Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Vol 10 [10] September 2021 : 80-85

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD

REVIEW ARTICLE **OPEN ACCESS**

Evaluation of Different Image Processing Techniques for Detection for Lung Cancer

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ABSTRACT
Each year, lung cancer claims the lives of more than a million people. Because of the complexity of cancer cells, lung cancer is the most challenging kind of cancer to predict .Image processing can forecast lung cancer and diagnose and treat it early. Computer tomography, a type of medical imaging, can be used to detect lung nodules early on. It is feasible to see lung nodules before combining CT images and Computer-Aided Diagnosis (CAD) System images. As a result, new procedures and techniques are needed to detect cancer nodules early. This system can find lung cancer early by detecting nodules in CT lung images. CT lung scans are used to build a MATLAB image classification toolbox. Performance metrics evaluate the categorization rate and the false positive rate.
Keywords: *Lung Cancer, Image Processing, CT Images, CAD Images.*

Received 29.08.2021 Revised 08.09.2021 Accepted 21.09.2021

INTRODUCTION

Lung cancer is a significant cause for concern despite its high mortality rate as one of the most destructive diseases in the world. According to the 2016 World Cancer Report, men and women are equally at risk of developing lung disease due to smoking, drug inhalation, and allergic materials. Computed tomography imaging is used to diagnose the most severe forms of lung disease. Additionally, soft tissue visibility has been increased due to the requirement for an acceptable CT images for this method's analysis. However, despite the lack of direct application to lung cancer screening, the CAD techniques discussed above provide a theoretical reason and hope for enhanced CT lung cancer screening. According to the facts and their relevance, the effectiveness of lung cancer screening must be evaluated [1].

Low-dose spiral computed tomography (LDCT) decreases lung cancer mortality by 20% in smokers who smoke 30 packs a year or more. Smokers aged 55 to 74 who are in excellent health and have a 30-pack-year smoking history should participate in lung cancer screening programs with a high volume and screening quality. Shared decision-making must consider both the benefits and risks of lung cancer screening. The size of the tumor and other factors determine how a patient with lung cancer will be treated. Their cancer cells' molecular characteristics may limit their therapy options. In addition to surgery, radiation treatment, chemotherapy, and non-small cell lung cancer can be treated using these methods. For advanced non-small cell lung cancer, targeted therapy, chemotherapy, and immunotherapy are standard therapies. Small-cell lung cancer is commonly treated with radiation treatment and chemotherapy, but the disease frequently returns.

LITERATURE REVIEW

Lung cancer is one of the most lethal malignancies, according to Kanakatte et al. [1]. CT and MRI scans fall short of PET scans in sensitivity and specificity (MRI) to detect lung cancer in its early stages. SVMs and the closest neighbor algorithm are commonly used to classify inputs for classification. With an average sensitivity and specificity of 81% and 99%, a wavelet-based SVM classifier obtained a 97% accuracy rate. SVMs.

Lung cancer occurs due to abnormal cells growing and frequently increasing until they form tumors. Blood and lymph fluid around lung tissue can transport cancer cells away from the lungs. There are now several proposed systems, many of which are merely notions. Using artificial neural networks, classification and detection of lung cancer is a theoretical endeavor with limited accuracy [2-3]. In chest radiography, computer-aided diagnostic [4] has classified lung area extraction approaches into two categories: rule-based and pixel classification-based. The usual paradigm of employing a local density maximum approach to detect microscopic lung nodules on CT scans [5] is ineffective at this task. There are both density-based and model-based CADs [4]. Specific systems exhibit the traits of homogeneity, connectivity, and location [6]. One of the two segmentation techniques demonstrated in [7] is the artificial neural network and fuzzy clustering; the other two are Lung Cancer image Processing Techniques [8-9,10] and Early Detection and Prediction of Lung Cancer Survival Using Neural Network Classifier [11].

Researchers believe neural networks and curvelet transformations can diagnose lung cancer from CT scan images. Lung cancer detection and classification using machine learning and multinomial Bayesian classification [12], lung cancer detection and classification using Bayesian Classifier [13], automatic detection of lung cancer in CT images [14], lung cancer detection using BPNN and SVM [15], and lung cancer size estimation using image segmentation and back propagation [16-17] have all been conducted in recent years.

Generic algorithm template matching (GATM) [18] locate lung nodules in computed tomography images. We used GA to find the target in our pictures, and as soon as we found it, we selected a matching image from our database. 72% of nodules may be found using this procedure.

With clinically meaningful FPR and TPR values and new ROC techniques [19], screening for most cancers in low-risk populations is best accomplished using low FPRs of less than 1.0.Based on a CT scan from the NIH/NCI Lung Database Consortium, Sharma and Jindal [8] developed a computer-aided diagnosis technique. To detect lung cancer, scientists employed a variety of methods. Bit image slicing, erosion, and the wiener filter extracted the lung area from a CT scan. This study used a region-expanding segmentation strategy to split the lung regions obtained. Following lung segmentation, they used a rule-based technique to identify cancer nodules. Indicators and data were used to create diagnostic criteria. The overall accuracy of 80% was reached by the proposed method.

Tariq *et al.* [20] devised an automated approach that utilizes CT scan images. The method's initial two stages are automated lung segmentation and augmentation and feature extraction and categorization. The photograph's backdrop was removed, and the nodules were recovered using threshold segmentation. After extraction and segmentation, the anomalous region was calculated using a feature vector. The parts were then classified using a fuzzy neural classifier. This technique can detect lung cancer early, detecting even the tiniest lesions.

Anand [21] used image processing techniques and neural network categorization to predict lung cancers from CT scans. Individual lung segments were then differentiated from one another and each other using the optimal noise reduction thresholds. It was determined that a growth approach might be used to split the lung nodules into distinct zones. We used a back propagation neural network to detect whether a sample was cancerous. Sivakumar and Chandrasekar [22] proposed an efficient method for detecting lung nodules based on nodule segmentation. Nodules were grouped using a fuzzy probabilistic clustering technique that was weighted. The data were classified using SVM.Images may be classified using eight texture characteristics produced from the histogram and gray level concurrence matrix [23].

Researchers discovered [24] that sputum cells may be segmented and identified using Hopfield Neural Network (HNN) and Bayesian classification. They segmented nuclei and cytoplasm with HNN surpassing Fuzzy CMean clustering, which was previously adequate for this task. The HNN method performed better on the segmented picture after morphological processing. Kancherla and Mukkamala [25] advocated for using nucleus-based characteristics to diagnose early lung cancer. The seeded region growth method was employed to segment nuclei in this study. A nucleus size criterion was added to the seeded region manufacturing method to improve the results.

The Song et al. [26] CAD system can aid radiologists in detecting pulmonary nodules on chest radiographs by decreasing false positives. 44.3% may be saved, while 2.3% may be acquired intangible advantages. Additional adenocarcinoma non-small cell lung cancer patients were explored [27]. In the future, the comparison of classifiers will help develop selection procedures. Survival time can be predicted using classifiers.

Chen et al. [28] proposed using virtual SAW gas sensors with picture recognition for non-invasive lung cancer diagnosis. Electronic nose with SMPE and capillary column preconcentrated and separated volatile organic compounds (VOCs).

According to Noha et al. [29], developments in computer-aided design may improve the effectiveness of lung cancer screening. They differentiated lung tissue, classification of nodules, and characterization using CAD systems. CT scans' sensitivity and specificity for lung cancer screening may need to be improved using CAD technology.

David et al. [30] established a method for detecting lung nodules and polyps in helical CT images using CAD standard surface overlap.As a result of this research, a computerized diagnostic system was developed that encodes the findings of a multipliable output encoding technique using a two-level

convolutional neural network (CNN) architecture. For training, testing, and evaluation of the architecture, digital chest X-rays were used. The system automatically extracts and analyzes features from a given pattern class to obtain a high rate of detection of "true-positive" and "low-positive" patterns.
According to Freedman [31], mammography can detect breast and lung cancer symptoms. While solutions for various diseases and phototypes are currently being developed, a dependable database is critical to this process. The Radiologist-contributed CT nodule database worked well with Siemens Lung Care CT CAD. The findings were consistent across all radiologists and CADs who participated in the study.
According to Patil et al. [32], classifiers can be paired with a definitive decision rule or optimal ROC curve. Consider the terms sensitivity and specificity in clinical terms.

LUNG CANCER DETECTION AND CLASSIFICATION

The following table summarizes identifying and classifying lung nodules as shown in figures 1 and 2.Combining image processing and data mining classification methodologies has significantly impacted the medical business regardingthe early detection of lung cancer.The work in image processing and classification has been summarized in Table 1, and the accuracy and sensitivity of various algorithms.

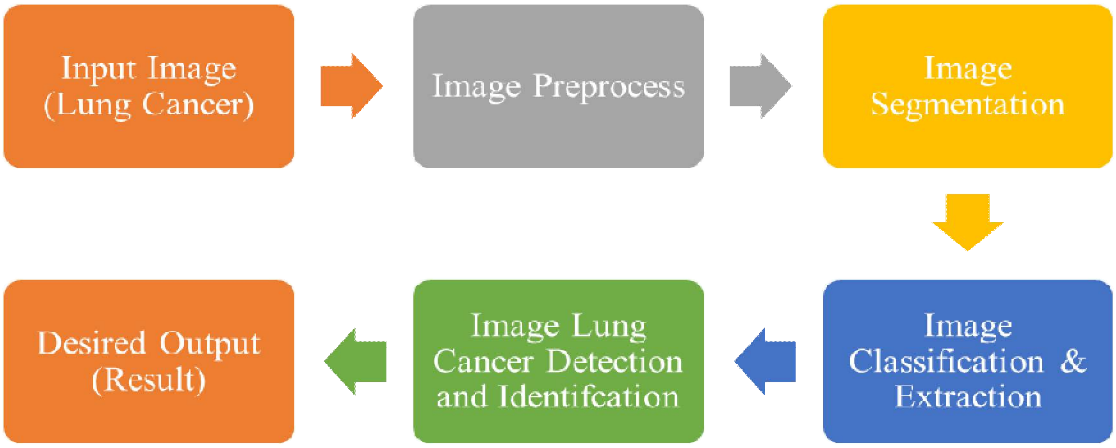

Figure 1. Image Processing methods to Detect Lung Cancer

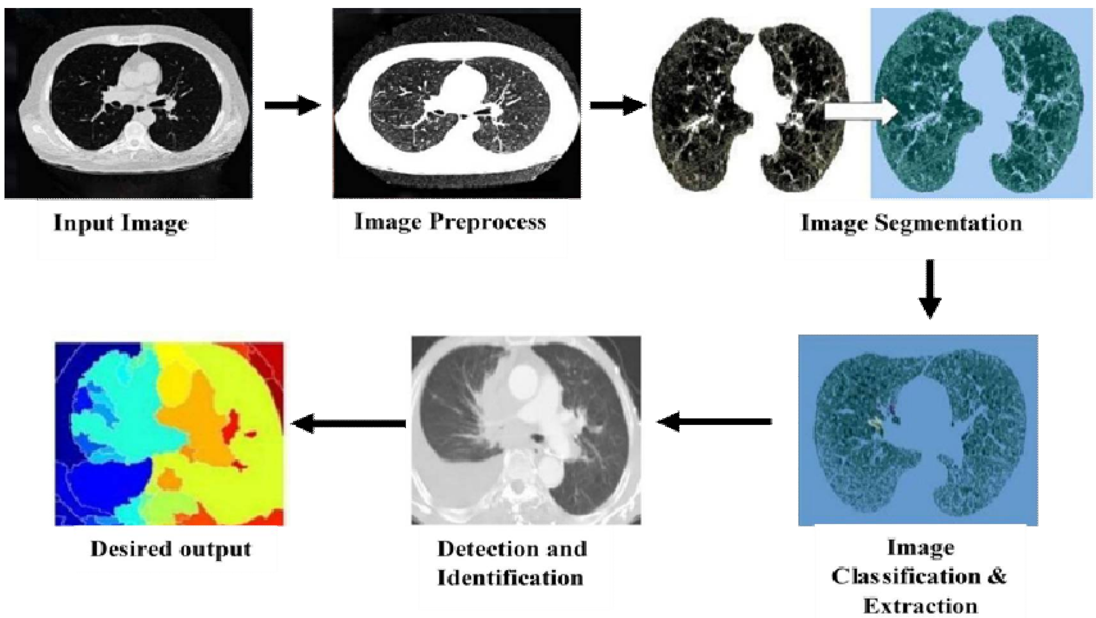

Figure 2. Example of Image Processing Methods to DetectLung Cancer

Table 1. Lung Cancer Detection and Classification Techniques using Image Processing

Author(s) and Year	Images	Classification Techniques	Accuracy (%)
Sharma and Jindal	CT	Diagnostic Indicators	80
Tariq et al	CT	Neuro-Fuzzy	95
Orozco et.al	CT	SVM	84
Anand	CT	Back propagation network classification	86.30
Song et.al	CT	SVM	85
Sivakumar and Chandrasekar	CT	RBF Kernel Type (SVM)	80.36
Lee et al	CT	Classification	72
Atiyeh Hashemi	CT	ANN	95
Basavanna et.al	CT	KNN,DT	85
Kancherla and Mukkamala	Sputum	Random forest (bagging)	87
Taher	Sputum	Bayesian	88.62
Kanakatte et.al	PET	k-NN,SVM	97

- Classification accuracy varied between 80.36% and 85% when CT scans and SVM were used.
- When CT scans and the Back Propagation Network classification method were used, classification accuracy was 86.30%.
- When CT scans and the ANN classification method were used, classification accuracy ranged from 95%.
- When CT scans and the KNN and DT classification methods were used, classification accuracy ranged from 85%.
- The Neuro-Fuzzy classification system correctly classified CT scans 95% of the time.
- With Sputum, Bayesian classification achieved an accuracy of 88.62 percent.
- With Sputum, Random Forest classification achieved an accuracy of 87%.
- CT images were used between 80% of the time when the Diagnostic Indicators classification technique was used.
- When PET scans and the KNN and SVM classification methods were used, classification accuracy was 97%.

CONCLUSION

Predicting lung cancer is the most challenging endeavor due to the complexity of cancer cells. Lung cancer prediction and early diagnosis are two of the most common applications of image processing technology. Because pattern recognition techniques extract several pieces of information from photographs, they are effective for lung cancer prediction. A comprehensive review of previous researchers' use of image processing techniques for lung cancer prediction was presented in this article. The previous studies utilized image processing approaches for cancer diagnosis.

ACKNOWLEDGMENT

The authors express gratitude towards the assistance provided by The Management, Krupanidhi Group of Institutions (KGI), and Krupanidhi Research Incubation Centre, KGI, in completing the research. We also thank our Research Mentors, who guided us throughout the study and helped us eve the desired results.

REFERENCES

1. Kanakatte A, Mani N, Srinivasan B, Gubbi J.(2008). Pulmonary tumor volume detection from positron emission tomography images. International Conference on BioMedical Engineering and Informatics .(Vol. 2, pp. 213-217). IEEE.
2. Bhat G, Biradar VG, Sarojadevi H. (2012). Artificial Neural Network based Cancer Cell Classification (ANN–C3). Computer Engineering and Intelligent Systems.3(2).28-34
3. Pathan A, Saptalkar BK. (2012). Detection and classification of lung cancer using artificial neural network. International Journal on Advanced Computer Engineering and Communication Technology. 1(1).34-39

4. Van Ginneken B, Romeny BT, Viergever MA. (2001). Computer-aided diagnosis in chest radiography: a survey. IEEE Transactions on medical imaging. Dec;20(12):1228-41.
5. Zhao B, Gamsu G, Ginsberg MS, Jiang L, Schwartz LH. (2003). Automatic detection of small lung nodules on CT utilizing a local density maximum algorithm. journal of applied clinical medical physics. ;4(3):248-60.
6. EI-Baz A, Farag A, Falk R, Rocco RL. (2002). Detection, visualization, and identification of lung abnormalities in chest spiral CT scans: phase I. information Conference on Biomedical Engineering, Egypt..
7. Lin DT, Yan CR. (2002). Lung nodules identification rules extraction with neural fuzzy network. In Proceedings of the 9th International Conference on Neural Information Processing, ICONIP'02. 2002 Nov 18 (Vol. 4, pp. 2049-2053). IEEE.
8. Al-Tarawneh MS. (2012). Lung cancer detection using image processing techniques. Leonardo Electronic Journal of Practices and Technologies. 11(21):147-58.
9. Sharma D, Jindal G. (2011). Identifying lung cancer using image processing techniques. InInternational Conference on Computational Techniques and Artificial Intelligence (ICCTAI) (Vol. 17, pp. 872-880).
10. Miah MB, Yousuf MA. (2015). Detection of lung cancer from CT image using image processing and neural network. In2015 International conference on electrical engineering and information communication technology (ICEEICT) . (pp. 1-6). ieee.
11. Ada RK. (2013). Early detection and prediction of lung cancer survival using neural network classifier. International Journal of Application or Innovation in Engineering and Management (IJAIEM). 2(6).1-8
12. Dwivedi SA, Borse RP, Yametkar AM. (2014). Lung cancer detection and classification by using machine learning & multinomial Bayesian. IOSR Journal of Electronics and Communication Engineering (IOSR-JECE). 9(1):69-75.
13. Yametkar AM, Patane RD. (2014). Lung Cancer Detection And Classification By Using Bayesian Classifier. In Proceedings of IRF International Conference(pp. 7-13).
14. Vijaya G, Suhasini A, Priya R. (2014). Automatic Detection of Lung Cancer in CT Images. IJRET: International Journal of Research in Engineering and Technology.;3(7):182-6.
15. Khumancha MB, Barai A, Rao CR. (2019). Lung Cancer Detection from Computed Tomography (CT) Scans using Convolutional Neural Network. In2019 10th International Conference on Computing, Communication and Networking Technologies (ICCCNT) (pp. 1-7). IEEE.
16. Reddy U, Reddy B, Reddy B. (2019). Recognition of Lung Cancer Using Machine Learning Mechanisms with Fuzzy Neural Networks. Treatment du Signal. 1;36(1):87-91.
17. Sankar K, Prabakaran M. Gray (2014). Co-Efficient Mass Estimation Based Image Segmentation Technique For Lung Cancer Detection Using Gabor Filters. Journal of Theoretical & Applied Information Technology. 20;66(1).
18. Lee Y, Hara T. (2001). Hiroshi, shigeki and Takeo: IEEE Transactions on Medical Imaging vol 20 No 7. 2001.
19. Basavanna M, Shivanand SG, Govindaiah TN. (2016). Tumor cell identification in medical images using image processing techniques. Global Journal of Advanced Engineering Technologies and Sciences. 3(10): 13-17.
20. Tariq A, Akram MU, Javed MY. (2013). Lung nodule detection in CT images using fuzzy neuro classifier. In2013 Fourth International Workshop on Computational Intelligence in Medical Imaging (CIMI): (pp. 49-53). IEEE.
21. Anand SV. (2010). Segmentation coupled textural feature classification for lung tumor prediction. In2010 International Conference on Communication Control and Computing Technologies.pp. 518-524.
22. Sivakumar S, Chandrasekar C. (2013). Lung nodule detection using fuzzy clustering and support vector machines. International Journal of Engineering and Technology. 5(1):179-85.
23. Orozco HM, Villegas OO, Domínguez HD, Sánchez VG. (2013). Lung nodule classification in CT thorax images using support vector machines. In2013 12th Mexican International Conference on Artificial Intelligence. pp. 277-283.
24. Taher F, Werghi N, Al-Ahmad H. (2012). Bayesian classification and artificial neural network methods for lung cancer early diagnosis. In2012 19th IEEE International Conference on Electronics, Circuits, and Systems (ICECS 2012) pp. 773-776.
25. Kancherla K, Mukkamala S. (2013). Early lung cancer detection using nucleus segmentation based features. In2013 IEEE Symposium on Computational Intelligence in Bioinformatics and Computational Biology (CIBCB). pp. 91-95.
26. Song D, Zhukov TA, Markov O, Qian W, Tockman MS. (2012). Prognosis of stage I lung cancer patients through quantitative analysis of centrosomal features. In2012 9th IEEE International Symposium on Biomedical Imaging (ISBI).pp. 1607-1610. IEEE.
27. Hashemi A, Pilevar AH, Rafeh R. (2013). Mass detection in lung CT images using region growing segmentation and decision making based on fuzzy inference system and artificial neural network. International Journal of Image, Graphics and Signal Processing. 1;5(6):16.
28. Chen X, Zhang J, Wu D, Han R. (2005). HIPPA's compliant Auditing System for Medical Imaging System, proceedings of the 2005 IEEE Engineering in Medicine and Biology 27th Annual Conference. Shanghai, China, Sept1-4.
29. Noha Lee, Andrew F. L Aine, Guillermo, Jeffrey and John K. Gohagan (2009). Using Various Processing Methods to Identify Lung Cancer. IEEE Review in Bio Medical Engineering, vol 2.1-9
30. David S paik, Christipher, Geoffrey, rubeen, RubakAcar, Joyoni Dey and Sandy Nepel: (2004). Review Paper on a Review on Lung Cancer Detection using Digital Image Processing Techniques: A Comparative Study. IEEE Transactions on Medical Imaging vol 23 No 26, 90.

31. Freedman M. (2004). Improved Small Volume Lung Cancer Detection with Computer-Aided Detection: Database Characteristics and Imaging of Response to Breast Cancer Risk Reduction Strategies. Annals of the New York Academy of Sciences. 1020(1):175-89.
32. Patil BG, Jain SN. (2014). Cancer cells detection using digital image processing methods. International Journal of Latest Trends in Engineering and Technology. Mar;3(4):45-9.

CITATION OF THIS ARTICLE

B Lukose and Anuradha N. Evaluation of Different Image Processing Techniques for Detection for Lung Cancer. Bull. Env. Pharmacol. Life Sci., Vol 10[10] September 2021 : 80-85.