Method (CPM) in the classification of lung nodules. The SVM classifiers are involved and K-means are introduced for the segmenting the given input image. Cluster is labeled to the type which has the highest frequency according to the SVM classifier. Most of the the overlapped nodules are between the well-circumscribed and vascularized.For the better nodule classification K mean is used in SVM classifier. SVM is utilized for computing each nodule among the different nodules. Here also the four type of nodules are presented in the lungs and gives classification over the overlapping nodule with the anatomical parts.

III PROPOSED METHOD

The input image given to the concentric level partition, before this method the image has to be amplified. As the images from LDCT are low intensity images the image interpolated to get the samples.Here we separate the nodules from the anatomical parts for classification process.

Here we proposing the classification techniques over the four types of nodules in the lungs. PLSA (Problematic Latent Semantic Analysis) is used for computing the probability of the level-context. In this paper we classify the nodules and get the comparison results over the other classification methods.

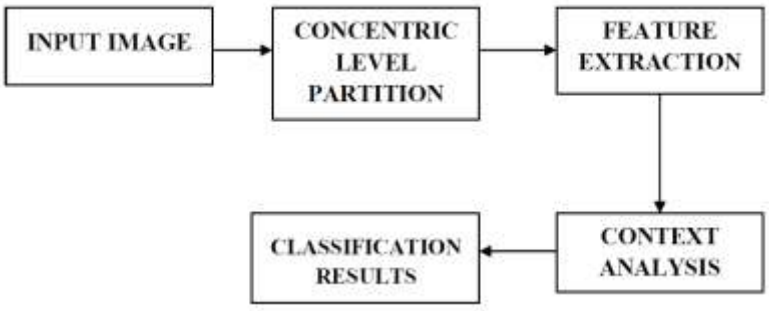


Fig 2:BLOCK DIAGRAM OF PROPOSED METHOD

3.1 Concentric Level Partition

This paper approaches the patch-based division for the partitioning of the given image.The superpixel formulation is the initial process of this method.Before going to the super pixel is required the enlarged image. In the proposed method amplification is performed over the small size of the inage.

This partition is based on the patch-based approachthat the given input image is divided into multiple parts with the segmentation.After the segmentation the image has to enlarged.

3.1.1 Superpixel Method

Thequick shift algorithm is proposed with the upsampling and downsampling of the given image.For the upsampling process the interpolation is applied and it gives the enlarged image.The amplified image is used for the segmentation process.

Here the well-circumscribed input image is taken and this image is taken as input for the segmentation.Before the segmentation,upsampling is performed over the image.The input image is interpolated by a factor of four inorder to enlarge the image.Figure 3 shows the given input image for the process of the concentric level partition.

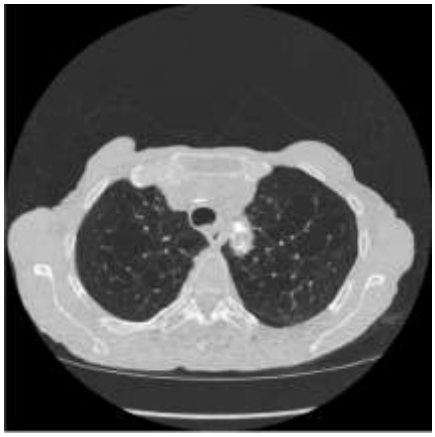
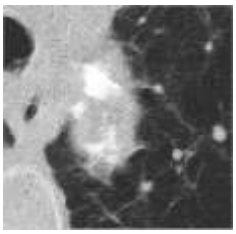
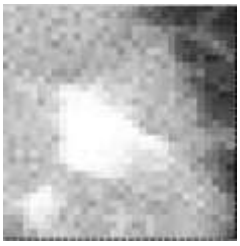


Fig 3 Input Image

Kernel size and maximum distance are the two parameters introduced in quick shift method.The given input image is cropped for the interpolation and the nearest pixels are enlrged in the cropped image.In the segmentation process the superpixel method is applied for the multiple small images.

This approach divides the image into multiple patches so that we can classify the nodules.After the segmentation process context level partition is applied over the segmented image.The downsampling process gives the original segmented image.





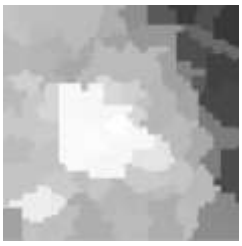


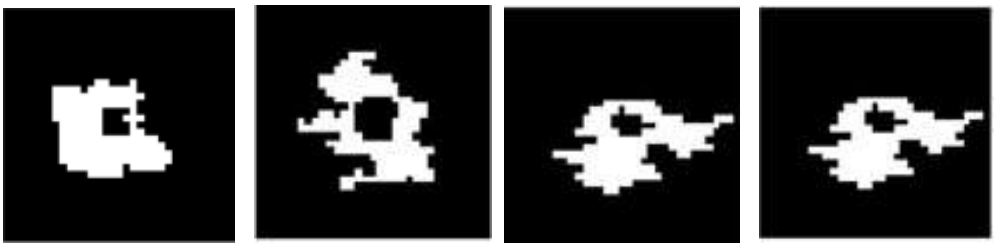
Fig4 (a) Cropped image **4(b) Interpolated image** **4 (c) Segmented Image**

In the segmentation process nearest pixels are segmented and they are partitioned to their regions.The levels of the nodules are formed by the context level partition.Initially the kernel size is 2 and maximum distance also 2. Figure 5 shows the context level of the four types of lung nodules in the lungs.In this concentric level partition nodules are partitioned. Here the patches are partitioned in different shapes.The context levels are used for the classification results. Here the nearest pixels are formulated for the context levels.

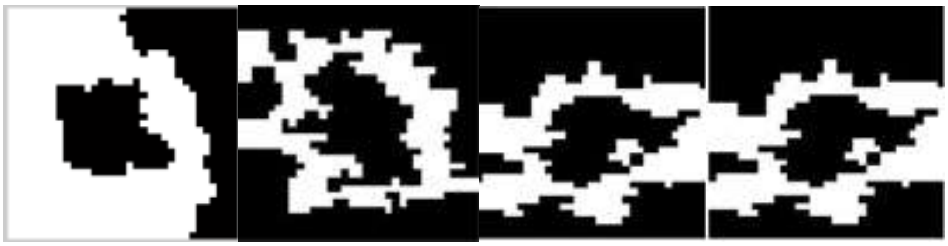
Pleural-tail **Well- circumscribed** **Vascularised** **Juxta-pleural**

Lung nodule **Lung nodule** **Lung nodule** **Lung nodule**

(A)LEVEL NODULE



(B)LEVEL CONTEXT 1



(C)LEVEL CONTEXT 2

Fig 5: Partition Levelsfor the four types of loung Nodules

3.2 Feature Extraction

For the classification of lung nodules,we propose a feature set for getting the information of the given input image. Here SIFT descriptor is introduced for the desription of the image. In this feature extraction texture, intensity and gradient information of the given images are specified. It gives the information by using the keypoints of given input image.SIFT descriptor is invariant for the images translation and rotation.This process is used for getting the required parameters for the classification of four types of lung nodules.

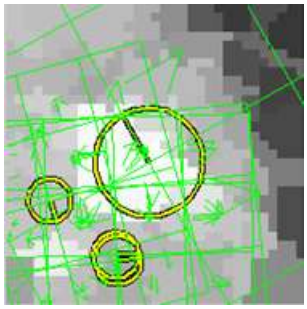


Fig 6 SIFT Descriptor

Figure 6 shows the SIFT description of the given input image.Here for every key point 128bit length vector is generated.This gives the details of the texture and intensity informations.The Feature set have the information of lung nodule data.This transformation doesn't change for rotation and tranlation of the images and it is used for the classification and detection techniques.

IV CONCLUSION

The classisfication is done for the four types of lung nodules in the lungs.The superpixel formulation is applied for the many patches from given input image.The LDCT images are used for this process.The quick shift algorithm is got more faster than the other methods.After the SIFT descriptor,we need to apply the context analysis for the classification process.The derived feature set is used for classificatio results.

This pach-based division of the image has many advantages for the classification of the image.Concentric level partition has the good classification rates and feature set is very important for the classification of the lung nodules.By classifying these four types nodules are very useful for the lung cancer treatments. It has some limitations over the early stages of the cancer, So we have to detect and classify the nodules in the early stage.

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