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A Literature Survey Of Lung Cancer Detection Using Different Machine Learning Approach

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Abstract- **In this paper the literature survey of Lung cancer detectionNow a days lungs are very important body part due to indomitable cancer problem rice in patient. Lung cancer is the most harmful disease in human life. There are many patients, how safer from cancer now a days also suffer from covid related problems. In this servery paper discuss the different machine learning approach to disease lung cancer. for the detection of lung cancer. using machine learning first we collection the training data set for testing data set with the help of training of data set we have to learn system learn machine to disease the lung cancer. In this article discuss different machine learning approach for cancer detection using medical image processing (MIP) techniques. Image proceeding's help to detection the cancer and machine learning technique prediction cell origination. Deep neural network is powerful tool for detection such type of deceases detection. In the review discuss the different techniques and it's specification.**

Keywords— Machine Learning(ML), Fully Connected Convolutional Networks (FCN's), cancer imaging archive (CIA), Support Vector Machine (SVM), Machine learning Approach(MLA), Computer Aided Diagnosis (CAD), and Medical Image Processing etc.

I. INTRODUCTION

People in the United States are diagnosed with lung cancer at a rate that is second only to breast cancer. Only 15% of people with lung cancer survive five years following their diagnosis. In medical research, survival analysis is a frequent topic. A predictor variable is used to indicate whether certain factors, such as death or recurrence of a disease, have happened in a given period of time in order to predict cancer survival. Predictor models must be able to predict whether a patient will live for a certain amount of time after diagnosis. The human lungs are the two sponge-like organs in your chest. His right lung has three lobes. The left lung has two lobes, one on each side. The heart takes up more space on the left side of the body, resulting in a smaller left lung. Air enters your lungs through the trachea when you breathe in via your nose or mouth (windpipe). The trachea divides into smaller bronchi in the lungs. Smaller branches, known as bronchioles, branch out from the main bronchial tree and are called bronchial branches. The bronchial tubes culminate in little air sacs called alveoli. Carbon dioxide is expelled from the blood as you inhale oxygen via the alveoli. Your lungs are responsible for taking in oxygen and exchanging carbon dioxide. It is common for lung cancer to begin in the lining of the bronchi and other parts of the lung, such as the bronchioles or alveoli.

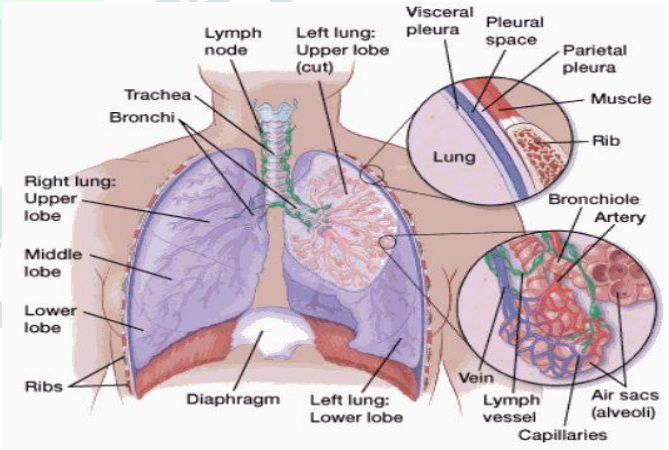

Fig. 1Normal structure and function of the lungs

The lungs are protected from the outside world by the pleura, a thin layer of lining. The pleura acts as a cushion between human lungs and the chest wall, allowing them to expand as well as contract when you breathe.This dome-shaped diaphragm divides the upper and lower torsos by forming a barrier between the two areas. When you inhale and exhale, the diaphragm rises and falls, causing the lungs to fill and empty.

Lung cancer is the second most frequent kind of cancer in men and women, affecting one out of every five men and one in every nine women who are diagnosed with the disease. Unfortunately, whereas male lung cancer rates have steadily fallen in recent years, female lung cancer rates have risen drastically. In 1940, there were seven cases per 100,000 women; now, there are 42 cases per 100,000 women. Furthermore, the data strongly suggests that smoking is to blame. "How long it takes to acquire cancer depends on how many cigarettes you smoke a

day," says one expert in the subject. But studies show that stopping smoking reduces the risk. One of the leading causes of mortality worldwide is cancer. One in every five cancer deaths is caused by lung cancer. Because of the fragile nature of the lungs, it may be difficult to diagnose cancer of the lung. Pulmonary biopsies may be quite painful to remove cancerous cells for microscopic examination. A biopsy will only be recommended if there is a high probability of lung cancer. Doctors often utilise computed tomography (CT) scans to make the diagnosis of lung cancer in patients who have symptoms. A cross-section of the whole lung will provide around 300 pictures using this novel CT approach. The radiologist has to analyse each patient's scan images, which makes their job more challenging. Surveillance, Epidemiology, and End Results (SEER) data was used to predict the survival of lung cancer patients. Cancer cases from all throughout the nation are being collected by SEER. A broad variety of subjects and statistics have been collected since the beginning of data collection in 1973. It takes SEER's current data on cancer incidence and survival to account for 30 percent of the US population.

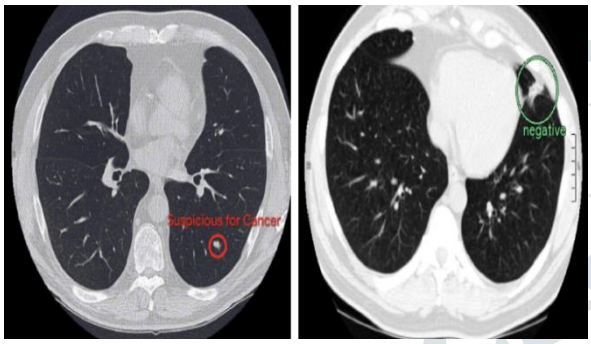

Fig. 2 less noisy as compared to MRI lung cancer

1.1 Classification of Lung Cancer

Epithelial cell tumours, known as carcinomas, account for the majority of lung cancer cases. It is possible to differentiate between non-small cell lung cancer (80 percent) and small cell lung cancer (20 percent) based on the size and appearance of the malignant cells under the microscope (16.8 percent). In terms of therapy and prognosis, this categorization is quite important.

- **Non-small cell Lung cancer (NSCLC)**

Non-small cell lung tumours form a cluster due to their similar prognosis and treatment. The three most prevalent lung cancers are squamous cell carcinoma, adenocarcinoma, and large cell lung carcinoma. In the central bronchus, squamous cell carcinoma is the most frequent form of lung cancer. There is a lot of necrosis and cavitation in the tumor's core.

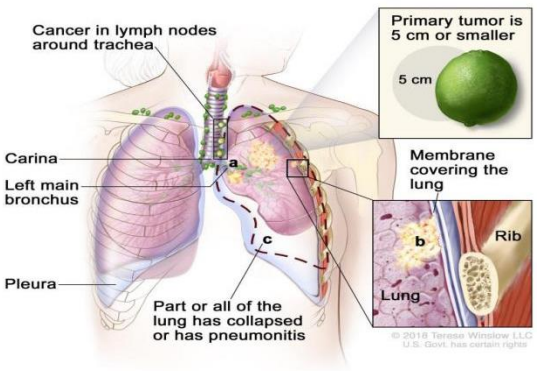

FIG.3 NON-SMALL CELL LUNG CANCER

- **Types of NSCLC**

Epithelial cells are the origin of NSCLC. When it comes to diagnosing lung cancer, clinicians must distinguish between squamous cell carcinoma and other types of the disease. This data is then used to decide the best course of action for a patient.Your doctor will use a microscope to determine the type of NSCLC that you have.

- Adenocarcinoma
- Squamous cell carcinoma
- Carcinoma of the large cell
- NSCLC-NOS(nototherwisespecified)orNSCLC undifferentiated

- **Small Cell Lung Cancer**

Lung cancer small cell, also called oat cell carcinoma is much less common. Tends to occur in the airways of larger caliber, as in primary and secondary bronchi-grows fast coming to make a substantial size. The oat cell contains dense neurosecretory granules, ie, vesicles that contain hormones, neuroendocrine, that gives an association with an endocrine or paraneoplastic syndrome. The prognosis for this type of cancer, despite the fact that it is initially responsive to chemotherapy, eventually worsens and it frequently metastasizes.

- **Mesothelioma**

Mesothelioma is a rare cancer of the chest lining, most often caused by asbestos exposure. Approximately 5% of all cases of lung cancer are caused by smoking. It takes between 30 and 50 years for mesothelioma to develop from asbestos exposure.The vast majority of those diagnosed with mesothelioma did so after spending time in an environment where they were exposed to asbestos fibres on the job.

- **Mediastinal Tumors**

Tumors of the mediastinum, the region of the chest that divides the lungs, are extremely rare. The front of the breastbone and the back of the spine protect it. They can form any tissue in the chest cavity, be it healthy or cancerous, and be either benign or malignant. The majority of paediatric mediastinal tumours are benign, but the majority of adult mediastinal tumours are malignant. It is important to get rid of both benign and malignant tumours because they are in the chest cavity or near the spinal cord.

1.2 Tumors of the mediastinum can take a variety of forms:

Germ cell tumors: It is possible to treat and even cure these types of cancer. As a result of their origin in reproductive cells, they can be found in the systems of both sexes. Extragonadal germ cell tumours are another name for these tumours if they are discovered outside of the female reproductive system. We don't know how these cells get from the uterus to the mediastinum.

Lymphomas: Lymphoma and non-lymphoma Hodgkin's lymphoma Both Hodgkin's and lymphomas are lymphomas that develop in the body's lymphatics. Two of the lymphatic system's most significant roles are filtration and drainage. Capillaries, ducts, valves, nodes, and organs all make up the system. When lymphoma develops in the lungs, it's quite rare.

Teratomas: Cysts containing one or more layers of embryonic cells form the basis of these cancerous tumours. The ectoderms, mesoderms, and endoderms are the three layers. Teratomas are an uncommon malignancy that affects men in their 20s and 30s. The chest is the most common location for tumours. In many cases, the cancer has spread by the time it is discovered. These tumours are frequently linked to a variety of other malignancies, including:

- Acute myelogenous leukemia (AML)
- Embryonal rhabdomyosarcoma (ERMS)
- Malignant histiocytosis
- Myelodysplasia (MDS)
- Small cell undifferentiated carcinoma

Thymomas: On a rare occasion, malignant cells develop on the outside of the thymus, a tiny organ in the upper chest that produces white blood cells. Thymomas and thymic carcinoma are rare cancers. Thymomas are benign tumours that seldom spread outside of the thymus. They grow slowly and rarely become cancerous. Myasthenia gravis and other autoimmune illnesses have been associated with thymoma (diseases that cause the immune system to attack healthy cells and tissue).

In the next section discuss the previous works that is presented by different researchers after that discuss the proposed method for Machine Learning Artificial Intelligence In Cancer Detectionsection III describe Section IV discusses the simulation and result parameters of the proposed method. Last but not least discuss the conclusion in section V

II. LITERATURE SURVEY

Gnanavel, S. (2021) -This research work describes how to diagnose as well as forecast the condition of a person for lung cancer that has been detected inside the early stages. Lung definitive diagnosis as well as categorisation are accomplished through the use of Deep learning System and Morphological Implementation strategies, and the segmentation but instead recognition mechanisms are decided to carry out using brightness calculations, GLCM, visual quality evaluation, as well as feature extraction, among other methodologies. Because it enhances overall images by reducing the noise, the Search Algorithm is an efficient way of analyzing Lung Cancer at an early stage. The classifier is evaluated using input from an earlier data set that was collected. It's also working successfully, and also the reliability of the forecast was increasing. It became discovered that patient had lung cancer at an early stage beginning**[01].**

Abdullah, D. M., et. al (2021) -In this research work presented, lung cancer is one of the most dangerous diseases and the most common cause of death. The severity of the disease lies in the difficulty of diagnosing it in the early stages. For this study, three different classifiers are being tested to find the best one for detecting lung cancer early on.This study's informative indices were generated from lung cancer patient databases at UCI. Studying categorization methods using the WEKA Tool is what this research is all about. For early detection of lung cancer, K-Nearest Neighbor (KNN) and the Support Vector Machine (SVM) were the most accurate algorithms examined. The answer was wrong 88.41% of the time.**[02].**

Sujitha, R., et. al. (2021) - This research work describes Hadoop has a significant impact and it's going in for a deep dive when they need to come up with ideas.A leading big data platform, Apache Spark excels when the conditions are optimal for its performance. But when it comes to gigabytes, Pyspark outperforms and is more efficient than the competition. In the study described here, the severity of nodules was rated in a new way. In order to better classify the stages of lung cancer, the method uses T-BM SVM in conjunction with binary classification and multi-class classification. To do this, SVM extracts a variety of features with values that are intended to improve the classifier's performance. T-BM SVM yields better outcomes as compared to other research. Sputum colour pictures were used in all studies. It is clear that both of the classifiers are good at figuring out how bad the disease is and how many stages of lung cancer there are, but which one is better?. Therefore, the proposed method assists medical diagnosis such that early detection of lung cancer stages with accurate results**[03].**

Shanthi, S., et. al. (2021) -This research work describes, Lung cancer has been observed to be a very dangerous disease which is wide-spread which is also the most common cause of death. The object for this is the prediction of early detection by means of employing classifers that have optimal features. Feature selection has been used for the identifcation of predictive subsets of the cancer cells in a database that can bring down the cancer cells.When some functionalities are removed, the system performs better. Additionally, the SDS was implemented to choose all relevant subsets for classification. The SDS was modified to choose an acceptable feature subset for this approach. In order to process enormous amounts of data, classification techniques were used. In the Naive Bayes classifier, the factors that contribute to the classification are assumed to be correlated. The NNs will be used to solve other issues where the neurons were trained and tested with the specified database. The effectiveness of this method was evaluated, and the results revealed that NN was utilised effectively for the diagnosis of lung cancer to assist oncologists. According to the results, classification accuracy increased by 2.51 percent for the SDS-decision tree and by 1.25 percent for the SDS-Naive Bayes using an SDS-NN. It is seen that feature selection improves the classifcation of images, further investigation to optimize the classifer needs to be explored. This work focused on feature selection, some pre-processing methods such as noise removal, optimal classifers can be further investigated**[04].**

Doppalapudi, S., Qiu, R. G., & Badr, Y. (2021) -In this research work presented, Survival period prediction through early diagnosis of cancer has many benefits. It lets patients and caregivers to arrange resources, time, and intensity of care in order to provide the best possible treatment path for the patients. In this study, we used deep learning approaches to develop numerous survival prediction models for lung cancer patients, with the goal of addressing both the classification and regression challenges associated with predicting cancer survival. In addition, we perform feature importance analyses to learn how the relevant characteristics of lung cancer patients affect their survival times. We help the medical field find a standard and effective way to figure out how likely it is that someone will live**[05].**

Naik, A., & Edla, D. R. (2021)In this research work presented lung cancer is the fastest-growing on the globe, and the majority of patients are identified at an advanced stage. It is essential that a computer-aided detection method be used to accurately categorise lung nodules into benign and malignant varieties in order to minimise any delays in the diagnosis of the ailment. This is how the current state of the art works: Classifying pictures with machine learning algorithms and manually chosen characteristics from imaging modalities is done with this method:On the other hand, many deep learning algorithms have recently been applied to the classification of pulmonary nodules, with promising results when compared to other current methods. In order to examine the role deep learning approaches play in the diagnosis of malignant tumours in CT scans of the lungs, we combed through 108 studies. This research compares and contrasts various deep learning strategies for lung nodule classification that have been applied to deep learning architecture in order to increase classification accuracy. The results of this study, which have been culled from a variety of sources, show that sophisticated deep learning algorithms present both obstacles and potential for categorising lung nodules. Study: If cancerous lesions are to be found early, new problems in nodule classification must be solved**[06].**

Patel, D., Cowan, C., & Prasanna, P. (2021, April) -In this article, a hierarchical CT radiomics-deep learning pipeline was provided to predict mutation status and recurrence-free survival in NSCLC. It was successful in this study**.** Our preliminary results on 140 studies demonstrate that features predictive of mutation status are prognostic of recurrence free survival. In our computational model, we show that patients with

KRAS/EGFR mutation have a higher risk of early recurrence. Additionally, we show that combining deep features with traditional clinical parameters resulted in better prognostic metrics. While making clinical decisions, cases with targetable mutations, as identified on CTs, can be flagged for expedited molecular testing and patients may be placed on tentative targeted therapies while awaiting results from molecular analysis. Also, patients with a higher recurrence risk can be surveilled more rigorously post-surgery or given aggressive therapies. Future work includes implementation of a multi-task deep learning pipeline for both mutation and survival prediction**[07].**

Shakeel, P. M., et.al (2020) - In this research work presenteddeep neural networks and ensemble classifiers are used to study lung cancer. Training (2543) and testing (2543) photos from the cancer imaging archive (CIA) collection are collected by the system (3500). As a result of this analysis, a brighter image and less noise can be achieved in CT lung images. The impacted region of the lung image is then segmented using a multi-layer neural network that examines each pixel. There are numerous features that are taken from the segmented area, which is why it takes longer to identify malignancy. A spiral configuration and approximation concept successfully pick optimal characteristics to reduce system dimensionality. The features are boosted with the help of ensemble classifier which effectively classifies the abnormal cancer features. The efficiency of the system is evaluated using experimental results, and system recognizes the cancer with maximum accuracy**[09].**

Toğaçar, M., Ergen, B., & Cömert, Z. (2020) - In this research work presented, researchers used six different machine learning classifiers, three CNN models, and the mRMR feature selection method to create a hybrid model that can detect lung cancer. A publicly available collection of 100 chest CT scan pictures was used to do this. The 10-fold cross-validation method was used in the studies to obtain generalised results. Five experiments are part of the study. In the first two tests, without the use of picture enhancement techniques, CNNs and machine learning classifiers were tested. The experiment had to employ augmentation methods because the initial dataset had a minimal number of observations. The third and fourth tests followed the same route as the first two. The main difference was that we wanted to see if the models' success rates might be boosted by using picture augmentation techniques. A success rate of 98.74 percent was achieved, and the augmentation approaches were shown to have a positive impact on overall classification performance.By using fewer but more efficient features, we hoped to improve on our previous experiment's success (by picking the top-performing CNN model and classifier). The last experiment was distinct from the others since it made better use of both time and speed during the classification process. mRMR feature selection was used in the previous experiment since it was the most efficient strategy to reduce the number of features. A combination of AlexNet, kNN, and the mRMR approach yielded the best results, with 99.51 percent accuracy, 99.32 percent sensitivity, and 99.71 percent specificity, as compared to the best results obtained using AlexNet alone**[10].**

Yuan, F., Lu, L., & Zou, Q. (2020)- In this research work presented,researcher presentedLung cancer is one of the most common cancer types worldwide and causes more than one million deaths yearly. There are two main subtypes of lung cancer, adenocarcinoma and squamous cell carcinoma. Identifying genes that are differently expressed and their gene expression patterns will help us better understand these two kinds of genes. Multiple machine learning methods were used to analyse gene expression patterns in lung AC and SCC tissues, which were obtained from the Gene Expression Omnibus. To begin with, the profiles were examined using a powerful feature selection method known as Monte Carlo feature selection. As well as listing all available features in order of usefulness, we also included several instructive ones in our final feature set. From the feature collection, support vector machine (SVM) was used to extract the best features for categorising lung AC and SCC samples from the feature set, which were then used in the incremental feature selection method. Lung adenocarcinoma (AC) and adenocarcinoma were found to have significant levels of expression for some of the most widely researched genes (CSTA/TP63/SERPINB13/ CLCA2/BICD2/PERP/FAT2) (SCC). As a result, a rule learning approach was used to generate the categorization rules. How to organise things and how the genes of AC and SCC vary in the lungs may be explained by these concepts**[11].**

Valluru, D., & Jeya, I. (2020) -In this research work presented, researchers devised an optimum SVM for lung image classification. We have developed the GWO-GA as a solution to the challenge of selecting parameters and features in SVM. Testing for parameter optimization, feature selection, and optimal SVM all takes place in three dimensions. All of the test photographs applied to this procedure show superior results in a variety of ways. The average classification accuracy is 93.54, which is much higher than the comparison methods' average classification accuracy of 89.97. The thorough examination of the test photos ensured that the method given may be applied in real-time data analysis in hospitals, telemedicine, and so on. It is possible to incorporate deep learning models into the suggested method in the future**[12].**

Günaydin, Ö., Günay, M., & Şengel, Ö. (2019, April) - In this research work presented, researcher applied different machine learning methods to detect lung cancer from chest radio graphs. We also used PCA to reduce dimension of chest radiographs in ratio of 1/8. Reducing dimension would cause feature loss. In our case, it was not caused too much information loss. It also increased accuracy in KNN (when k=2, and k=3) and SVM. Accuracy results affected small amounts that can be ignored to reduce time complexity and save storage. We could not apply Naïve Bayes and Feed Forward Neural Network with 10 layers to our images without PCA due to big amount of data. Even though neural net gets relatively higher accuracy than other machine learning methods. Decision Tree has highest results for all performance measurements in original data**[13].**

Luna, J. M., et.al (2019). -In this research work presented,researcher presents, Radiation pneumonitis (RP) is a radiotherapy dose-limiting toxicity for locally advanced non-small cell lung a kind of cancer (LA-NSCLC). Dosimetric limitations have been suggested in previous studies as a means of reducing this toxicity. According to our machine learning-based analyses, previously unknown criteria were discovered and the relative importance of various parameters was defined. The following are the origins and methods of the information: There were 203 patients with stage II–III non-small cell lung cancer (NSCLC) who received a median dosage of 66.6 Gy in 1.8 Gy daily fractions between 2008 and 2016, and each patient had 32 clinical features assessed. This group contained 17.7 percent of people with Grade 2 RP. Individually, the statistically significant determinants of RP were examined, and feature selection was carried out using univariate analysis. The combined performance of the RP predictors was examined using Random Forest multivariate analysis. As determined by univariate analysis, the best predictors of RP were found to be lung V20, average lung V20, lung V10, and lung V5. Oesophageal maximum, lung V20, lung mean, and pack-year were shown to be the most prevalent main RP distinguishers in the Random Forest (AUC = 0.66; p = 0.0005). To identify previously unidentified predictors of RP symptoms, we turned to the accurate machine learning approach

of Random Forest. In the wake of this research, esophageal maximum has been added to the list of RP predictors, along with lung V20, lung mean, and pack-years**[14].**

Huo, D., et. al.(2019) -In this research work presentedThe CT scan length for low-dose CT lung cancer screening tests was analysed using machine learning techniques. According to the model's projections, the average lung scan length is 252.1 mm, with a standard deviation of 27.7 mm. 28% of the total higher scan coverage, researcher see a standard deviation of 9.3%, which indicates that the patient might save almost 20% on their radiation dose as a whole.. The percentage of over-range is weakly related with patient weight and BMI and is dependent on the individual technologist. However, it is independent of patient age, patient height, date and time of the acquisition, and the acquisition station**[15].**

TABLE - I Comparison of Various Machine Learning Approach based Lung Cancer Detection The Many Aspects Drawn From The Literature

TABLE - I Comparison of Various Machine Learning Approach based Lung Cancer Detection				
Ref./year	**Topic**	**Method**	**Tools**	**Application**
[01]/2021	"Identification and Classification of Lung Nodules Using Neural Networks.	Deep Learning with RGB color model	-----	-------
[02]/2021	Lung cancer prediction and classification based on correlation selection method using machine learning techniques	SVM based KNN Machine Learning Methods	WEKA Tool	Convolutional Neural Network (CNN)
[03]/2021	Classification of lung cancer stages with machine learning over big data healthcare framework	gray-level co-occurrence matrix (GLCM) method)	promising tool	deep learning applications
[04]/2021	Lung cancer prediction using stochastic diffusion search (SDS) based feature selection and machine learning methods	Stochastic Difusion Search (SDS) Algorithm	--	clinical applications.
[09]/2020	Automatic lung cancer detection from CT image using improved deep neural network and ensemble classifier	Improved deep neural network (IDNN) method	MATLAB tool	------
[10]/2020	"Detection of lung cancer on chest CT images using minimum redundancy maximum relevance feature selection method with convolutional neural networks	Maximum relevance (mRMR) feature selection method	CNNs tools	LDA applications
[13]/2019	Comparison of lung cancer detection algorithms	Artificial Neural Networks machine learning Method	-----	--------
[14]/2019	Predicting radiation pneumonitis in locally advanced stage II–III non-small cell lung cancer using machine learning	Machine learning methods	Random Forest tool	application of a machine learning
[15]/2019	Investigation of Low-Dose CT Lung Cancer Screening Scan “Over-Range” Issue Using Machine Learning Methods	Machine learning methods	Machine learning is a powerful tool	python-based, software application.
[31]/2019	A comparative study of lung cancer detection using machine learning algorithms	Data compression methods	----	----
[32]/2018	An evaluation of machine learning classifiers and ensembles for early stage prediction of lung cancer	majority voting method	machine learning tool	reduce and accurate application

[33]/2018	A deep learning based approach to lung cancer identification	Convolutional neural networks (CNN)	tools used to diagnose the disease is computerized tomography.	---
[34]/2018	Comparative performance analysis of different classification algorithm for the purpose of prediction of lung cancer	K-Nearest Neighbors (KNN) method	Orange data mining tool	-----
[35]/2018	Unsupervised machine learning of radiomic features for predicting treatment response and overall survival of early stage non-small cell lung cancer patients treated with stereotactic body radiation therapy	two-way clustering method	Radiomic analysis has been a powerful tool	------
[36]/2017	Early detection of lung cancer using SVM classifier in biomedical image processing.	Gray level Co-occurrence Matrix (GLCM) method	latest emerging tool	
[37]/2017	Lung cancer classification using deep learned features on low population dataset	machine learning (ML) algorithms including artificial neural network (ANN), support vector machine (SVM)	-----	application of deep learning
[38]/2017	Small-cell lung cancer detection using a supervised machine learning algorithm	Entropy degradation method (EDM)	----	CT imaging for different applications
[39]/2017	Lung cancer detection using digital image processing and artificial neural networks.	artificial neural network Method	recognition tool of MATLAB	------
[40]/2016	Prediction of malignant and benign of lung tumor using a quantitative radiomic method	quantitative radiomic method	----	----
[41]/2016	Intelligent classification of lung & oral cancer through diverse data mining algorithms	Supervised Learning Methods	data mining tool	-----
[42]/2016	Lung cancer detection using bayasein classifier and FCM segmentation	bayasein	MATLAB. tool	application of sequential forward selection algorithm Bayesian
[43]/2016	Detection of Lung cancer cells using image processing techniques	Image Processing Techniques	-----	Image Processing Techniques
[44]/2015	Analysis of statistical texture features for automatic lung cancer detection in PET/CT images	Boylov's graph cut method	MATLAB. tool	Application of Texture Analysis
[45]/2015	Detection of lung cancer from CT image using image processing and neural network	neural network	MATLAB tool	CT Image

[46]/2015	SVM based lung cancer diagnosis using multiple image features in PET/CT	SVM based	statistical machine learning tool	Multiple image feature
[47]/2014	Lung cancer classification using genetic algorithm to optimize prediction models	genetic algorithm	SVM and ANN are powerful tools	application of microarrays
[48]/2014	Segmentation and feature extraction of sputum cell for early detection of lung cancer	Biopsy method	-	Extraction Of Sputum Cell
[49]/2014	Automatic detection of lung nodules using classifier	computer-assisted diagnostic (CAD) methods	-	Automatic detection of lung nodules
[50]/2014	Classification of lung cancer stages on CT scan images using image processing.	Sobel edge detection method	gabor function tool	Images Using Image Processing
[51]/2013	Content-based medical image retrieval using patient's semantics with proven pathology for lung cancer diagnosis	content-based image retrieval (CBIR) approach	-	CAD applications
[52]/2013	Semantic and content-based medical image retrieval for lung cancer diagnosis with the inclusion of expert knowledge and proven pathology.	content-based Medical Image Retrieval	---	applications of medical image retrieval
[53]/2013	Ensemble based optimal classification model for pre-diagnosis of lung cancer.	Correlation Feature Selection (CFS)	multiple statistical tools.	-
[54]/2013	Clustering of lung cancer data using foggy k-means	foggy k-means	powerful data analysis tool	wide range applications
[55]/2012	Computer aided diagnosis system based on machine learning techniques for lung cancer	Multi-resolution	MATLAB tool	CAD applications

III. TECHNICAL BACKGROUND

3.1 Machine Learning Artificial Intelligence In Cancer Detection

Before beginning with a detailed analysis of what machine learning methods work best for which kinds of situations, it is important to have a good understanding of what machine learning is – and what it isn't.Research in artificial intelligence known as machine learning uses statistical, probabilistic and optimization methods to "learn" how to categorise new data, find new patterns, or forecast new trends based on previous instances (Mitchell 1997).It is feasible to analyse and interpret data using machine learning and statistical techniques. Machine learning methods are now capable of modelling data or classifying patterns in novel ways by employing logic such as AND/OR/NOT and absolute conditionality (IF, THEN, ELSE). These later techniques are more like the ones people use to learn and categorise information. However, machine learning still relies significantly on statistics and probability, but it is inherently more powerful since it can make conclusions or judgments impossible with standard statistical approaches [55]. For instance, many statistical methods are based on multivariate regression or correlation analysis. However, these methods presume that the variables are independent and that data can be described by utilising linear combinations of these variables. Nonlinear interactions and interdependent (or conditional) variables are difficult for standard statistics to handle. Machine learning excels in these kinds of scenarios. Nonlinearity is found in many biological systems, and as a result, the parameters of these systems change. Many simple physical systems are linear and their parameters are essentially independent.For the evaluation as well as understanding of human human cognition, machine learning and artificial intelligence (ML/AI) require complicated and sophisticated techniques. Intelligent machines may strategy termination irrespectively of whether or not the user provides instruction. The machine learning of Machine Intelligence techniques in terms of collecting information, evaluating it, but also deciding/finalizing the desired outputs distinguishes them from conventional methods in

Machine Learning , which are discussed below. These approaches are accomplished via the use of neural network models. The use of artificial intelligence in health coverage is divided into two categories depending on the kind of data being analysed. Machine learning techniques are used to analyse data sets, images, genomes, but also diagnostics. In unstructured information, such as health records, clinical articles, as well as magazines, natural language processing (NLP) methods are being used to assess the representation of the information. Initially, applying NLP approaches, the collected input text is transformed to binary format, but this binary data is evaluated by machine learning approaches to generate correct output and decisions

Cancer, neurology, and cardiology are the most common medical research in which artificial intelligence is used. As a result, the death rate for this illness is higher. Besides these illnesses, artificial intelligence is being used to various medical fields for the purposes of forecasting, analysis, and treatment. Some of the most well-known machine learning algorithms that have been used in the healthcare sector include SVM, NN, random forest, logistic regression, discriminant analysis, decision trees, linear regression, closest neighbour, naive bayes and others.

- The following are indeed the finest Artificial Intelligence (A.I.) methodologies that can presently be implemented in the medical field:
- The method for identifying variations together in tumour is described in detail below.
- Images of hearts are classified according to their shape.
- The method is proposed for forecasting heart problems.
- Using artificial intelligence, dermatologists could make precise tumor diagnoses.
- An artificial intelligence framework for the intensive care unit.
- Algorithms are being used to identify individuals who are at risk of developing cervical cancer.
- AI is beneficial in the diagnosis of breast cancer.

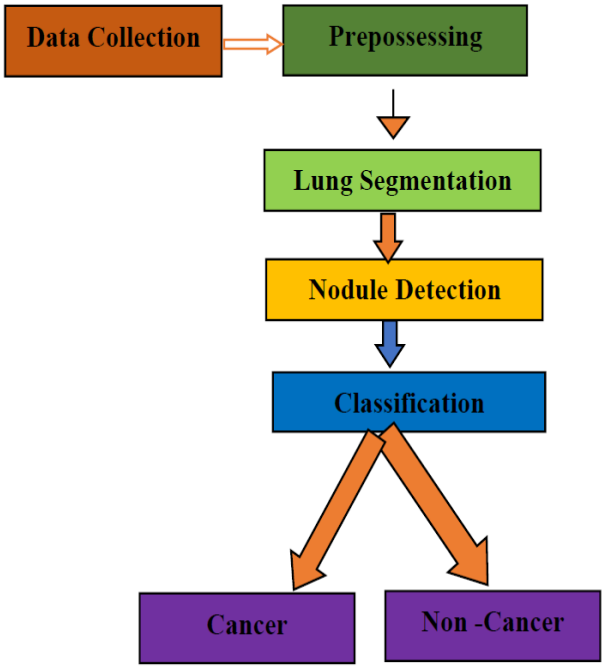

Fig.4 Block Diagram for Machine Learning based Lung CancerDetection

3.2 Machine Learning Steps

Deep learning algorithms specifically CNN, Fully Connected Convolutional Networks (FCN's), Deep Belief Networks (DBN's) had promptly evolved techniques and strategies to study and examine/analyze the imaging in medical area like MRI, X-Ray and computed tomography(CT) images, etc., Deep learning approaches are used for image classification, lesion classification and detection, organ and lesion segmentation, enhancement and image generation and it can be also used for combining image data with reports.

A. Data Prepossessing

Data prepossessing is an integration part of machine learning. Photographs taken at a 20 equivalent magnification (0.5 m/pixel) that have been processed were used to ensure that both global perspective and localised details were preserved.. In order to document the TIFF-format WSIs using unique colored roughness polygons identifying a particular histological lung tissue type, the doctors developed the ASAP technology.

B. Deep Neural Networks (DNN)

A CNN with high accuracy and low tuning costs was our aspirational framework.By using compound scaling as well as auto architecture search, the Efficient Net systems received a performance boost, helping them attain state-of-the-art accuracyperforming PictureNet performs fewer floating-point operations per second (FLOPs).At the time of this research, the Efficient Net network supported both MATLAB and Python up to version B5. The slides were randomly divided into training, validation, and testing sets at the slide level in order to enhance and adjust the systems. Res Net, a CNN architecture, is often used in academic papers. A growing number of industries, from academia to industry, are using deep learning techniques. With today's cutting-edge technology, learning machines can now process large amounts of data thanks to new algorithms and increased parallel computing approaches.

C. Network Training (NT)

A significant barrier to medical research is the restrictive privacy rules as well as disorganised management systems that apply to most medical materials, particularly labelled ones. Thus, because of our limited training data set, transfer learning methods were used to train the Efficient Net-B5 system. The training process was comprised of two steps. First, we initialized the network with default weights transferred from the ImageNet dataset, froze all the layers except the last fully connected layer, and trained it with our data. Second, we unfroze the frozen layers and fine tuned the whole network to fit the target best. The trainable layers' settings were changed or optimised, with cross-entropy values being used to compare the predictions with the ground facts.The initial learning rate was 0.0005, and the optimizer was Adam, with both momentum and decay set as 0.9. During processing, the data were augmented using a number of different manipulations, including horizontal and vertical flips, uniform variations in brightness and contrast, changes in gamma, zooming, as well as sliding. Except for horizontal flipping, all the other augmentation operations were conducted with a certain probability, either 0.3 or 0.5. The Z-score-normalized learning characteristics were improved by rescaling the pixels from 0 to 255 to 0–1 by dividing 255. (0.229, 0.224, 0.225). The training procedure took 60 epochs, after which the best model was stored as well as used[18].

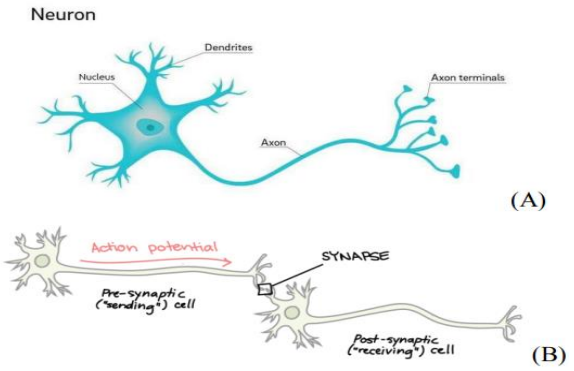

Fig. 5 Deep Learning Neural Networks

IV. PERFORMANCE ANALYSIS

4.1 Introduction

In this chapter discuss the simulation model and result of proposed algorithm. For the implementation of proposed algorithm use Matrix laboratory. Matrix laboratory is a well-known tool for such kind of algorithm implementation related to data analysis calculation. MATLAB contain a rich function family of data analysis.

Result Parameters and Simulation Tool

The result of proposed method for development of middle ware using machine learning technique for diabetic type 2 shown in this section, simulation of our proposed method and result calculation. We have done proposed work with the help the MATLAB R 2015a (8.1.0.602) software and simulate our whole proposed methodology in data analysis. Basic configuration of our system is: Processor: Intel (R) Quad Core (VM) i3 – 3110 Central Processing unit @, 2.40 GHz with 4GB RAM: System type: 64-bit Operating System.

Accuracy :

The accuracy is the ratio of addition of number of correct production (TP+TN) and total number of production ($TP + TN + FP + FN$) .

$$Acc = \frac{TP + TN}{TP + TN + FP + FN}$$

Where: TP = True positive; FP = False positive; TN = True negative; FN = False negative.

Selectivity -Selectivity is usually measured as **a ratio in** $\frac{TP}{TP+FP} \times 100$, comparing the signal output received in class against that of a similar signal on another frequency.

$$\text{selectivity} = \frac{TP}{TP+FP} \times 100$$

TP = sum (tp)
FN = sum (fn)
FP = sum (fp)
TN = sum (tn)

Sensitivity - The sensitivity of a test is its ability to determine the patient cases correctly. To estimate it, we should calculate the proportion of true positive in patient cases. Mathematically, this can be stated as:

$$\text{Sensitivity} = \frac{TP}{TP + FN} \times 100$$

Specificity - The specificity of a test is its ability to determine the healthy cases correctly. To estimate it, we should calculate the proportion of true negative in healthy cases. Mathematically, this can be stated as:

$$\text{Specificity;} = \frac{TN}{TN + FP} \times 100$$

precision - Precision is calculated by dividing the true positives by anything that was predicted as a positive.

$$\text{Precision} = \frac{TP}{TP + FP} \times 100$$

Recall - Recall (or True Positive Rate) is calculated by dividing the true positives by anything that should have been predicted as positive.

$$\text{Recall} = \frac{TN}{TP + FN} \times 100$$

% jc

$$\%\,jc = \frac{TP + TN}{TP + TN + FP + FN} \times 100$$

% dc

$$\%\,dc = \frac{2 \times TP + TN}{2 \times TP + TN + FP + FN} \times 100$$

V. CONCLUSION AND FUTURE WORK

In this survey paper discuss the different previous methods Lung cancer is a serious disease in the types of cancer which are present and it is almost impossible to detect it at its initial stages. Lung cancer is detected by showing its one of the highest incidences and also standout amongst the highest mortality rates in all other cancer types. In this paper, An image improvement technique is developing for earlier disease detection and treatment stages; the time factor was taken in account to discover the abnormality issues in target images. Image quality and accuracy is the core factors of this research, image quality assessment as well as enhancement stage where were adopted on low preprocessing techniques based on Gabor filter within Gaussian rules. The proposed technique is efficient for segmentation principles to be a region of interest foundation for feature extraction obtaining. The proposed technique gives very promising results comparing with other used techniques. Relying on general features, a normality comparison is made. The main detected features for accurate images comparison are pixels percentage and mask-labeling with high accuracy and robust operation. An artificial Neural Network for diagnose the presence or absence of lung cancer in human body movie was developed. The model was validated; it was 96.67 accurate. This study showed that the neural network is able to diagnose lung cancer, so it can used as a diagnose tool by doctors.

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