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AI AND LUNG CANCER: BASIC OF AI, IMAGING MODALITIES, DIFFERENT TOOLS, CLINICAL APPLICATIONS, CHALLENGES & LIMITATIONS AND FUTURE DIRECTIONS

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Abstract

Artificial Intelligence is now known as the most powerful aspect of computerized world and emerged in every field of life due to its versatility. In field of medication, there are amazed functional aspects of applications to resolve different problems. The lung cancer is one of the solid reason for mortality in both male and female. Different techniques are now used for the solution of problem through the help of AI tools. In this review, we will discuss about the different tools used for the detection, diagnosis, prediction and medication plane for the lung cancer and also about the limitations of using these tools and models. By suggesting the suitable counter strategies to resolve the lemmatizing factor for use of AI tools, the future perspectives of the AI models are discussed for further advancements in cancer field for facilitation worldwide.

INTRODUCTION

AI tools are thought to be the most emerging aspect in the field of medical sciences due to its present and future advancements (Series, Whicher et al. 2023). AI tools are most importantly used in the cancer field for early detection, diagnosis, precaution and cure because of its fast and accurate working if applied in authentic process (Sufyan, Shokat et al. 2023). Lung cancer is one of the leading problem to be results in death for both male and female annually with heavy abundance (Siegel, Miller et al. 2023). Lung cancer observed to be most deadly type of cancer throughout the world and having high mortality rate as 1.8 million deaths result globally due to it (Sung, Ferlay et al. 2021). The early detection of cancer can be helpful for ensuring the more chances of curing and survival of the individual got affected by lung cancer (Field, Vulkan et al. 2021). Lung cancer, if detected at early stages, it is possible to control its more drastic effects which lead to ultimately death because at early stages, the complications are not much spreading in lungs (Burzic, O'Dowd et al. 2022). Some of the lung cancer detection technologies such as LDCT can be used also but having drawbacks like, false positive up to 25%, also exposure to repeated scanning and can also cause tumors that don't show any symptoms (Medicine 2011). Sputum cytology can also be used for detection but having low diagnostic accuracy and more likely the poor detection about peripheral nodules (Thunnissen 2003). Ct screening might resulted in much of false results that leads to further complication in the delaminated one (Patz Jr, Black et al. 2001). When there will be false results or the positive results are not true or the detection is not considerably effective, then it may leads to unnecessary treatment that results in other problems like over diagnosis (Welch and Black 2010). AI algorithms are widely used in medical field for dealing different aspects of it, like detection of disease and different suitable treatments for recovery, protection or control further damage (Lewandowski, Koller et al. 2023). In this review, we will discuss about different aspect of AI emergence in lung cancer detection and its important beneficial future applications.

Basics of AI in Medical Imaging

AI can be termed as the field of computer science that simply defined as the tool, which is used for mimicking human intelligence (Wang, Fu et al. 2024). The massive data set learning can be made now easy and time manageable by the usage of AI generated deep learning system, that give the output in precise way according to prescriptions (Amin, Al Ghamdi et al. 2021). The domain specific tuning, human-AI collaboration, regulatory and technical frameworks and data governance can be possible by the usage of AI technologies in medical field (Zhang, Shi et al. 2024). The careful validation of AI tools in the clinical zone can be useful for informing about prognosis and guidance treatment intensity in certain cases of cancer (Yuan, Cai et al. 2021). For the working of AI tools, different tool swill be used for the processing o four command, like CNNs, RNNs and transformers. The CNNs (Convolutional Neural Networks) cover the different aspect of analysis parameters like as radiology, dermatology, pathology and cardiology by giving output as image segmentation and classification (Suganyadevi, Seethalakshmi et al. 2022). The RNNs (Recurrent Neural Network) helpful for the prediction of diagnosis when the sequencing data is given because it also having another form that is LSTM (Men, Ilk et al. 2021). The triage can also be outputted by the combination of RNNs and attention mechanism and also play key role in risk prediction and modeling of irregularly placed data (Xie, Yuan et al. 2022). The GNNs and different transformers combination can leads to modeling of patient drugs dosage (Wang, Chen et al. 2021). Different transformer mechanisms are used for the detection of patient recovery, for chemical protein engaging, for effectiveness of dose, health record, disease forecasting and survival data about patient (Khader, Kather et al. 2023). AI based radiology technology used for the X-rays analysis of different part for the image, detection, classification and segmentation of any disturbance or any irregular functioning, like pneumonia, cancer detection, and also for chest tuberculosis diagnosis (Nafisah, Muhammad et al. 2024). Data collection and providence, the main key forward to the AI working efficiency, it will includes about random forecasting for recognition of pattern, use of unsupervised clustering for anomaly model detection and for the tracking of deviation from healthy person, used model having time series forecasting (Jordan 2025). The training for AI tools will be proceed by fine tuning in response to pre trained architectures, learning with the help of multimodal that includes clinical data, genomics and imaging, also the data in the form of images can be precisely structured by noise removal and augmentation and use ensemble learning and cross validation for improving of generalization (Wang, Maniscalco et al. 2025). The AI transparency, reproducibility and usability is designed for promotion and assessing structure with the help of MOF (Model Openness Framework) (White, Haddad et al. 2024).

Imaging Modalities for Lung Cancer Detection

Different model prepared for the cancer detection, but the key characteristics they having should include basic tasks, as the tumor detection, classification of tumor, and the tumor localization which will ensure about type, location and spreading of the specific tumors (Abdulqader, Abdulameer et al. 2025). The AI based X-Ray analysis provides the better detection accuracy along with enhancing the sensitivity of the operates and the partial AUC gained while focusing about specificity and confidence (Homayounieh, Digumarthy et al. 2021). The 20% reduction in the death rates results by using LDCT (Low Dose Computed Tomography) and also more accuracy in detection rates will be produced by decreasing false results and helpful in early detection of cancer (Radiology 2011). The PET/CT can be used for the analysis of NSCLC (Non-Small Cell Lung Cancer)with involvement of three models as, deep learning alone, radiomics alone, and combination of both, which result in improved patient therapies and their outcomes (Peng, Wang et al. 2025). The AI used tools helps in imaging multiparametric leveraging for enhancing recurrence sensitivity with the help of MRI in case of soft tissue for cancer case study (Emma 2025). The image enhancing methodologies, like as FNet-based model are used for the better image resolution and interpretation, to avoid the false positive or negative test by clearly knowing the difference among the cancerous and non-cancer cell during the oncology examination for specified organs (Şeker, Akhan et al.).

AI System and Tools for Detection of Lung Cancer

1) Commercial and Open Source AI Tools

The tools generated for the tumor or cancer detection will be based on any of modulated pattern, like in case of modern and evolving working, the cfRNA sample are collected from the both of healthy and effected patient and the comparative study of the cells, tissues and other parameters will make a suitable transcriptomic data for the analyzing process in AI tools for specific algorithms development and then help in further future identification, presence of tumor and their characteristics (Shubin, Shpak et al. 2024).

LYNA: LYNA (Lymph Node Assistant) model is emerging evolution in field of new medical field tool as when combining with AI, because it having accuracy of 94% along with 88% sensitivity, that helps in the identification of tumor and nodes in the cancer case patient for early diagnosis and more survival chances (Jin, Rosenthal et al. 2022).

IBM: IBM Watson Imaging can be used for lung cancer detection AI generated tool, because it carries the data processing with high throughput, integration along with genomic database and prognostic modeling, which can be proffered because it leads to interpretation concerns, overhyped expectations and institutional variability (Dlamini, Francies et al. 2020).

Aidoc: Automatic alert for the danger of lung cancer and nodules, the urgent clinical study requirement approaches and improvement in diagnostic consistency along with radiologist stress reduction with supportive techniques can be also possible by the use of Aidoc (Khalifa, Albadawy et al. 2024).

Zebra Medical Vision: ZMV (Zebra Medical Vision) also having the ability to broadly covering in different parts and point of cancer which provides a regularity validation and potential with respect to early detection but less integrated as compare to Aidoc (Fujita and technology 2020).

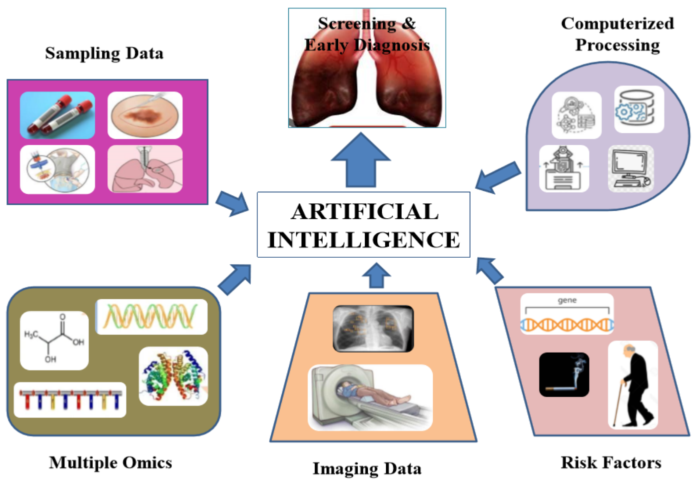
InferRead CT Lung by Infervision: The early detection of nodules and cancer with the help Infervision is important tool in AI medical field because it can also improves clinical triage and radiologist performance that can be useful for both routine workflow and screening purpose (Yu, Zhang et al. 2024).

Lung-RADS AI-enhanced systems: The Lung-RADS (Lung Image Reporting and Data System) having beneficial aspects due to manual nodule detection with variability in scoring consistency and faster triage that become more interested with moderate false positives results and radiologist dependent scalability (HaghighiKian, Shirinzadeh-Dastgiri et al. 2024).

2) Academic and Research Based Tools

Pivotal role played by National Institute of Health (NIH) for the research on NCI (National Cancer Institute) or its other branches that play key role in molecular biology, AI diagnosis, immunopathology, population surveillance, that leads to clinical trial and investigation in genomic, and immune relevant targeted cells therapy (Gong, Guo et al. 2021). Stanford and other institute working consciously on AI employed method for the cancer detection, Natural Language Processing (NLP), deep learning, machine learning, and reinforcement learning for the enhancing of diagnosis and lung cancer prognostic workflow (Huang, Yang et al. 2023). The MIT (Massachusetts Institute of Technology) are significantly influencing about the lung cancer research that focuses on robust diagnosis, large dataset leveraging, prognostic models and AI advancement translation for clinical viable tools that aims to surveillance monitoring, precision treatment and earlier detection (Darvish, Trask et al. 2024). One of the widely used dataset for study of lung cancer that having 1000 annotated CT scan dataset by different radiologists and used for the CT based analysis, lung cancer diagnosis, along with AI model training which is termed as LIDC-IDRI (Lung Image Database Consortium and Image Database Resource Initiative) (Pehrson, Nielsen et al. 2019). Also NLST

(National Lung Screening Trial) is a multicenter project, & this study conducted and controlled by United States that demonstrate the 20% reduction in mortality rate due to lung cancer for the very first time and it uses LDCT instead of standard X-ray, that proved better innovation in oncology field by engaging it with AI tools and models (Yoo, Lee et al. 2021). The Kaggle also provide a big competition platform for the better and more accurate and up to date dataset to study about the lung cancer, its different aspect for deep study and workflow pattern to install in the AI generated models for working more precisely (Yu, Lee et al. 2020).



Clinical Applications and Integration

New innovations are emerging in the field of AI for medical assistant. Some of the important aspects of AI driven tools for lung cancer analysis are given below.

1) AI Assisted Radiology Workflow

The AI models are performed on non-small cells for lung cancer practical consideration and model provide high accuracy curve that offers random forest system and importantly helpful for predicting blood oxygen level, pulmonary function, tumor size and Charlson Comorbidity Index (Rabbani, Kanevsky et al. 2018). AI modulated tools play significant role in the thoracic imaging, for example, nodule detection, radiomics modeling, 3D reconstruction and prognostic modeling for cancer cell analysis (Chassagnon, Vakalopoulou et al. 2020). Different hybrid model are now available and further more working upon it, which can be useful in terms of the timely detection in microscopic changing that aiding in timely diagnosis and imaging dataset (Wang the detection of lung cancer and decision for specific diagnosis treatments and precautionary measures (Shaikh and Rao 2022). Recent surgical planning, 2022). In case of emergency radiology concern, the tools are used for the image automated interpretation, performance enhancement, workflow optimization and integration with PACS & RIS (Alabi 2025). AI driven hybrid Multi-Wavelet Transformer (MWT) are now available that use hybrid programming working and leads to more precise results with 95% accuracy, higher sensitivity, specificity & AUC and more competitive as compare to other classifiers (Mostafa, Elrefaei et al. 2022).

2) Decision Support System

The lung cancer having high risk in persons with smoking history and the persons with old age have more chance of early detection of cancer in their lungs, although also some limitations with traditional methodologies, but AI generated tools can counter many of issues, like accuracy, precision and early detection facility (Chapla, Chorya et al. 2024). The decision support system of the AI generated machine learning system can be more helpful as compare to traditional methodologies for like real time DSS tools , that are used in case of lung cancer intra-operative support and also enhancing lymph node and nodule CT imaging

(Leivaditis, Maniatopoulos et al. 2025). The precision oncology can be improved by using the analysis techniques in digital pathology and classification of deep CNN images to improve history analysis during decision making with the help of deep neural networks study (Keerthi and Iniyan 2025). For the better real time alerts and better decision making tools, the multi-modal supported with the help of DSS model in case of AI integration in rare and high incidence of cancer is beneficial (Abbas, Asif et al. 2024).

3) Diagnostic vs. Screening Use

AI techniques are now used for the linking of histopathology with the expression of gene, which leads to early detection of cancer and for the segmentation of tumors in the targeted areas with the use of DeepLabV3 technology (Pan, Salvatierra et al. 2025). New AI model are designed for the screening of NSCLC (Non-Small Cell Lung Cancer) under critical circumstances and it basically focuses on the detection of genetically driven mutations by using of histological images (Tan, Li et al. 2022). In case of lung and gastric cancer, the AI drug repositioning models are used for the screening of tumor in specific parts by combining it with early detecting tumor technologies (Yun, Kim et al. 2025). Different chemical inhibitors are synthesized and designed by using of AI techniques, that are helpful in case of early stage lung andenocarcinoma, by inhibiting tumors and further stopping of their spreading (Sinha, Hawley et al. 2025). The rapid screening of lung cancer for supporting of techniques without genetic sequencing made possible with the help of AI detector EGFR mutations that having high accuracy and multiple directional models to ensure better survival conditions for patient (Park, Brattoli et al. 2025). The combination of AI tools with the methylation analysis of genome can be facilitating during the early detection of cancer and their diagnosis by uses blood plasma as sample, which is based on technique of liquid biopsy (Pass, Melton et al. 2025).

Feature	Diagnostic AI Use	Screening AI Use
Primary Goal	Tumor Characterization & Confirm Diagnosis	Triage & Early detection
Data Type	Biopsy Images, CT, Genomics & PET-CT	LDCT Scans, Chest X-rays & e-Nose Outputs
Challenges	Small Lesion Differentiation & Interpretability	Over Diagnosis & False Positives
Clinical Integration	Precision Medicine & Oncology Clinics	Large Cohorts & Public Health Initiatives,
Examples	Multi-modal Platforms for Diagnostic & CADx Systems	Risk Prediction Models & CADe Systems

4) Rural Healthcare Accessibility and Telemedicine

AI tools can be role player by engaging it with the telemedicine which can leads to better results for patient management, diagnosis and digital therapeutics (Giansanti 2025). The chronic disease management and predictive diagnosis of the cancer patient can be helpful for life concern of individual by the use of AI and virtual telemedicine technology (James, Olawale et al. 2025). The AI driven telemedicine application are under most concern in the digital era for the public health crises and emergency situations (Anggo, Rahman et al. 2025).

Rural areas are more delayed in any diagnostic facility in case of lung cancer due to less accessibility toward with latest technologies available in urban areas, and thus AI driven tools can be encounter of this problem (Mangayarkarasi, Durairaj et al. 2025). The AI combining with loT can enables the remote monitoring of health, bridging the rural areas from the healthcare gaps and use wearable sensor with early health care diagnostic technologies for isolated areas (Khan and Javaid 2025). Different machine learning models are now prepared for the reduction in hospitalization and improvement in early intervention for rural areas with health issues (Prasad

2025). The transformation of rural areas is possible through the use of AI techniques that results in AI guided treatment, detection of disease, AI enhanced diagnosis, treatment planning, prioritize critical care, and enabling of personal patient management (Das, Sanyal et al. 2023). AI tools can be revolutionizing in field of medicine and treatment zone due to global spreading technology network and easy availability to every part of globe (Mansoor, Ibrahim et al. 2025).

Challenges and Limitations

Although the AI generated tools and models are much helpful in case study of lung cancer, here are also some limitations in this aspect.

1) Annotation and Data Quality Issues

AI models can be misleading due to annotation error in the immune histochemistry of given data and leads to false results, especially in case of macrophages in NSCLC (Arbel, Ben-David et al.). The unreliable segmentation of lung nodules model generated due to smaller and limited annotation in dataset which is because, it leads to poor accuracy and consistency (Abdani, Ariffin et al. 2025). For the accurate training of AI tools to develop a better model, there will be stress challenging for the areas with invasion of tiny tumors (Kudo, Saito et al. 2025). The variability of observer for the tools training and validation can be affected due to difficulties in the annotation consensus of multi-radiologist (Li, Aruperes et al. 2024). CT imaging for the detection of lung cancer can be limited by the blurred tumor margin, which is sign of low precision about annotation (Arunachalam, Geetha et al. 2024). Noisy images and low resolution can also effect the AI prediction in case of accuracy concern for lung cancer that shows the high need about high quality images (Sinha, Yadav et al. 2024). Negative impact observed on the early detection of lung cancer when the data records are biased or incomplete (Batra, Nathany et al. 2024). The imaging of lung cancer is directly linked with the data augmentation and preprocessing techniques for the AI tools guider dataset (Seitaj 2025). The false negatives and drifting of model happened due to synthetic dataset or poor quality augmentation (Ashofteh Barabadi, Zhu et al. 2025).

2) Explainability and Algorithm Transparency

Segmentation model of lung nodule for deep learning trade-offs the explainability concern to purpose visual explanation of clinical trust (Zafaranchi, Lizzi et al. 2024). Decision support of surgery about lung cancer having performance and clinical reliability with the bridge of gaps between AI tools and integration of explainable AI (Abbaker, Minervini et al. 2024). The verification of model reasoning about the risks and CT scans complex features in radiomics can be critical for explainable AI (Chetan and Gleeson 2021). Attention is needed about the combining of CNNs approaches by hybridization when the case is about early detection of lung cancer (Wedisinghe and Fernando 2024). The careful concerns are about the patient data privacy, when the visual interpretation of AI decision with the help of Hires-CAM is possible and the framework with explained federated learning is used (Md Siam, Hasan et al.). An assemble model is compulsory for the exact accuracy results about the detection of lung cancer that can improve clinician trust and transparency (Vanitha, Sree et al. 2024). For the improvement of model interpretation, the saliency maps are purposed and retinopathy is focused because this methodology is applied for lung cancer (Lim). Here is need of external auditing because the problems are faced during the use of AI for healthcare due to transparency issues (Zou, Natsiavas et al. 2024). Detection of lung cancer through AI generated models, the basic aim is to balance performance and transparency optimization framework (Arunachalam, Geetha et al. 2024). The challenges that are faced during breast cancer detecting AI tools are directly applicable to lung cancer, which shows about the black-box-nature of the model and here is need in medical imaging explanation model for resolving it (Bachiri, Azibi et al.).

3) Regulatory Approvals

There is lack of interpretability demands, standardized validation and clinical efficiency evidence before the approval of model and need to focus upon AI models for diagnosis, prognosis and emphasizing of major hurdles in regularity for lung cancer (Hussain and Braxton 2024). For the screening of lung cancer, here is barrier in reproducibility, scalability and clinical trust with the

Raman spectroscopy when linked with AI, as an emerging technology (A'dawiah, May Yap et al. 2025). The genomic data approval and safety proof is concern in case of ovarian cancer, but it also directly linked to lung cancer detecting AI tools for approval (Pedersen and Pedersen 2024). The use of ctDNA analysis and liquid biopsy is required for the validation of models in regularity concerns about AI driven tools for lung cancer detection (Ünal, Yazarkan et al. 2024). The lung cancer patient care with clinical compliance and validation through the help of scrutinized AI models uses landscape regularity cancer therapy (Wiktorowska-Owczarek, Iacono et al. 2025). Here is slow pace of approval emphasizing in the clash between the traditional regularity frameworks and AI driven tools of molecular profiling for lung cancer research (Carbone and Immunity 2024).

4) Ethical Concerns

Different issues are concerned like ethical risks which includes lack of informed consent, bias, missing of human oversight by over reliance on AI tools for the diagnosis of cancer (Frasier, Hash et al.). The ethical concerns can leads to the different challenges about the patient consent, security of data and accountability of model that can limits the AI diagnostic efficiency acceptance (Smith and Javaid 2025). For the diagnosis of cancer, different AI model are ensuring about the transparency, avoidance of algorithms and fairness in the result of experiments while also consideration about the aspect of ethical issues (Idowu and William 2025). By focusing on informed patient autonomy and avoiding about the misuse of predictions generated by AI tools, can be helpful to overcome the ethical challenges (Hovornyan, Ilashchuk et al.). Before the implications of any newly launched AI tool for the cancer detection, there must be surety about the covering of ethical and privacy concern of the patient data history and profile records (Hinostroza Fuentes, Abdul Karim et al.).

5) Integration into Existing Hospital Systems

The installation of AI generated tools in hospitals is also a problem due to emphasizing interoperability, cloud system, clinician trust issue and cyber security concern in hospitals and clinics about these tools and models (Rehan 2024). The AI tools integrated with surgical planning, nodule detection and screening of cancer, which is disrupted by workflow issues and technical challenges for the adaptation in hospitals (Leivaditis, Maniatopoulos et al. 2025). For the successful integration of AI generated images to detect lung cancer, there will be standardized installation of technologies in the hospital are required (Bonmatí, Miguel et al. 2022). There is also risk of over reliance of hospitals on AI generated tools for lung cancer detection and heat-maps in routine workflows difficulties (Kotoulas, Spyratos et al. 2025). The difficulty is also faced during the transfer of HER (Electronic Health Records) system data toward the AI modeling tools for continuing case study of individual facing cancer issues. Infrastructural barrier also faced in hospital workflows for NSCLC diagnosis with the help of AI integrated tools (El Sabrouty, ELOUADI et al. 2025).

Future Directions

In future, following different aspects of AI generated tools for lung cancer can be revolutionized.

1) Multimodal AI

Imaging through multimodal real time technique, the integration of breast and lung cancer data leads to holistic patient management from single modality models (Mia and Studies 2024). For the enhancement of detection of lung cancer through the genomics, clinical and radiomics records, the combination can leads to developing multimodal for future outlook (Zeng, Wang et al. 2024). The personalized protocols for screening of lung cancer can be possible by combination of CT & MRI data records to develop new multimodal based tools (BR and Rengarajan 2024). The precision medicines knowledge and immunotherapy can be explorer for future multimodal development to manage next generation lung cancer (Kedar, Bhattacharya et al. 2025). The principle of multimodal lung imaging is highly applicable for the early detection of any tumor or cancer (Wen, Chen et al. 2024).

2) Privacy Preserving and Federated Learning AI

Multi-party computational secure system techniques and federated learning can purpose a framework for privacy concerns of AI generated tools (Amin, Hasan et al. 2025). The secure and trustworthy detection of lung cancer can be made easier with the use of explainable AI, synthetic data generation and different multimodal with AI tools (Bhokare 2025). The more careful discussion concerned about the decision based model with the help of image technique to built techniques by considering privacy preservation for the detection of disease in case of methodologies adaptable for cancer dataset (Mridha and Dey 2024). For the explainable AI tools and privacy concerns, the federated AI models are discussed for case study of lung cancer (Aabaah and Appiah 2025). The precision about lung cancer detection and surgery cases is enhanced through federated learning and frameworks of ethical AI (Leivaditis, Maniatopoulos et al. 2025). With the help of CT images, the combination of federated learning and explainable HIRes-CAM maps for interpretation of lung cancer (Md Siam, Hasan et al.).

3) Mobile Health and Real-time Diagnostics

In future, the mobile AI techniques provide a platform to screening programs and prediction of occurrence chances of lung cancer through support system of wearable integrated diagnosis (Mia and Studies 2024). The screening of lung cancer at national public healthcare level is performed with the help of mobile health platforms that are scalable (Mulshine, Avila et al. 2025). With the use of mobile devices, the remote assessment is obtained in lung cancer risk prediction on the radiomics tools that are mobile based (Martell, Linton-Reid et al. 2025). The conservational AI models are used for the detection of lung cancer through the real time patient interaction with AI assessment (Hasnain, Alotaibi et al.). The inter-operative diagnosis is enhanced through the workflows of real time AI diagnostic tools for the lung cancer and thoracic surgery (Leivaditis, Maniatopoulos et al. 2025). The identification of smaller lung cancer at early stages to evolve smart healthcare of patient is revolutionized through real-time clinical data and analyzing imaging (Muna, Amjad et al. 2025).

4) AI in Prognosis Prediction and Treatment Planning

The machine learning leads to improvement in the lung cancer prediction prognosis at early stages through use of imaging like CT and X-ray for AI models (SRIRAMKUMAR, SELVAKUMAR et al. 2025). With the help of earlier inventions, the timely prognosis prediction is provided, which aim is to reduce the mortality due to lung cancer (Mehrzadi, Maghanaki et al. 2025). The patient prognosis modeling and stratification for the lung cancer are obtained through AI driven bio-banks that are based on the molecular data and combined clinical data (Oskolas, Nogueira et al. 2025). AI tools can be used for the planning of personalized treatment through real time techniques by the integration of genomic data, pathology and imaging for lung cancer (Mia and Studies 2024). The inter-operative decision making is achieved through the real time optimizing plans for the lung cancer treatment through the AI tools and models (Leivaditis, Maniatopoulos et al. 2025). The monitoring models for the treatment of lung cancer and the planning of treatment strategies for the non-invasive tools in the future to shape out about the combination in modeling of PET radiomics and AI dataset (Zhang, Huang et al. 2024).

5) Personalized Medicine Applications

The combination of electronic health records, genomics and imaging technology can leads to evolve personalized diagnostic AI driven model (Mia and Studies 2024). The patient lung cancer specific data can be helpful for the post-operative care and personalized surgical planning through AI models generation (Leivaditis, Maniatopoulos et al. 2025). For the personalized decision about immunotherapy, liquid biopsy and AI integration can be useful tool in future (Lu, Liu et al. 2024). The targeted therapies for precision are operated through combination of AI modeling and genomic data (Chaudhari and Gudadhe 2025). Tailored blueprints for the treatment purpose are designed with the help of AI based radiomic dataset for lung cancer patients (Martell, Linton-Reid et al. 2025). New technologies and modeling ideas are concerned for the personal decision making and detection to treatment strategies for lung cancer (Kedar, Bhattacharya et al. 2025).

Conclusion

The emergence of Artificial Intelligence leads to the significant transformation in the field of lung cancer about the diagnosis, detection, prediction, treatment planning and prognosis. The exploration of AI tools in decision support system, imaging modalities, telemedicine and multi-domain model building leads to improvement in diagnostic strategies, early detection of cancer, increased in healthcare accessibility, personal treatment strategies and accuracy along with precision in working, with most concern for less accessible areas. Although of all above modern strategies and inventions, also some challenges seemed, like algorithm transparency, data quality concern, ethical aspects, regularity hurdles, privacy problem and clinical workflow integration limits the application of AI tools on peak potential. The innovative strategies are concerned by addressing about the barriers to adopt privacy preserving framework, real-time diagnosis, mobile health technologies, application of personalized medicine and multimodal AI tools for better approaches about AI application in cancer field. The advancement in research, ethical, collaborative and patient centralized approach though to be essential in future for applied AI capabilities, which leads to care about lung cancer transformation and improvement in outcomes of patient throughout the world.

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