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Segmentation & Threshoilding of Covid-19 and Lung Cancer Using Enhanced Ct Images

[1]Ranjani.R, [2]Dr. R. Priya,

[1]Department of Computer Science, Vels Institute of Scinece,Technology and Advanced Studies, Chennai,India

[2]Department of Computer Applications, Vels Institute of Scinece,Technology and Advanced Studies, Chennai,India

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KEYWORDS

Covid-19, Lung Cancer, CT, Preprocessing, Segmentation, ROI.

ABSTRACT:

Diagnosing the lung severity diseases like COVID-19 and Lung Cancer segmentation using Computed Tomography (CT) scans plays a significant role. Detecting them in the initial phase is significant to bring down the rate of mortality risk of patients. There are 2 important factors that affects the existing methods which use CT Images employ i)huge bundles for images for training ii)handling fixed network for the completion of training process. In this research, a cascaded system is proposed to segment the lung, detect, localize, and quantify COVID-19 infections and Lung cancer from computed tomography images. The proposed system clusters and localizes infections of varied shapes and sizes. In this research, the enhanced CT scans are used and segmented using 2D Hybrid Fuzzy C Means (2D HFCM) for segmentation of lungs caused by COVID-19 as well as lung cancer. The 2D Adaptive Otsu Thresholding (2D AOT) is used for image thresholding and a comparison has been made between traditional algorithms to show the efficiency of the proposed algorithms. Further Superimposed principle is applied to show the exact location of infection.

I. INTRODUCTION

Cancer is one among the most severe and common illness causing significant quantities of deaths each year. It is diagnosed using Computed Tomography (CT) scans since as it gives a clear image of the human body tumor and monitors growing development. Although CT is favored over other imaging modalities, visual processing of similar CT scan images may be an error-free process. Image recognition technologies are generally employed in medical sciences for early phase lungtumordiagnosis.Initially Covid19 was discovered in Wuhan, China and society faced an alarming health extremity in 2021 because of the Delta-Varian and as well as Cancer is a contagious disease. Both the severities affects the respiratory system and, in some extreme cases inner swelling of lung parenchyma or its surroundings might occur which leads to the decrease in the working ability of the respiratory system. CT is much useful because it's cheap, quick, extensive, and uses lesser radiation. For detection of lung severity disease, manual detection is very much difficult for the radiologists. Due to this doctors tend to get pressurized and miss out some features which might be useful in detection. To avoid this problem a cascaded proposed system based on CAD is applied to CT images which will detect, localize the infection. Usually doctors use Chest X-rays to detect such lung infections but because of large number of cases and manual investigation, radiologists preferred the use of Low- dose Raw CT (LDRCT) images have been used which has less amount of radiation. There are different types of cancers affecting different parts of lungs. CT images are used because it shows a clear image of the human body tumors and monitors the growing development. Radiologists and patients prefer CT images because they are quick, reliable, and extensive and are less exposed to radiation when compared to other medical imaging techniques.

II. LITERATURE SURVEY

Zhu [13] found that seafood that was sold in some parts of Wuhan, China was linked to the rapid spread of covid-19 among a group of people in 2019.

Roberts [14] researched using Machine learning approaches that give fast and accurate results for COVID-19 using chest computed tomography (CT) as well as CXR Chest X-Ray Images and found a vision but due to technical reasons the medical situation became unclear due to the discovery of variants in 2021.

Shan [15] used 300Chest CT Covid reviews and applied a deep learning segmentation method which will extract the ROI automatically. This system also used HTL method for faster delineation of the samples.

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Wang [16] discovered that to reduce the contagious spread of covid-19 the affected areas and unaffected areas must be separated and small scale pathological labs with radiologists must be opened to detect covid19 which might save time

Fan [17] used a Deep Network (Inf-Net) to detect COVID-19 Lung Infection Segmentation which will automatically identify infected regions from chest CT slices.

Kim [18] discovered and compared the values like co-efficient of variation .Peak signal to noise ration, correlation co-efficient with his method known as MASH phantom Gaussian imaging on adult CT Images.

Jalali [19] discovered a morphological operation using ResNet-34 deep network. In this method the images are fed which automatically segments the lung CT images.

Cheng [20] developed a system based on Artificial Intelligence(AI) for detection of covid-19.This approach used statistical methods on CT images and discovered influenza-A & B and non-viral Community Acquired Pneumonia .

Pathak [21] classified covid19 infections using smooth functions in deep learning transfer learning functions to handle the disparities that existed in different kinds of datasets.

III. OBJECTIVE

Discovery/ Detection of covid19 or lung cancer so as to bring down the rate of mortality of patients is very significant .An cascaded fully automatic, efficient method which will cluster and threshold the lung severity disease. To use a system this will be robust in nature like deep models for faster examination. To show the efficiency of the proposed algorithms comparisons are made with tradional methods. To provide a model with the ability to produce results without any information

IV.DISADVANTAGES OF EXISTING SYSYEM

In the existing system accurate segmentation of lung nodules is not possible because of the differences in the visual characteristics like shape of lung nodules. Similarly the clustering models were unable to provide with instructions required to obtain the same

Cluster in case of result retrieval, because the existing clustering models are suspected to activation. The existing system also faced many challenges like dealing with volumes of images which caused failures in uniformity in the lung areas. These drawbacks limit the accuracy of the existing system and leads to complexity

V. PROPOSED METHODOLOGIES

Framework -1:

2D Improved Anisotropic Diffusion Bilateral Filter (2D IADBF)

Image restoration is done to filter out the speckle noise from the lung CT images. This is done based on the combination of anisotropic diffusion model and the bilateral filter and was implemented using 2D Improved Anisotropic Diffusion Bilateral Filter (2D IADBF).The Restoration algorithm is a combination of Spatial and Frequency domain making it an Spacio-Frequency Domain (i.e. Bilateral + Anisotropic).The Anisotropic algorithm is a spatial domain algorithm which removes noise and preserves gradient information. Similarly the Bilateral Algorithm (Frequency domain) is used in speckle noise detection is very high. Therefore the improved variation form of filtering is the 2D Improved Anisotropic Diffusion Bilateral Filtering algorithm is implemented.

Framework-2:

2D Hybrid Fuzzy C-means Algorithm (2D HFCM)

This algorithm first clusters a single input image into diseased and non-diseased portions. Secondly it creates two dictionaries Dr and Dn where Dr contains ROI dictionary and Dn contains Non-ROI dictionary. Further these dictionaries are concatenated to a single dictionary D i.e. D= [Dr, Dn].To create the dictionary Orthogonal Matching Pursuit algorithm is used which checks if The ROI /Non-ROI portions are obtained from the input image and classifies the resultant image by using Residue condition[i.e. checks the o/p image obtained is different from the image before manipulation.

2D Edge Preservation Efficient Histogram Improvement (2D EPEHI)

The next step in the proposed framework is the image enhancement. This is done to improve the overall contrast of the image. The Enhancement algorithm is used as it gives an effective edge preserving and an efficient histogram giving an improved result. Therefore the enhancement algorithm is named as 2D Edge Preservation Efficient Histogram Improvement algorithm is implemented.

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2D Adaptive Otsu Thresholding (2D AOT)

Once after clustering using HFCM, the resultant is applied to thresholding to remove the discontinuities in the image.

AOT algorithm uses region based thresholding to extract ROI.Examing the lungs deeper into parts like nodules, bronchi, blood vessels which differ in shapes for example nodules appear to be spherical in shape

while the others appear to be in cylindrical shape. These appear in bright spots because of the intensity levels of the differences in Shapes and are identified using Near-Round Shape detection algorithm. Region growing algorithm (a morphological operation) is applied to extract the ROI.

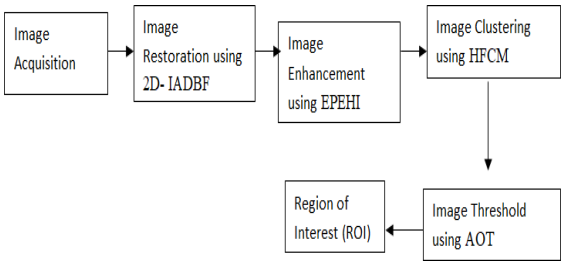


Fig 1. Architecture Diagram of Proposed Methodology

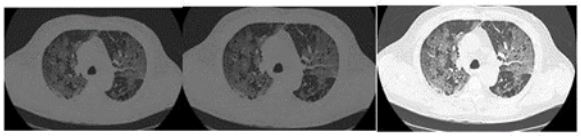
VI. EXPERIMENTAL SETUP

In this section, the experimental results and discussed using MATLAB 2018 software. The cancer/covid categorization could be developed in MATLAB on a laptop with a Windows 10 operating system and 4GB of RAM.

VII. DATASET DESCRIPTION

In this research, Medical scans are obtained from EIBIR/GITUB and Iraq Oncology Teaching Hospital. The lung cancer dataset consists of 2200 CT images out of which 242 are Begin; 1124 are malignant and 834 Normal cases which were collected in 2019. The covid-19 dataset consists of 750CT images out of which 350 comprising of covid images and 400 non-covid images. All the datasets used in this research
are attested by doctors.

VIII. RESULTS & DISSCUSSION



(a) (b) (c)

Fig 2. (a) Input low quality CT lung image, (b) Filtered Image using 2D IADBF, (b) Enhanced Image using 2D EPEHI

Fig 2 (a) shows the input low quality CT lung image which may be affected by Covid 19 or cancer disease. Fig 2 (b) show the CT low quality image is pre-processed using novel algorithm called 2D IADBF to remove various noises such as salt and pepper noise, random noise and Gaussian Noise. The Figure 2 (c) shows enhanced image in terms of contrast and brightness using 2D EPEHI.

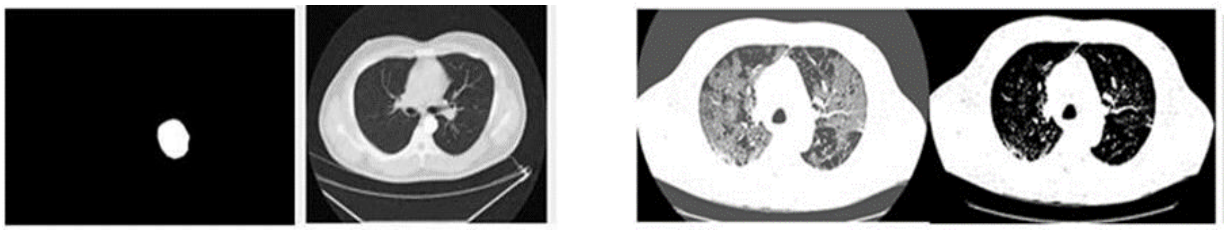


Fig 3 (a) Clustered image using 2D HFCM, 3 (b)Thresholding image using 2D AOT, (c) Segmented ROI (d) Superimposed segmented image.

Figure 3 (a) shows the clustered image using 2D Hybrid Fuzzy C Means Algorithm. Figure 3 (b) shows the thresholded image using 2D Adaptive OTSU Thresholding Algorithm. The Figure 3 (c) shows segmented ROI image which contains the diseased portion. Figure 3(d) shows the final superimposed principle which is used to locate the exact the position/location of the disease. It is a combination of the clustered output image and the input image.

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Algorithm	*Segmented pixels*	*Gradient clusters*	*Intensity pixel*	*Min.IntensityPixels*	*Max.IntensityPixels*	*K Values*	*Edge Information*
2D HFCM	**26214**	**4**	**0.7169**	**0**	**255**	**8**	**512**
Fuzzy C-Means	438983	2	0.3378	0	236	7	476
K-Means	637663	3	0.2187	0	250	5	763
Fast Fuzzy C-Means	387365	5	0.4523	0	247	6	546

Table 1 Comparison of Clustering Algorithms

Algorithm	*True Segmented Pixels*	*False Segmented Pixels*
2D AOT	256	128
Gradient Descent	171	103
Binary Thresholding	103	86
OTSU Thresholding	253	125

Table2 Comparison of Thresholding Algorithms.

IX. CONCLUSION

The research executed the clustering and thresholding of covid19 and lung cancer. To show the efficiency of the proposed algorithms comparisons have been made with the traditional algorithms in which the results show that the proposed algorithms 2D HFCM has an Intensity pixel value of 0.71 (IP>0.74) and therefore detecting the presence of lung cancer or covid-19.Similarly AOT Algorithm yielded TSP=256 and FSP=128 thresholding the entire image.

X. FUTURE SCOPE

In the future, planned to test classification approaches in other classes similar as the machine learning/deep learning based methods to apply the following (i) automatic discovery and classification of COVID-19 cases into categories like mild, moderate, and severe classes; (ii) automatic spotting of ailment progression; and (iii) detecting the various covid-19 variants as well as the lung cancer types with its stage severity.

XI. ACKNLOWDEMENT

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