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Quantitative Evaluation of Lung Tumor Detection Applied to Axial MR Images

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***Abstract:** Segmentation helps in locating different boundaries and objects present in a digital image. During the segmentation process, similar pixel intensities are assigned with the same label for the ease of identification. Several methods and algorithms have been developed for defined and the problems are domain specific. Our aim is to analysis of lung tumor in color and colorless algorithms. In color algorithm such as modified color based K-means clustering and region growing provides better result compared to the colorless algorithms.*

***Keywords:** Adjustable surface normal overlapping, modified color based K-means clustering and region growing.*

I. INTRODUCTION

Lung cancer are assigned grade for better communication, treatment planning and prediction of outcomes. Grade range from I to IV and it indicates the severity of tumor. Grade I tumor are slow growing and can be treated easily. While, grade IV tumor are aggressive, fast growing, cancerous tumor those are hard to treat. A single tumor may have different grades of tumor cells and the highest grade cell defines the tumor grade.

II. LITERATURE SURVEY

[1] K-Mean with FCM to overcome the drawbacks of both methods. K-Mean detects tumor faster than FCM and FCM predicts tumor tissues with are not identified by K-Mean. FCM is less accurate in the scenario of detecting the noisy images. Combining these two algorithms, accuracy and efficiency are increased. But the execution time and computational complexity are high.

[2] Developed hybrid K-C-Means technique, in which more properties of Fuzzy K-Mean are used with K-Means. Initially this algorithm reads input image and computation the iterations needed. Then it performs distance checking to reduce iterations and thereby reduce computational complexity. The algorithm identifies significant data component in the beginning and it stop with the elapse of identification. This algorithm is optimized for gray scale image and the required number of iteration is similar to FCM. The disadvantage is the algorithm is that the output is similar to FCM output and computational time increased by 2 seconds.

[3] [4] Developed an efficient algorithm based on spatial information applied to conventional FCM. It is well suited for imaged with noise and intensity inhomogeneity.

[5] Developed segmentation system by creating wavelet of the image and then segmented using FCM.

[6] Modified possibilities FCM for the segmentation of noisy MR images. Misclassification error is less compared to bias corrected FCM. In order to achieve effective segmentation of noisy images, the fuzzy membership function and typically functions are differently weighted. [4] developed a frame work to estimate bias field and tissue segments simultaneously. The algorithm modified the objective function of standard FCM to improve the problems occurred due to noise and intensity inhomogeneity were avoided. The neighbourhood pixels are attracted by each towards its cluster. The execution time is reduced by 3% and the parameters are optimized within 30 iterations. This algorithm produces outputs with better accuracy and it is specifically suited for noisy images.

[7] Developed a segmentation method based on distributed Estimation (DE) algorithm. A concave likelihood function is formulated to estimate the abnormality. The accuracy and sensitivity of segmentation were better compared to other methods. Complexity of segmentation process is a drawback. This technique is a semi-supervised method for lung image segmentation and DE is used to deal with statistical modelling. ROC analysis exhibited robust performance in segmentation using SPM8 software.

[8] Developed segmentation method using Deep Neural Network (DNN). The algorithm is highly efficient and flexible. Sped of computation is increased and DNN can adapt to any kind of data inputs.

PCA was used by [9] for segmenting lung image. He compared various modifications of PCA algorithm and Probabilistic PCA (PPCA) is found to be better among other methods. Combinations of PPCA and K-means clustering provided better accuracy.

[10] Proposed a level set segmentation algorithm using FCM clustering and spatial constraints. Level set algorithm is used to overcome the computational complexity of FCM. A probabilistic model was adopted by [10] to increase the accuracy of segmentation. MRF and saprse representation were used to solve spatial and structural problems. The dice coefficient obtained was higher than that of other methods. Semi supervised clustering approach was developed by [7]. Simulated annealing with capability

of search is developed. This approach is capable of handling small clusters and finding tumor regions. Intensity features alone were considered for clustering.

III. METHODOLOGY

In this section focused on the segmentation part, it is deals with two methods such as Colorless and color model. Colorless model method is adjustable surface normal overlapping segmentation and color model method include two technique, first one is adjustable surface normal overlapping segmentation and second one is modified color based K-means clustering and region growing. The second methods done in a HSV color model.

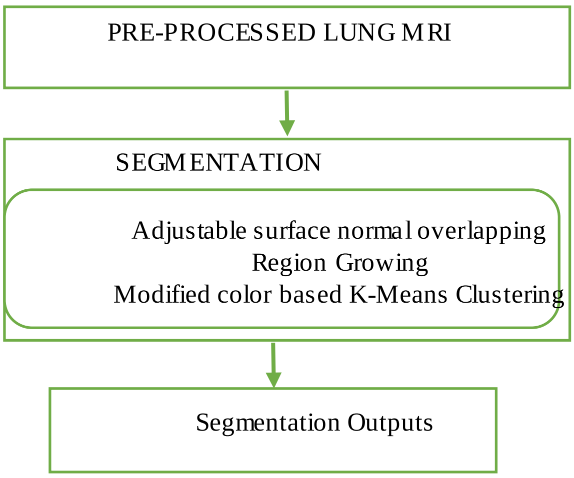


Fig. 1. Proposed Block Diagram

Adjustable Surface Normal Overlapping Segmentation:

The adjustable surface normal overlap step is critical for detecting lesions. Generally speaking, both colonic polyps and lung nodules tend to have some convex regions on their surfaces and thus, the inward pointing surface normal vectors, near these features tend to intersect or nearly intersect within the tissue. Pulmonary vessels in the lungs and haustral folds in the colon also have convex surfaces, but since they have a dominant curvature along a single direction (as opposed to high curvature in two directions as is common on the surfaces of polyps and nodules), the score for vessels and folds is generally less than that for nodules and polyps.

Providing robustness to variations from perfectly spherical objects is critical to the success of this algorithm in real patient data. Our algorithm provides robustness both in the radial direction (objects with non-constant distance from surface points to center) and in the transverse direction (objects with non-uniform magnitude of curvature). Robustness in the radial direction is provided by the fact that normal vectors can intersect at different distances from the surface, thus allowing many non-spherical but roughly globular objects to have a significant response.

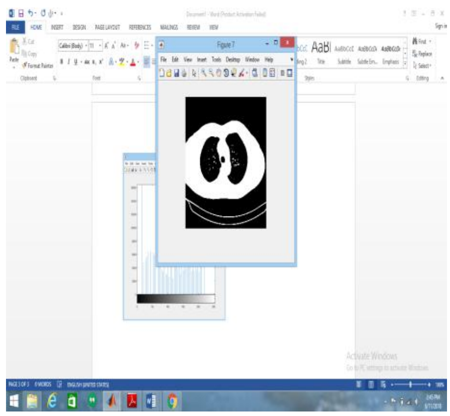
Modified Color Based K-Means Clustering:

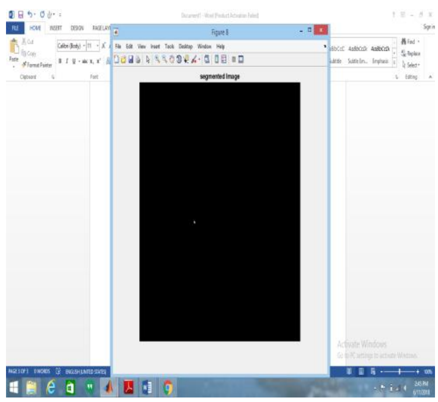
The modified *K*-means clustering algorithm uses iterative refinement to produce a final result. The algorithm inputs are the number of clusters *K* and the data set. The data set is a collection of features for each data point. The algorithms starts with initial estimates for the *K* centroids, which can either be randomly generated or randomly selected from the data set.

Region Growing:

In this method, segmentation process starts with respect to initial seed points based on predefined criteria. These selected seed points act as the initial points of different regions available in the considered image. When the region growing process is initialized the pixels in the neighbourhood of a seed point belonging to a particular region are evaluated for similarity. If there is similarity between pixels, then those pixels are added to that region. In this manner each pixel in an image is assigned to a particular region in the segmentation image.

IV. RESULT AND DISCUSSION





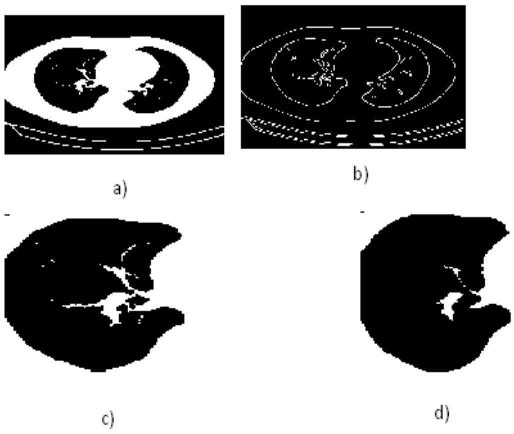


Fig. 3. Experimental result of color model lung segmentation image (a) Segmented tumor image (b) Canny edge detection Image (c) region growing Image (d) Juxta region segmented image

V. CONCLUSION

In this paper discuss the use of segmentation algorithms like adjustable surface normal overlapping, region growing, modified color based K-Means clustering. The modified color based K-Means clustering segmentation is implemented and the outputs are obtained. The segmentation accuracy of proposed modified color based K-Means is high and it is suitable for inclusion in the framework.

VI. REFERENCES

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