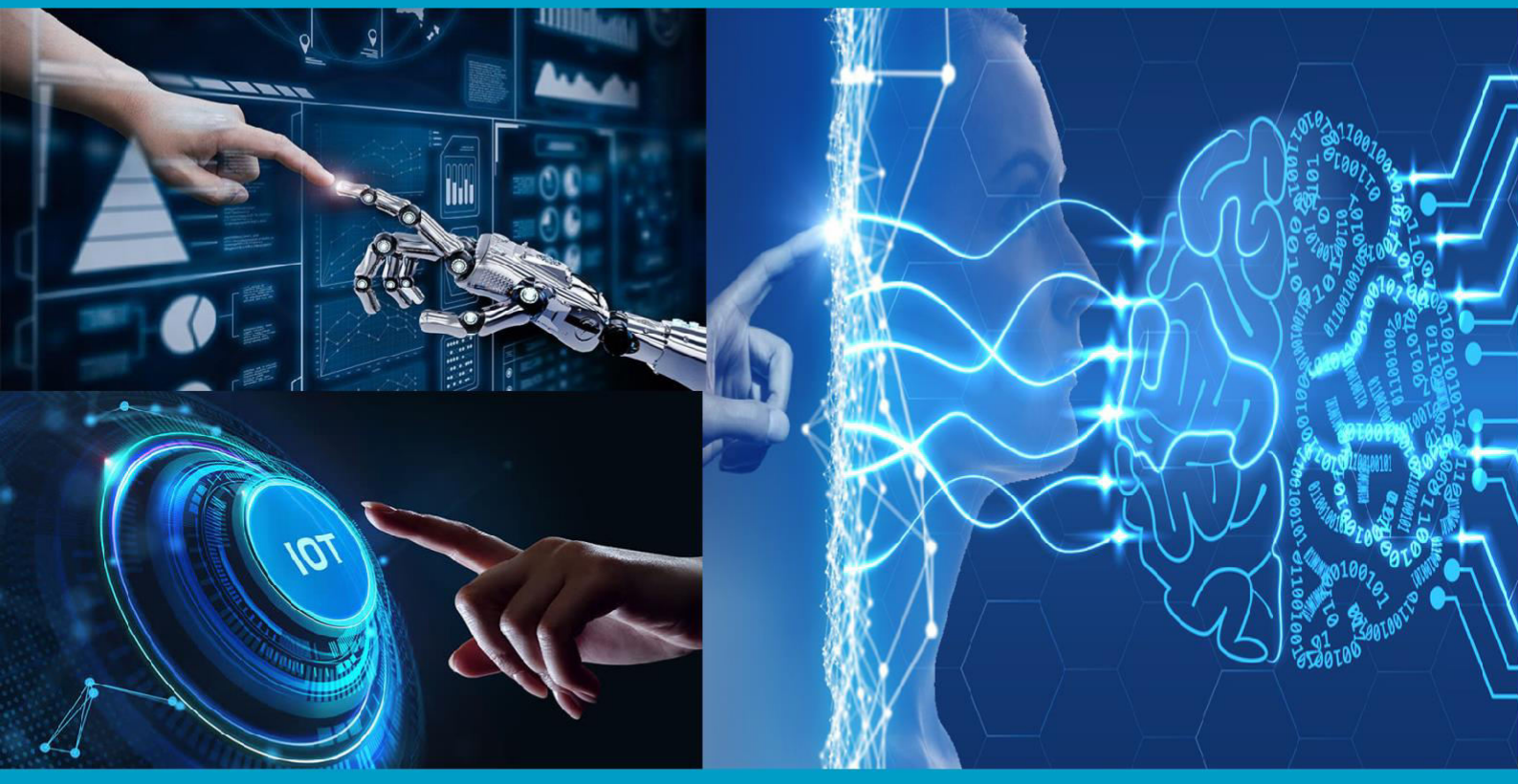
IJMRSETM

e-ISSN: 2395 - 7639



INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH

IN SCIENCE, ENGINEERING, TECHNOLOGY AND MANAGEMENT

Volume 10, Issue 12, December 2023

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.580

International Journal of Multidisciplinary Research in Science, Engineering, Technology & Management (IJMRSETM)

| ISSN: 2395-7639 | www.ijmrsetm.com | Impact Factor: 7.580| A Monthly Double-Blind Peer Reviewed Journal |

| Volume 10, Issue 12, December 2023 |

Advanced Methods of Lung Cancer Disease Prediction Through Deep Learning (DL): A Comprehensive Review

[1]Sukrit Kumar, [2]Mr. Deepesh Dewangan

[1]M. Tech Student, Department of Computer Science and Engineering, Shri Rawatpura Sarkar University, Raipur, India

[2]Assistant Professor, Department of Computer Science and Engineering, Shri Rawatpura Sarkar University, Raipur, India

ABSTRACT: For accurate and fast screening of lung cancer, medical imaging tools are significant in effective analysis and aid clinicians in the effective diagnosis of patients. There are available vital screening tools namely magnetic resonance imaging (MRI), X-ray, CT scanning, and many others. However, the cases of lung cancer development still growing and it leads to mortality worldwide due to lack or delay in treatment. Computer-aided (CAD) tools are vital for the correct prediction of lung cancer. Recently, machine and deep learning techniques have been adopted by investigators for the timely predictions of lung cancer to reduce the mortality rate. This comprehensive review aims to investigate the advanced methods of lung cancer prediction through machine as well as deep learning (DL). Nevertheless, the existing deep and machine-learning approaches used for lung cancer diagnosis have some limits and require research further to build pragmatic solutions.

KEYWORDS: Deep Learning, Disease, Lung Cancer, MRI, Machine Learning.

I. INTRODUCTION

Numerous CAD techniques have been thoroughly investigated to identify as well as categorize lung cancer. In contrast to radiologists with training, CAD methods do superior in identifying lung cancer in MRI pictures [1]. Four phases are typically included in the CAD-rooted lung cancer screening system: the processing of images, choosing features, ROI extraction, as well as categorization. Worldwide, lung disease is the primary contributor to cancer-associated fatalities. It is the second-most prevalent cause of mortality amongst all malignancies, accounting for eighteen percent of all mortality caused by cancer [2]. Nicotine is the main risk factor for lung disease because its prevalence has peaked or is still rising in several nations. It means that over a few years, cancer of the lungs would grow progressively prevalent. Figure 1 illustrates the major lung cancer classes. The results of patients with lung cancer might be greatly enhanced by early identification as well as precise identification. After assessment, cancer of the lung's patients has an approximate 15% chance of survival for five years. MRI, as well as CT scanning, are vital tests for medical treatments for initial identification that increase the lifespan of patients. Smart processes have traditionally relied on feature collection techniques such as Genetic Algorithms (GA) that might be used to manually generate the finest attributes [3], [4]. Generally speaking, the chance of a complete recovery could be raised by the initial identification of a malignancy incidence via precise diagnostics and efficient therapy. Authorized professionals are necessary for understanding medical records to diagnose ailments, irrespective of the healthcare equipment used [5]. This is also common for professionals to differ occasionally because of how complicated healthcare images may be. For this reason, in the area of medicine, a smart, aided diagnosing method is crucial. To diagnose clinical pictures DL as well as traditional ML methods were applied in the past few years [6].

| ISSN: 2395-7639 | www.ijmrsetm.com | Impact Factor: 7.580| A Monthly Double-Blind Peer Reviewed Journal |

| Volume 10, Issue 12, December 2023 |

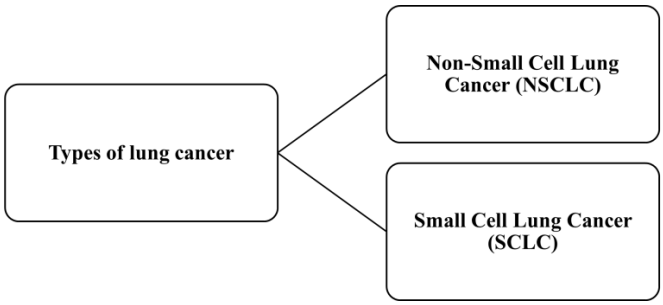


Figure 1: Illustrates the major lung cancer classes.

Modern technology might assist with timely diagnosis, improved therapy, and faster identification of lung disease, as delayed treatment is associated with bad survival. Utilizing CT tools to assess, characterize, and identify lung lesions puts clinicians under a lot of burden [7], [8]. Technical developments might aid doctors in doing less labor as well as improving diagnostic sensitivity while lowering false positive rates (FPR). Furthermore, by raising the rates of prompt detection and effective care, lung cancer diseases' death and disability might be decreased, due to advancements in lung carcinoma detection technology [9]. It is common to divide computerized training techniques into two groups: unsupervised learning as well as supervised learning. The kind of information required to train the algorithms as well as the training goals are the primary distinctions among unsupervised as well as supervised ML. Labeled training dataset, or input dataset linked to accurate labeling or answers, is essential to the supervised ML technique [10]. Figure 2 major risk factors of lung cancer development.

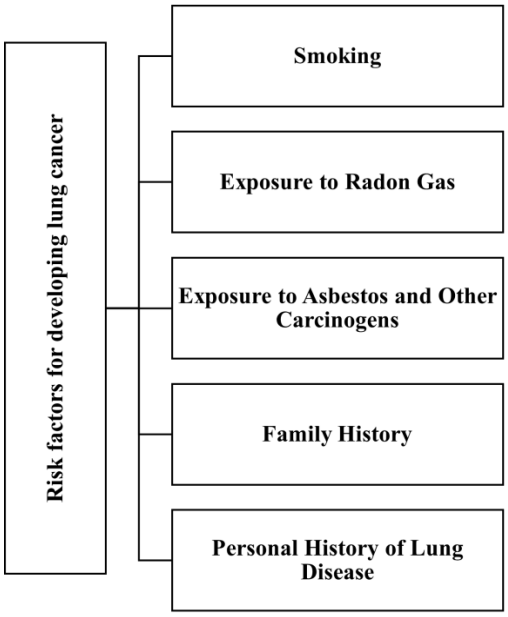


Figure 2: Major risk factors of lung cancer development.

The application of DL techniques for CT-rooted lung cancer monitoring as well as treatment has been the subject of numerous investigations. Generally speaking, normal as well as diseased CT scans have different picture attenuation characteristics [11], [12]. Simplified lung segments are easily achieved by applying methods including shape-rooted techniques, gray-level thresholding, as well as quantitative methods to separate the lung disease symptoms from the tissues that surround them [13]. This research describes current advances in DL approaches for lung cancer identification, and division, including categorization. The most advanced DL-based lung cancer screening techniques are highlighted in this article. Along with recent accomplishments, pertinent investigation issues, including future study objectives are highlighted in the present paper.

| ISSN: 2395-7639 | www.ijmrsetm.com | Impact Factor: 7.580| A Monthly Double-Blind Peer Reviewed Journal |

| Volume 10, Issue 12, December 2023 |

II.LITERATURE REVIEW

In this section, we offer a succinct summary of the best current pertinent studies on the use of ML as well as DL algorithms and methods for predicting the development of malignancies of the lungs. Physicians use clinical scanning technologies to identify lung illness. CT is the most advantageous of all medical scanning modalities; it can detect nodules as well as lung cancer based on its dimensions, setting, characterization, as well as disease progression [14]. Lung cancer treatment is greatly impacted by the highly accurate radiation dosing that four-dimensional CT offers. The use of clinical scanning techniques is crucial for detecting lung cancer in its earliest phases, therefore increasing the chance of survival. Such approaches can't recognize lesions, though, resulting in significant false positive rates (FPR). To detect cancer of the lungs, various computer-aided design (CAD) tools were created [15].

In [16] N. Nasrullah et al. discussed lung cancer identification through DL. Because of its aggressiveness as well as the delayed discovery of severe phases of the disease, lung carcinoma remains one of the leading reasons for cancer-based fatalities. For a person to survive, rapid recognition of lung disease is critical yet presents a substantial challenge. X-rays as well as CT scanning are typically utilized in the early stages of diagnosing cancerous lesions in the lung; nevertheless, the potential presence of small tumors might result in incorrect conclusions. Y. Li et al. [17] studied varied applications of ML in lung cancer diagnosis and improved treatment of patients. Medical research of lung carcinoma has advanced methodically thanks to the latest developments in scanning as well as sequencing tools. the capacity of the human brain to process as well as utilize the vast volumes of data that have accumulated is restricted.

P. Chalasani [18], discussed lung cancer recognition of patients using the CT images and DL methods. For researchers, a particularly significant area of the initial stages of studies is lung carcinoma diagnostics. Two levels of early lung carcinoma identification are intended for the suggested approach. Picture capture, preprocessing, feature extraction, as well as CNN detection, are some of the phases that make up the suggested technique. Z. H. U. Rong et al. [19] explored lung cancer classification using DL. Omics datasets often exhibit higher dimensionality, higher noise, as well as small sampling sizes. Thus, efficiency can't be enhanced by simply applying conventional categorization algorithms directly; instead, customized improvements must be made. To create an advanced migrating training model of categorization to facilitate early carcinoma of the lung assessment, this study proposes a CNN along with an auto-encoder technique.

B. Dunn et al. [3] explored lung cancer automated classification by the DL technique. Medical imaging scanners are being interpreted with the use of AI as well as other data science methods. Conventional picture processing depends on a qualified radiologist's eye comprehension, which takes effort as well as might be rather subjective. One of the main objectives of radiomics, a rapidly expanding field of study that blends customized healthcare with clinical scans, is the creation of trustworthy, computerized diagnostic instruments. R. Mothkur et al [20] used a deep hybrid learning approach for the analysis of lung cancer classification. A new hybridization extraction of features method utilizing transfer learning (TL) for the categorization of lung nodules. By determining the ideal levels that enhanced the classifications' effectiveness, the deep features were retrieved. Reduced dimension can be accomplished by applying the principal component assessment approach after DL has been utilized to obtain picture data. Based on deep characteristics, the effectiveness of many classifications relying on ML was examined. Table 1 shows a literature review summary for lung cancer detection through machine and deep learning methods.

Table 1: Literature review summary for lung cancer detection through machine and deep learning methods.

Year	Reference	Methods	Limitation
2023	[21]	This research is based on deep learning methodology.	The proposed methods require a large time in model training.
2019	[22]	The proposed model integrates the CNN technique.	This method requires a large amount of data for analysis of lung cancer
2023	[23]	This method integrated the LSTM and D-CNN methods.	This model is complex in implementation
2022	[24]	Random Forest and CNN are key algorithms used in this research.	The proposed approach requires a large volume of data for correct predictions.

| ISSN: 2395-7639 | www.ijmrsetm.com | Impact Factor: 7.580| A Monthly Double-Blind Peer Reviewed Journal |

| Volume 10, Issue 12, December 2023 |

2023	[25]	Deep Learning and Tuna Swarm Algorithm	Data Dependency is a key concern
2023	[26]	The proposed model is rooted in a hybrid neural network	Training challenges are crucial to manage
2022	[27]	Ensemble learning and particle swarm optimization	Limited management of key constraints in prediction
2021	[28]	Key Machine learning algorithms are SVM, Decision tree in this approach	Less accuracy in pre-processing of the images.

III. DISCUSSION

The lungs regulate breathing while making certain that all human body cells get enough oxygen. Simultaneously, the lungs perform the filtering of the air to stop pathogens as well as unnecessary chemicals from entering the human body. The lungs are shielded by defense mechanisms that are specifically created for the benefit of humans. These measures are insufficient, though, to remove the chance of developing several lung-related illnesses [29]. The lungs could be impacted by sickness, inflammatory conditions, or additional hazardous issues like the development of a malignant lung tumor. In the present study, we explored excellent algorithms to detect patients at increased hazard for cancer of the lungs and, consequently, initiate early therapies to prevent longer-term consequences using ML techniques [30].

Cancer issues of the lungs are highly prevalent yet fatal illnesses throughout the entire globe. A person's chances of longevity are solely increased by early detection of carcinoma of the lungs. CT scanning is a widely employed technology for lung disease diagnosis as well as detection because it offers a thorough image of the lung. Methods based on DL were thoroughly investigated to aid in the interpretation of CT scans for diagnosis of carcinoma of the lungs, in keeping with the evolution of computerized solutions [31]. Therefore, the purpose of this study is to present a thorough analysis of the DL methods created for lung carcinoma detection as well as diagnosis. An introduction to DL approaches, proposed DL strategies for cancer-related applications, including innovative aspects of the studied approaches are included in this paper. Figure 3 shows the classification of lung cancer detection using machine learning.

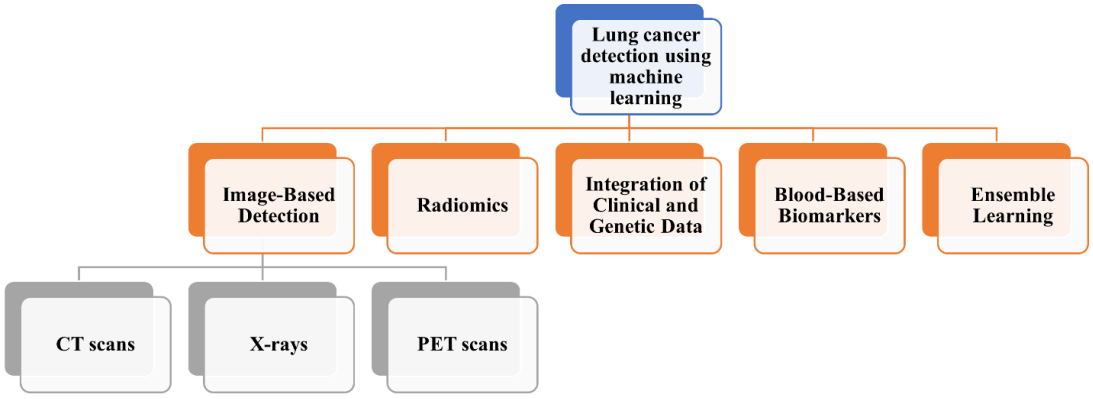


Figure 3: Lung cancer detection using machine learning.

Artificial intelligence (AI) tools have the power to completely transform lung cancer identification at its earliest stages. There are several potential uses for it, such as picture reconstruction, customized testing plans, as well as automated nodule identification, division, along characterization. Accurately characterizing and evaluating tumors in the lungs as well as patient prognosis or mortality may be made possible by the incorporation of multimodality along with the development of effective algorithms that have been tried as well as evaluated. Collaboration, coordination, with synchronization amongst radiology and physicians are required to achieve this. among the most exciting issues of future healthcare is the use of AI in lung examination. which has enormous promise for therapeutic applicability [32]. Figure 4 shows a classification of lung cancer detection using deep learning.

| ISSN: 2395-7639 | www.ijmrsetm.com | Impact Factor: 7.580| A Monthly Double-Blind Peer Reviewed Journal |

| Volume 10, Issue 12, December 2023 |

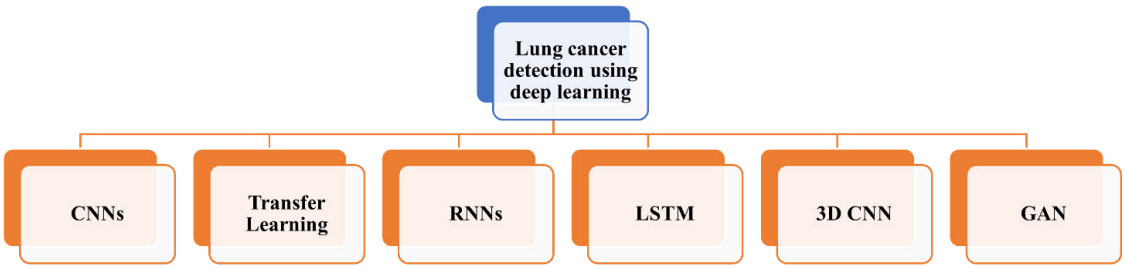


Figure 4: Lung cancer detection using deep learning.

Among all aggressive tumors, cancer of the lungs possesses the highest rates of illness as well as death. The majority of lung tumors are found in the intermediate as well as advanced phases of the illness, whenever there are few options for therapy as well as the lowest chance of a patient's survivability. To enhance patient results, lung carcinoma monitoring aims to detect lung carcinoma early in the illness, while there are greater possibilities for efficient therapies. AI is a crucial tool in this setting since several advances for improved patient treatment are driven by the aim to increase the effectiveness of medical treatment. Every step of the procedure for malignancy detection might use AI [33].

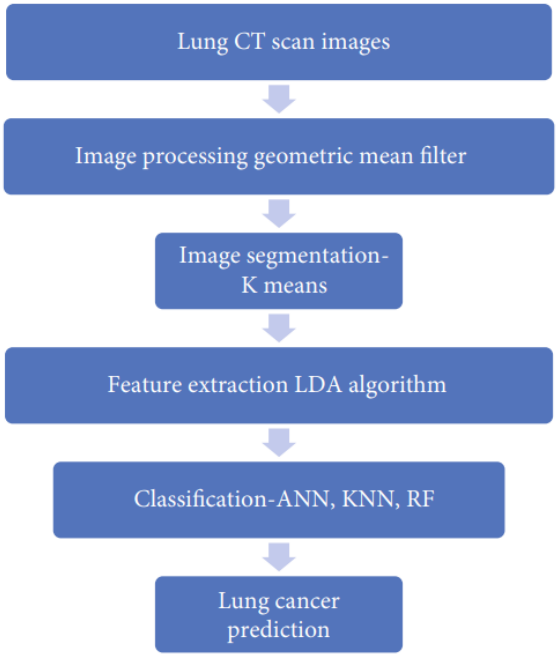


Figure 5: Lung cancer prediction and classification through machine learning [36].

Initially, AI-rooted reconstruction enables an additional amount decrease for lower-dose CT collection for cancer screenings whilst preserving excellent picture clarity. AI could assist in hazard assessment focused on the gathering as well as examination of copious amounts of medical as well as imaging datasets, which will enable the tailoring of scanning strategies. By acting as a simultaneous or second reader along with automating the very sensitive identification of possible lung tumors, CAD systems shorten the timeframe required for interpreting the picture [34]. AI algorithms may provide several advantages and are now a crucial component of the malignancy detection procedure. These involve reducing the amount of radiation exposure, correctly identifying including classifying lung tumors, customizing monitoring plans, and offering LDCT interpreting in areas where specialists are in limited availability. Utilizing photographs as well as medical data extracted from CNN, a kind of DL artificial neural network, has demonstrated encouraging outcomes for forecasting

| ISSN: 2395-7639 | www.ijmrsetm.com | Impact Factor: 7.580| A Monthly Double-Blind Peer Reviewed Journal |

| Volume 10, Issue 12, December 2023 |

the likelihood of cancer of the lungs [35]. Figure 5 shows lung cancer prediction and classification through machine learning.

As among the primary reasons for cancer-related fatalities globally, lung tumors highlight the requirement for more advanced methods of diagnosis as well as cure. AI has gained significant attention recently due to its possible connection to lung malignancy [37]. A summary of the present state of AI solutions for lung tumor assessment, diagnosis, along therapy is what this paper attempt to give. Effective lung tumor examinations and diagnoses are made possible by the impressive powers of AI techniques such as ML, DL, and radionics in the identification as well as characterization of tumors in the lungs [38]. Sophisticated methods successfully detect worrisome spots and enable prompt treatment by analyzing a variety of scanning techniques, including lower-dose CT scanning, PET-CT scanning, etc.

AI algorithms have demonstrated the potential to augment the precision as well as the effectiveness of preliminary identification by employing biomarkers including cancer markers as additional diagnostic instruments [39]. Computer tools like these help physicians diagnose patients more precisely as well as intelligently by reliably differentiating between benign as well as cancerous tumors in the lungs. Furthermore, AI programs can include medical information and several scanning techniques, resulting in a deeper thorough therapeutic evaluation. AI algorithms may predict therapy outcomes and even direct the choosing of the best medicines by using excellent information such as the demographics of patients, medical histories, as well as genetic patterns [40]. Figure 6 shows the non-imaging methods of lung cancer detection.

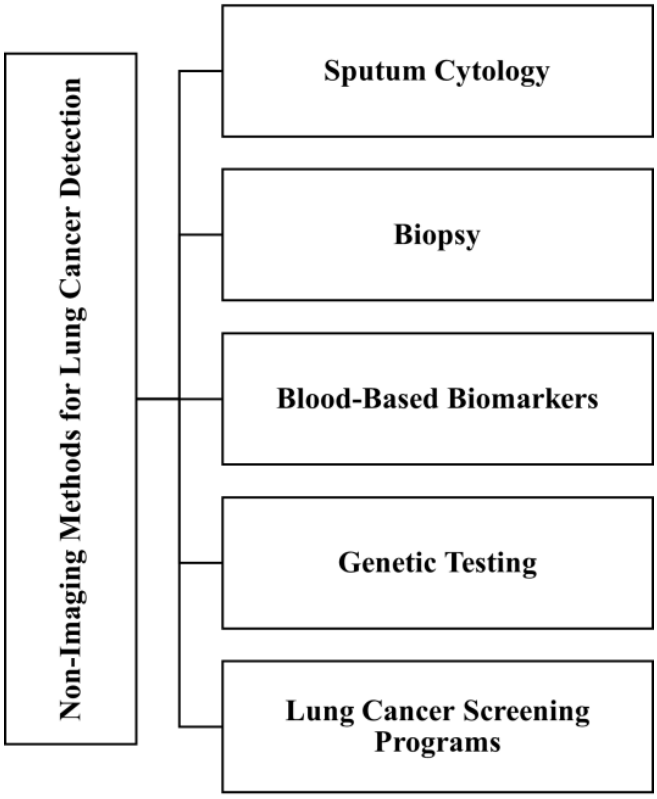


Figure 6: Shows the non-imaging methods of lung cancer detection.

IV.CONCLUSION

This study examined the most current developments in ML and DL-based methods for the identification, splitting, as well as categorization of lung lesions. CT picture datasets constitute the most often utilized scanning databases to train neural networks. CNN technique has become widespread and frequently employed DL methods for identifying as well as categorizing lung diseases. Upcoming studies should concentrate on developing uniform pre-processing techniques that address the diversity of CT images while improving the accuracy as well as reliability of lung disease screening as well as identification through the application of DL techniques. In its summary, the review study highlights the necessity for advancements in the detection of lung disease particularly cancer of the lung. Numerous topics, such as data availability,

classification, earlier identification, incorporation of medical information, image improvement, cloud-based computing, extraction of features, as well as uniformity, are recommended as potential future research avenues.

REFERENCES

[1] A. Halder, S. Chatterjee, and D. Dey, "Adaptive morphology aided 2-pathway convolutional neural network for lung nodule classification," *Biomed. Signal Process. Control*, 2022, doi: 10.1016/j.bspc.2021.103347.

[2] M. Humayun, R. Sujatha, S. N. Almuayqil, and N. Z. Jhanjhi, "A Transfer Learning Approach with a Convolutional Neural Network for the Classification of Lung Carcinoma," *Healthc.*, 2022, doi: 10.3390/healthcare10061058.

[3] B. Dunn, M. Pierobon, and Q. Wei, "Automated Classification of Lung Cancer Subtypes Using Deep Learning and CT-Scan Based Radiomic Analysis," *Bioengineering*, 2023, doi: 10.3390/bioengineering10060690.

[4] J. L. L. Calheiros, L. B. V. de Amorim, L. L. de Lima, A. F. de Lima Filho, J. R. Ferreira Júnior, and M. C. de Oliveira, "The Effects of Perinodular Features on Solid Lung Nodule Classification," *J. Digit. Imaging*, 2021, doi: 10.1007/s10278-021-00453-2.

[5] S. Ram, W. Tang, A. J. Bell, R. Pal, C. Spencer, A. Buschhaus, C. R. Hatt, M. P. diMagliano, A. Rehemtulla, J. J. Rodríguez, S. Galban, and C. J. Galban, "Lung cancer lesion detection in histopathology images using graph-based sparse PCA network," *Neoplasia (United States)*, 2023, doi: 10.1016/j.neo.2023.100911.

[6] D. Mhaske, K. Rajeswari, and R. Tekade, "Deep learning algorithm for classification and prediction of lung cancer using CT scan images," 2019. doi: 10.1109/ICCUBEA47591.2019.9128479.

[7] G. S. Tandel, A. Balestrieri, T. Jujaray, N. N. Khanna, L. Saba, and J. S. Suri, "Multiclass magnetic resonance imaging brain tumor classification using artificial intelligence paradigm," *Comput. Biol. Med.*, 2020, doi: 10.1016/j.compbiomed.2020.103804.

[8] P. Sinthia, M. Malathi, K. Anitha, and M. Suresh Anand, "Improving lung cancer detection using faster region-based convolutional neural network aided with fuzzy butterfly optimization algorithm," *Concurr. Comput. Pract. Exp.*, 2022, doi: 10.1002/cpe.7251.

[9] N. Aydın, Ö. Çelik, A. F. Aslan, A. Odabaş, E. Dündar, and M. C. Şahin, "Detection of Lung Cancer on Computed Tomography Using Artificial Intelligence Applications Developed by Deep Learning Methods and the Contribution of Deep Learning to the Classification of Lung Carcinoma," *Curr. Med. Imaging Former. Curr. Med. Imaging Rev.*, 2021, doi: 10.2174/1573405617666210204210500.

[10] M. A. Mezher, A. Altamimi, and R. Altamimi, "A Genetic Folding Strategy Based Support Vector Machine to Optimize Lung Cancer Classification," *Front. Artif. Intell.*, 2022, doi: 10.3389/frai.2022.826374.

[11] S. Ziegelmayer, M. Graf, M. Makowski, J. Gawlitza, and F. Gassert, "Cost-Effectiveness of Artificial Intelligence Support in Computed Tomography-Based Lung Cancer Screening," *Cancers (Basel).*, 2022, doi: 10.3390/cancers14071729.

[12] M. M. Jassim and M. M. Jaber, "Systematic review for lung cancer detection and lung nodule classification: Taxonomy, challenges, and recommendation future works," *Journal of Intelligent Systems*. 2022. doi: 10.1515/jisys-2022-0062.

[13] A. Davri, E. Birbas, T. Kanavos, G. Ntritsos, N. Giannakeas, A. T. Tzallas, and A. Batistatou, "Deep Learning for Lung Cancer Diagnosis, Prognosis and Prediction Using Histological and Cytological Images: A Systematic Review," *Cancers*. 2023. doi: 10.3390/cancers15153981.

[14] A. S. Oliver, T. Jayasankar, K. R. Sekar, T. K. Devi, S. Poojalaxmi, N. G. Viswesh, and N. G. Viswesh, "Early detection of lung carcinoma using machine learning," *Intell. Autom. Soft Comput.*, 2021, doi: 10.32604/iasc.2021.016242.

[15] S. Hadiyoso, S. Aulia, and I. D. Irawati, "Diagnosis of lung and colon cancer based on clinical pathology images using convolutional neural network and CLAHE framework," *Int. J. Appl. Sci. Eng.*, 2023, doi: 10.6703/IJASE.202303_20(1).006.

[16] N. Nasrullah, J. Sang, M. S. Alam, M. Mateen, B. Cai, and H. Hu, "Automated lung nodule detection and classification using deep learning combined with multiple strategies," *Sensors (Switzerland)*, 2019, doi: 10.3390/s19173722.

[17] Y. Li, X. Wu, P. Yang, G. Jiang, and Y. Luo, "Machine Learning Applications in Diagnosis, Treatment and Prognosis of Lung Cancer," *arXiv Prepr. arXiv2203.02794*, 2022.

[18] P. Chalasani, "Lung CT Image Recognition using Deep Learning Techniques to Detect Lung Cancer," *Int. J. Emerg. Trends Eng. Res.*, 2020, doi: 10.30534/ijeter/2020/113872020.

[19] Z. H. U. Rong, D. A. I. Lingyun, L. I. U. Jinxing, and G. U. O. Ying, "Diagnostic Classification of Lung Cancer Using Deep Transfer Learning Technology and Multi-Omics Data," *Chinese J. Electron.*, 2021, doi: 10.1049/cje.2021.06.006.

[20] R. Mothkur and B. N. Veerappa, "A Robust Approach for Segmentation and Classification of Lung Cancer using Marker Controlled Watershed Method and Deep Hybrid Learning," *Indian J. Comput. Sci. Eng.*, 2022, doi: 10.21817/indjcse/2022/v13i5/221305003.

[21] M. Sangwan, S. Gambhir, and S. Gupta, "Lung cancer detection using deep learning techniques," in *Applying AI-Based IoT Systems to Simulation-Based Information Retrieval*, 2023. doi: 10.4018/978-1-6684-5255-4.ch009.

[22] V. T. Ponnada and S. V. Naga Srinivasu, "End to end system for Pneumonia and lung cancer detection using deep learning," *Int. J. Eng. Adv. Technol.*, 2019, doi: 10.35940/ijeat.F8791.088619.

[23] A. A. Alsheikhy, Y. Said, T. Shawly, A. K. Alzahrani, and H. Lahza, "A CAD System for Lung Cancer Detection Using Hybrid Deep Learning Techniques," *Diagnostics*, 2023, doi: 10.3390/diagnostics13061174.

[24] A. A. Abd Al-Ameer, G. A. Hussien, and H. A. Al Ameri, "Lung cancer detection using image processing and deep learning," *Indones. J. Electr. Eng. Comput. Sci.*, 2022, doi: 10.11591/ijeecs.v28.i2.pp987-993.

[25] M. Obayya, M. A. Arasi, N. Alruwais, R. Alsini, A. Mohamed, and I. Yaseen, "Biomedical Image Analysis for Colon and Lung Cancer Detection Using Tuna Swarm Algorithm with Deep Learning Model," *IEEE Access*, 2023, doi: 10.1109/ACCESS.2023.3309711.

[26] S. Wankhade and V. S., "A novel hybrid deep learning method for early detection of lung cancer using neural networks," *Healthc. Anal.*, 2023, doi: 10.1016/j.health.2023.100195.

[27] F. S. Fatima, A. Jaiswal, and N. Sachdeva, "Lung Cancer Detection Using Machine Learning Techniques," *Crit. Rev. Biomed. Eng.*, 2022, doi: 10.1615/critrevbiomedeng.v50.i6.40.

[28] L. Hussain, M. S. Almaraashi, W. Aziz, N. Habib, and S. U. R. Saif Abbasi, "Machine learning-based lungs cancer detection using reconstruction independent component analysis and sparse filter features," *Waves in Random and Complex Media*, 2021, doi: 10.1080/17455030.2021.1905912.

[29] S. J. Adams, P. Mondal, E. Penz, C. C. Tyan, H. Lim, and P. Babyn, "Development and Cost Analysis of a Lung Nodule Management Strategy Combining Artificial Intelligence and Lung-RADS for Baseline Lung Cancer Screening," *J. Am. Coll. Radiol.*, 2021, doi: 10.1016/j.jacr.2020.11.014.

[30] G. Kasinathan and S. Jayakumar, "Cloud-Based Lung Tumor Detection and Stage Classification Using Deep Learning Techniques," *Biomed Res. Int.*, 2022, doi: 10.1155/2022/4185835.

[31] W. Zhao and J. Liu, "Artificial intelligence in lung cancer: Application and future thinking," *J. Cent. South Univ. (Medical Sci.*, 2022, doi: 10.11817/j.issn.1672-7347.2022.210645.

[32] I. Naseer, S. Akram, T. Masood, M. Rashid, and A. Jaffar, "Lung Cancer Classification Using Modified U-Net Based Lobe Segmentation and Nodule Detection," *IEEE Access*, 2023, doi: 10.1109/ACCESS.2023.3285821.

[33] M. Masud, N. Sikder, A. Al Nahid, A. K. Bairagi, and M. A. Alzain, "A machine learning approach to diagnosing lung and colon cancer using a deep learning-based classification framework," *Sensors (Switzerland)*, 2021, doi: 10.3390/s21030748.

[34] J. Civit-Masot, A. Bañuls-Beaterio, M. Domínguez-Morales, M. Rivas-Pérez, L. Muñoz-Saavedra, and J. M. Rodríguez Corral, "Non-small cell lung cancer diagnosis aid with histopathological images using Explainable Deep Learning techniques," *Comput. Methods Programs Biomed.*, 2022, doi: 10.1016/j.cmpb.2022.107108.

[35] S. M. Ashhar, S. S. Mokri, A. A. A. Rahni, A. B. Huddin, N. Zulkarnain, N. A. Azmi, and T. Mahaletchumy, "Comparison of deep learning convolutional neural network (CNN) architectures for CT lung cancer classification," *Int. J. Adv. Technol. Eng. Explor.*, 2021, doi: 10.19101/IJATEE.2020.S1762126.

[36] S. Nageswaran, G. Arunkumar, A. K. Bisht, S. Mewada, J. N. V. R. S. Kumar, M. Jawarneh, and E. Asenso, "Lung Cancer Classification and Prediction Using Machine Learning and Image Processing," vol. 2022, 2022.

[37] C. Janßen, T. Boskamp, L. Hauberg-Lotte, J. Behrmann, S. O. Deininger, M. Kriegsmann, K. Kriegsmann, G. Steinbuß, H. Winter, T. Muley, R. Casadonte, J. Kriegsmann, and P. Maaß, "Robust subtyping of non-small cell lung cancer whole sections through MALDI mass spectrometry imaging," *Proteomics - Clin. Appl.*, 2022, doi: 10.1002/prca.202100068.

[38] X. Cheng, H. Wen, H. You, L. Hua, W. Xiaohua, C. Qiuting, and L. Jiabao, "Recognition of Peripheral Lung Cancer and Focal Pneumonia on Chest Computed Tomography Images Based on Convolutional Neural Network," *Technol. Cancer Res. Treat.*, 2022, doi: 10.1177/15330338221085375.

[39] A. Maurer, "An Early Prediction of Lung Cancer using CT Scan Images," *J. Comput. Nat. Sci.*, 2021, doi: 10.53759/181x/jcns202101008.

[40] F. Silva, T. Pereira, J. Morgado, J. Frade, J. Mendes, C. Freitas, E. Negrao, B. F. De Lima, M. C. Da Silva, A. J. Madureira, I. Ramos, V. Hespanhol, J. L. Costa, A. Cunha, and H. P. Oliveira, "EGFR Assessment in Lung Cancer CT Images: Analysis of Local and Holistic Regions of Interest Using Deep Unsupervised Transfer Learning," *IEEE Access*, 2021, doi: 10.1109/ACCESS.2021.3070701.

Impact Factor: 7.580

INTERNATIONAL JOURNAL
OF MULTIDISCIPLINARY RESEARCH
IN SCIENCE, ENGINEERING, TECHNOLOGY AND MANAGEMENT

+91 99405 72462 +91 63819 07438 ijmrsetm@gmail.com