International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 12 | Dec 2020 www.irjet.net p-ISSN: 2395-0072

A Review on Lung Cancer Detection from CT Scan Images using CNN

P L G Suraj Reddy[1], Y Siva Kireeti Reddy[2], Suraj Kumar B P[3]

[1,2]Department of Computer Science Engineering, Sir M Visvesvaraya Institute of Technology, Bangalore, India
[3]Assistant Professor in Dept. of Computer Science Engineering, Sir M Visvesvaraya Institute of Technology, Bangalore, India

---

Abstract – *One of the major causes of death in humans is due to a disease called Lung Cancer. Cancer is a disease in which cells in the body grow out of control and is one of the most serious health issues. Lung cancer is the uncontrolled cell growth in tissues of lungs. Early detection of the cancer helps the physicians to act quickly which in turn which increase the survival chances of the infected patients. This is a review paper wherein different methodologies for the detection of Lung Cancer from Computed Tomography (CT) scan images are presented. It is observed that Convolution Neural Network along with Image Processing is the most suitable approach to detect the Lung Cancer from the CT scan image which is provided as input.*

Key Words: **Lung Cancer, Convolution Neural Network, Image Processing, Computed Tomography, Watershed Segmentation.**

1. Introduction

Cancer is one among the foremost serious health problems within the world. Cancer disease is caused due to the out-of-control growth of the cells in the body parts. Among the different types of cancer, Lung Cancer is the most dangerous type of cancer. This is due to the fact that its one of the leading causes of death in both men and women and also according to World Health Organization, it was seen that 2.09 Million cases of Lung Cancer was found and a sum of 1.76 Million people died due to the Lung Cancer in a single year of 2018. The cause for the large number of people getting infected with lung cancer is the fact that there are many ways present surrounding us and with the use of these or by coming in contact with these like Smoking and many more, we will be quickly prone to be infected with Lung Cancer. Also, the reason for high death rates is because of the late detection of the cancer. All these factors make it necessary to devise a methodology using current technology which can help to Detect the Lung Cancer from the scanned images of the Lungs. Once the Lung cancer is detected, there are various possible biological treatments available which includes Thoracic Surgery, Chemotherapy, Radiotherapy. Depending on the Cancer stage and other factors, the physicians can choose the appropriate treatment for the Lung Cancer. Hence, if the cancer is detected at the early stage, the chances of survival of the patient increases.

A literature survey is made on the possible techniques and methodologies which can be used to detect the Lung Cancer. There are various techniques, methodology and technology which can be used to accomplish the required objective.

2. Literature Review

Disha Sharma *et al* (2011),[1] gave an approach for early detection of disease called lung cancer by processing lungs CT images using Image Processing techniques. The authors used bit-plane slicing, erosion and Weiner filter image processing techniques. These techniques are used to extract the lung regions from the Computed Tomography image. Later the extracted lung regions were segmented using Region growing Segmentation algorithm. Once the segmentation was done Rule based Model was used to detect the cancerous nodules. It was observed that the above methodology gave an accuracy of 80%.

Anita Chaudhary *et al* (2012), [2] proposed a methodology for the lung cancer detection on a CT image by using Image processing. The pre-processing stage included image enhancement where Gabor filter and Fast Fourier transform techniques were used and further for image segmentation watershed algorithm was applied. Later feature extraction of the segmented image was done to specify the area, perimeter and eccentricity features which was used to detect and classify the lung nodules.

Hamid Bagherieh *et al* (2013),[3] proposed a methodology to detect the lung nodules and also give the classification of the same using Image Processing and Decision-Making techniques. First and foremost, image pre-processing was carried out on the CT scan images and the pre-processing was done using the techniques called contrast enhancement and linear filtering. Further, the filtered image was segmented using Region growing Segmentation process. Further the features like size, area and color were considered and were given as input to the Fuzzy system which employed fuzzy membership function to detect and classify Lung Cancer.

Prashant Naresh *et al* (2014), [4] specified the approach to detect the lung cancer using Image processing and Neural Network Techniques. Initially the CT scanned image of lung was filtered to remove Gaussian white noise and Otsu's threshold technique was used to do the segmentation of the image. The structural features were extracted and were used which were given as input to the machine Learning classifier. The Support Vector Machine and Artificial Neural Network

techniques were used for the classifying the input CT scanned image and it was found that SVM techniques gave a higher accuracy of 95.12%.

Jennifer D Cruz *et al* (2015), [5] provided a framework to detect the lung cancer from the Lung CT images using neural networks and Genetic Algorithm. Initially the pre-processing of image was done to enhance the quality of the image. Later the Feature extraction and selection phase was carried out on the enhanced image using the Genetic Algorithm. Then the Back Propagation Neural Network technique was used to classify the text image as cancerous or non-cancerous.

A Asuntha *et al* (2016), [6] proposed a method for segmentation of MRI, CT and Ultrasound images. Correct identification of neoplastic cell is completed by studying the required features extracted for the images. Ultrasound images have been used to detect the validity of the system. The feature selection by the use of Particle Swarm Optimization (PSO), Genetic Optimization and SVN algorithm gave an accuracy of about 89.5% with reduction in false positive.

Wafaa Alakwaa *et al* (2017), [7] designed a CAD system for lung cancer classification of CT scans with unmarked nodules. Thresholding was used as initial segment technique which produced best Segmentation of the lungs. A U-Net trained on LUNA16 data was used to detect nodule representatives. The U-Net output were fed into 3D Convolutional Neural Networks to finally classify CT image as infected or not for lung cancer. The 3-D Convolution Neural Network gave a test accuracy of 86.6%.

S Senthil *et al* (2018), [8] proposed an approach to detect the lung cancer by using neural network with optimal features. Initially the info pre-processing was applied on the input images for the image enhancement. Then the enhanced images were trained and tested by neural network. Initially, Particle Swarm Optimization was applied to extract the features of the input images and the input sample was classified as cancerous or non-cancerous depending on the Artificial Neural Network technique. It was observed that the given technique gave an accuracy of 97.8%.

S Sasikala *et al* (2018), [9] presented a technique to classify the tumors in lung as benign or malignant. The CT scan image which is taken as input, is pre-processed using median filter technique. Then, back-propagation algorithm was used to train the CNN to detect the lung tumors in CT image. To train the model, lung image with different shape and size of cancerous tissues were fed and the CNN based method was able to detect the presence or absence of cancerous cells with an accuracy of 96%.

K Mohanambal *et al* (2019),[10] proposed a methodology to detect lung cancer using machine learning techniques. The author processed the CT scan images to differentiate the benign and the malignant nodule and its level of the growth of the cancer cells by using machine learning. The author has also implemented the method to detect the growth of the cancerous cell in the initial stages. The approach to differentiate the pulmonary modules into malignant and benign nodules is to assist the radiologist and for the future enhancement.

Rohit Y. Bhalerao *et al* (2019),[11] presented an approach to classify the input CT scan lung image as cancerous or non-cancerous using CNN. Before training the images using CNN, the input images were converted to Gray scale and those in turn were converted into binary format. Later the images were trained using the CNN model to attain an overall accuracy of 94%.

3. CONCLUSION

This paper presents a Literature Survey on different methods, approaches, techniques and technologies which can be used to Detect Lung Cancer from Computed Tomography (CT) scanned images and classify them as cancerous or non-cancerous. Also depending on the input dataset which is used to train the model, it was found that we can classify the cancer as benign or malignant. As specified, there are several techniques to detect the cancer but the most widely used approach is to use Image Processing and Machine Learning techniques. From the study of above papers, we came up with the following conclusions. Early approaches used the traditional Machine Learning techniques and hence gave less accurate results. With the invent of Deep learning and specifically 3D Convolution Neural Networks, the classification of image datasets has become easier and gave good accurate results. With the use of traditional ML techniques, the processing of the input image has to be taken care by the programmer and hence the detection of Lung Cancer was complex and difficult. With the use of 3D CNN, the image classification involves less Image Processing. The CNN which is taken as a black box performs most of the processing internally and hence reduces the external programming and also give better and accurate results. Summarizing all the papers, it was found that Detection of Lung cancer involves mainly 3 phases. One is Image pre-processing, then Segmentation using Watershed Algorithm and then classifying the image as cancerous or non-cancerous using CNN. It is found that the usage of CNN classifier to detect cancer gave accuracies of 94%-96% [9][11].

REFERENCES

[1] Sharma, Disha, and Gagandeep Jindal. “Identifying lung cancer using image processing techniques.” In International Conference on computational Techniques and Artificial intelligence (ICCTAI), vol.17, pp. 872-880. 2011.

[2] Chaudhary, Anita, and Sonit Sukhraj Singh. "Lung cancer detection on CT images by using image processing." In 2012 International Conference on

Computing Sciences, pp. 142-146. IEEE, 2012.

[3] Bagherieh, Hamid, Atiyeh Hashemi, and Abdol Hamid Pilevar. "Mass detection in lung CT images using region growing segmentation and decision making based on fuzzy systems." International Journal of Image, Graphics and Signal Processing 6, no. 1 (November 2013):1.

[4] Naresh, Prashant, and Dr RajashreeShettar. "Early detection of lung cancer using neural network techniques." Prashant Naresh Int. Journal of Engineering Research and Applications 4, no. 8 (2014): 78-83.

[5] D'Cruz, J., A. Jadhav, A. Dighe, V. Chavan, and J. Chaudhari. "Detection of lung cancer using backpropagation neural networks and genetic algorithm." Comput Technol Appl 6, no. 5 (2016): 823-827.

[6] Asuntha, A., A. Brindha, S. Indirani, and Andy Srinivasan. "Lung cancer detection using SVM algorithm and optimization techniques." J. Chem. Pharm. Sci (2016).

[7] Wafaa Alakwaa, Mohammad Nassef, Amr Badr. "Lung Cancer Detection and Classification with 3D Convolutional Neural Network (3D-CNN)". (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 8, No. 8, 2017

[8] Senthil, S., and B. Ayshwarya. "Lung cancer prediction using feed forward back propagation neural networks with optimal features." International Journal of Applied Engineering Research 13, no. 1 (2018): 318-325.

[9] Sasikala, S., M. Bharathi, and B. R. Sowmiya. "Lung Cancer Detection and Classification Using Deep CNN." International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-8 Issue-2S December, 2018

[10] K Mohanambal, Y Nirosha, E Oliviya Roshini, S Punitha and M Shamini. "Lung Cancer Detection using Machine Learning Techniques."International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol 8, Issue 2, February 2019.

[11] Bhalerao, Rohit Y., Harsh P. Jani, Rachana K. Gaitonde, and Vinit Raut. "A novel approach for detection of Lung Cancer using Digital Image Processing and Convolution Neural Networks." In 2019 5th International Conference on Advanced Computing & Communication Systems (ICACCS), pp. 577-583. IEEE, 2019.