An Analysis of Lung Cancer Recognition Using Machine Learning Approach - A Review

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Abstract—**In this Review paper discuss on the analysis of Lung Cancer Recognition using machine learning approach describes a research study that explores the use of machine learning algorithms for the recognition of lung cancer. The Review study to develop an accurate and efficient lung cancer recognition system by analyzing medical images of lung cancer patients. In this research work present the process of collecting and preprocessing the lung cancer image data and then applying different machine learning techniques for classification and prediction. The study provides insights into the potential of machine learning in medical image analysis and highlights the importance of developing accurate and efficient disease recognition systems for early diagnosis and treatment.**

Keywords— *Lung Cancer, Machine Learning, MRI, CT-Scan, CNN, ANN, and Deep Learning.*

I. INTRODUCTION

Lungs cancer is one of the leading causes of the death among the world. Every year many of the peoples die because of lung cancer than other types of cancer. Not only men but women also suffering from the same dangerous disease. After the detection, the life span of the patient suffering from the lung cancer is very less. If the diagnosis is done in early stages then the chances of patient survival is more to increase the patient survival rate which is needed to detect cancer as early as possible [11]. Therefore to get the correct and instant result we can apply the modern techniques by using the image processing and machine learning domain. By increasing the quantity of replica used for the procedure, will improve the accuracy. Correct identification and prior prediction of cancer can extend the rate of survival. The previous techniques comprise study of Mammography, Computerized Tomography Scan, Magnetic Resonance Imaging images [13].The professional physicians identify the disease and determine the stages of cancer by professionalism.

Treatment includes some surgical procedures, chemical treatment to kill or halt the replication and stop of cancerous cell, radiotherapy and targeted therapy. These analysis is very long, expensive and part of body affected with pain/arduous [12]. Therefore, to reduce this process

by using various image processing algorithm. CT scan images and blood samples are obtain from hospitals. Computerized Tomography reports are less noisy as compared to MRI and X-Ray report [14].

Affected by genetic problem [9] due to the false mutations completely changes human life style. The false mutation entirely changes the structure and function of DNA. The generated wrong mutated DNA cell replaces old DNA cell that creates the abnormal growth of the DNA cell. The abnormal mutation [10] is happened due to the various external factors such as population air breathing, alcohol habits, chemical gas exposure and so on. Mostly, the abnormal cell (DNA) mutation [11] creates tumours that may be occurred in any places such as lung, skin, breast and brain in human body. Among the several tumours, lung cancer [12] is one of the most affected diseases because of the external factors that generally affect respiratory system. From the study in 2005, the number of deaths is increased up to 159,292 that is increased up to 25% in 2018. From the US [13] report of North American association of central cancer registries, it is declared that 234,030 people are inflfluenced by lung cancer in 2018.

According to the survey, it is filially concluded that lung cancer-affected people ratio is increased gradually in the last 5 years. Based on the analysis, lung cancer is the most common considered diseases in medical fifed

todiagnosis [14] the disease in earlier stage. Normally, the lung cancer is manually predicted with the help of the disease symptoms [15] such as blood coughing, chest pain, shortage of breath, fatigue, weight loss, memory loss, bone fracture, joint pains, headache, neurological problem, bleeding, facial swelling, voice change and change of sputum color. Once the patient has been affected by these technologies, different screening procedures [16] like genetic testing, scopy bronchi, reflex testing, fluid biopsy, biopsy and blood testing have been used continuously for evaluation. From the screening methodologies, national institute for health and care department provides the general guidelines to predict the lung cancer and stages of lung cancer effectively.

Lung cancer is a harmful disease that causes a huge number of deaths globally. The primal encounter of lung cancer is necessary to decrease the mortality rate of patients. Thus it is a great challenge encountered by doctors and researchers to detect and diagnose lung cancer. Detection of lung cancer can be done by using medical images such as computed tomography, chest X-ray; MRI scans, etc. [19], ML approaches recognize the main characteristics of complex lung cancer datasets. A CAD (Computer-Aided Diagnosis) was developed in the early 1980s to enhance the survival rate and efficiency that aid the doctors in interpreting medical images. Some of the machine learning algorithms that have a profound impact in health care are decision trees, linear regression, random forest, SVM, naive Bayes, K-nearest neighbors and so on [17]. We have also discussed the deep learning methods techniques and algorithms that can be implemented for diagnosis, detection, and prediction of various cancers. The preeminent intent of this research work is to present a concise vision of present work on different cancers and mainly lung cancer prediction using deep learning and machine learning models [21] [23].

II. LITERATURE SURVEY

Shigao Huang, et. al. (2023)- In this research study, Lung cancer is one of the malignant tumours with the highest incidence and mortality in the world. The overall five-year survival rate of lung cancer is relatively lower than many leading cancers. Early diagnosis and prognosis of lung cancer are essential to improve the patient's survival rate. With artificial intelligence (AI) approaches widely applied in lung cancer, early diagnosis and prediction have achieved excellent performance in recent years. This review summarizes various types of AI algorithm applications in lung cancer, including natural language processing (NLP), machine learning and deep learning, and reinforcement learning. In addition, we provides evidence regarding the application of AI in lung cancer diagnostic and clinical prognosis. This review aims to elucidate the value of AI in lung cancer diagnosis and prognosis as the novel screening decision-making for the precise treatment of lung cancer patient [01].

Md. Alamin Talukder, et. al. (2022) - This research work, Cancer is a fatal disease caused by a combination of genetic diseases and a variety of biochemical abnormalities. Lung and colon cancer have emerged as two of the leading causes of death and disability in humans. The histopathological detection of such malignancies is usually the most important component in determining the best course of action. Early detection of the ailment on either front considerably decreases the likelihood of mortality. Machine learning and deep learning techniques can be utilized to speed up such cancer detection, allowing researchers to study a large number of patients in a much shorter amount of time and at a lower cost. In this research work, we introduced a hybrid ensemble feature extraction model to efficiently identify lung and colon cancer. It integrates deep feature extraction and ensemble learning with high-performance filtering for cancer image datasets. The model is evaluated on histopathological (LC25000) lung and colon datasets. According to the study findings, our hybrid model can detect lung, colon, and (lung and colon) cancer with accuracy rates of 99.05%, 100%, and 99.30%, respectively. The study's findings show that our proposed strategy outperforms existing models significantly. Thus, these models could be applicable in clinics to support the doctor in the diagnosis of cancers [02].

Dakhaz Mustafa Abdullah, et.al. (2021) – In this research work presented, Lung cancer is one of the leading causes of mortality in every country, affecting both men and women. Lung cancer has a low prognosis, resulting in a high death rate. The computing sector is fully automating it, and the medical industry is also automating itself with the aid of image recognition and data analytics. This paper endeavors to inspect accuracy ratio of three classifiers which is Support Vector Machine (SVM), KNearest Neighbor (KNN)and, Convolutional Neural Network (CNN) that classify lung cancer in early stage so that many lives can be saving. Basically, the informational indexes utilized as a part of this examination are taken from UCI datasets for patients affected by lung cancer. The principle point of this paper is to the execution investigation of the classification algorithms accuracy by WEKA Tool. The experimental results show that SVM gives the best result with 95.56%, then CNN with CNN 92.11% and KNN with 88.40% [03].

Gnanavel, S. (2021) - Now a days the area of disease Diagnosis is an uninterruptedly developing and very vigorous field for research and development. The objective of this research is, to predict the status of the patient for initial stage detection of lung cancer. In this work, the Diagnosis of Lung cancer and classification is made by means of Neural Network and Morphological Operation techniques, the segmentation and detection processes are carried out by means of intensity computation, GLCM, image quality assessment and features extraction. Using Median Filter is an effective way of detecting the Lung Cancer at an early stage by enhancing the image by noise reduction. This system is trained by using previously taken data set. It is effectively

working and accuracy of the prediction is more. It's found out the lung cancer in the early stages. This tool can be fatherly used and developed by the biomedical department[04].

Abdullah, et.al (2021) - 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. This paper tries to endeavor to investigate of three classifiers to find the best classifier could classify lung cancer in early stage. The informational indices included in this study were derived from UCI databases for lung cancer patients. The focus of this paper is on using WEKA Tool to investigate the accuracy of classification algorithms. The results show that the Support Vector Machine (SVM) give the best accuracy 95.56%, that can detect lung cancer in its early stages and save several lives and, K-Nearest Neighbor KNN It gave less accuracy 88.40% [05].

Shakeel, P. M., et.al (2020) - Thus, the paper analyzes the lung cancer using improved deep neural network and ensemble classifier. The system collects the cancer image from cancer imaging archive (CIA) dataset and divided the images into testing (2543) and training (3500). Then the collected image intensity level is examined to improve brightness level and eliminate the noise present in CT lung image. After that, each pixel is examined using multiple layer of network for segmenting affected region from lung image. The segmented region is analyzed effectively, and various features are extracted which are huge in dimension that also consumes more time to recognize cancer. So, the dimensionality of the system is reduced by applying spiral settings and approximation concept that effectively selects optimized features. 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 **[06].**

Raoof, S. S., et.al (2020, March) - In this paper, we demonstrate a survey on lung cancer, its causes, symptoms, mortality rate due to cancer in India and throughout the Globe and deliberates the machine learning techniques, its applications in healthcare and cancer prognosis and detection. Most of the researchers developed the cancer prediction systems based on a supervised learning technique of ML and classification algorithms to produce an accurate outcome. Deep learning in health care and algorithms are emphasized. Prediction and diagnosis of the Lung cancer system can be embellished and extended further by employing deep learning techniques to enhance the accuracy of both identification and prediction of lung cancer. This paper will help the researchers to look insight into various ML techniques applied to lung cancer. In the future, we want to apply deep learning techniques to predict lung cancer **[07].**

Toğaçar, M., et.al (2020) - In this study, we proposed a hybrid model based on the six different machine learning classifiers, three CNN models and mRMR feature selection method so as to detect lung cancer. To this aim, a publicly available dataset consisting of totally 100 Chest CT scan images was used. In the experiments, the 10- fold cross-validation was employed to achieve generalized results. The study consists of five experiments. The aim of the first two experiments was to measure the success of CNNs and the machine learning classifiers without image augmentation techniques. As a result, since the number of the original dataset was small, it was inevitable to use the augmentation techniques in the experiment. The path followed in the third and fourth experiments was the same as in the first two experiments. The only difference was to learn whether the image augmentation techniques can contribute to the success rates of the models. As a result, we achieved a success rate of 98.74 % and it was observed that the augmentation methods contributed to improving the overall classification success. In the last experiment, the success of the fourth experiment (by selecting the best performing CNN model and classifier) was aimed to increase with less but efficient features. The main difference between the last experiment and the others was to use time and speed efficiently in the classification process. Since the most effective way to accomplish this was to reduce the number of features, so the mRMR feature selection method was used in the last experiment. As a result, it was seen that the feature selection method used time more efficiently Furthermore, using a combination of AlexNet, k NN and mRMR method provided the most effective results with an accuracy of 99.51 %, sensitivity of 99.32 % and specificity of 99.71 %**[08].**

Radhika, P. R., et.al (2019, February) - In earlier times, the doctor has to do multiple tests in order to detect whether a given patient has lung cancer or not . But this was a very time consuming process. In a diagnosis sometimes a patient has to undergo unnecessary check-ups or different tests to identify the disease of lung cancer. To minimize the process time and unnecessary check-ups there needs to be a preliminary test in which both the patient and the doctor will be notified with the possibilities of lung cancer. Nowadays the machine learning algorithms plays an important role in the prediction and classification of medical data. Logistic Regression, SVM, decision tree and Naïve Bays are the machine learning algorithms used for this comparative study. A comparative analysis of accuracy rates of each classifier is presented. The predictive performance of classifiers is compared quantitatively. In the performance chart, different results are produced for each classifier on the lung cancer dataset. Looking at the correct classification (CA) and other metrics; the best result is given by the support vector machine algorithm. SVM algorithm used high dimension to classify the observation so it's performance is the best. More accurate lung cancer detection can be done using this technique. Therefore, there is less mistakes. Finally, by

adding extra pre-processing the accuracy rate can be enhanced **[09].**

Rahane, W., et.al (2018, March) **-** Lungs cancer is a serious disease that described by unlimited growth of cells in tissues of the lungs. Detection of lungs cancer in earlier stages is very crucial it can save many lives. In our proposed system we are describing the lungs cancer and its stages using different image processing and machine learning algorithms such as, grayscale conversion, noise reduction and binarization. All this algorithms are used for the pre-processing of the given CT scan image. ROI is defined from main CT scan image. For pre-processing stages, median filter and segmentation gives accurate result. From the extracted ROI some features are extracted i.e., Area, Perimeter, and Eccentricity. These characters are helpful for defining the lungs cancer at earlier stages. For grouping purpose Support Vector Machine (SVM) classifier classifies the positive and negative samples of lung cancer images in this system **[10].**

III. ARTIFICIAL INTELLIGENCE IN HEALTHCARE

ML/AI use complicated and sophisticated algorithms for the appraisal and analysis of human perception and cognition. Computer algorithms can approach cessations regardless of user input. The intelligence of AI algorithms of acquiring the information, processing it and deciding/finalizing the accurate output discriminates the traditional technologies in Ai. These algorithms are implemented using ML techniques. AI in healthcare is branched into two categories based on the type of data I.e. analysis of structured data along with images, genes and biomarkers are done with ML techniques. The unstructured data such as prescription notes, medical magazines or journals are analyzed using natural language processing (NLP) methods. First, the input text acquired is converted to binary format using NLP methods then this binary data is analyzed by ML techniques to produce accurate output and decisions[16].

Cancer, neurology, cardiology are the major parts of medicinal studies where AI is implemented. As this disease are superior in the mortality rate [29]. Apart from these diseases, AI is even applied to other medicinal areas for prediction, analysis, and curing. Predominantly renowned ML algorithms extended in the healthcare sector are SVM, NN, random forest, logistic regression, discriminate analysis, decision trees, linear regression, nearest neighbor, naive bayes, etc [30].

The elite A.I. algorithms that can currently be initiated in healthcare are as follows:
- The algorithm detecting variation in a tumor.
- Classification of heart images.
- Heart attack predicting algorithm.
- More precise skincare cancer diagnosis with AI.
- AI system for ICU.
- Computers detecting breast cancer risk.
- AI. useful to diagnose breast cancer
- Smart algorithm predicting suicide risk

- Inpatients mortality can be predicted by AI [27]

IV.MACHINE LEARNING IN LUNG CANCER

This section intends to give a summary of the research direction in DL for health care. And we had discussed the DL concepts, algorithms, techniques, approaches and applications [17]. 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 [20] .

In medical image analysis of CT images and X-rays, the prediction, detection, labeling, and classification has become the most prominent challenging application. For example in the application of lung cancer analysis, detection, large dataset alike LUNA16, Lung are utilized to train the model that integrates deep learning approaches like CNN, DBNs for image analysis and NLP, RNN's are applied for text analysis [18][19].

A. Data pre-processing

To retain both global overview and local details, the images of $\times 20$ equivalent magnification (0.5 μm per pixel) was adopted throughout the processing procedure. The TIFF-format WSIs were manually annotated by the pathologists using the ASAP platform, with separate areas of colored irregular polygons responsible for a certain histopathological lung tissue type. Tumorous and inflammatory regions were obtained by masking annotated areas, and normal regions were retrieved by excluding the background of normal lung slides with Otsu's method. The annotation guaranteed that no non-lesion tissues were included in the annotated area, and thus, some lesion areas that were difficult to be marked clearly may be lost. These outlined areas were annotated with their respective categories, including LUAD, LUSC, SCLC, PTB, and OP [24]. Normal lung slides were derived from normal adjacent tissues of cases with the above diseases. The selected normal lung WSIs referred to the tissues of the whole slides that were normal without any lesions. Specifically, un-annotated regions of neoplastic slides were not considered normal due to the rigorous labeling method that excluded minor areas of tumor tissue surrounded by mostly normal tissues [22]. ROIs were traversed and tailored into non-overlapping tiles at the size of 256×256 pixels with a sliding window (stride = 256) to match the input scale of CNNs and avoid over fitting. Tiles with over 50% background space were removed to reduce noise and redundancy [26].

B. Deep Neural Networks

A CNN with high accuracy and low tuning costs was our aspirational framework [25]. The Efficient Net networks benefited from compound scaling and auto architecture search, achieving state-of-the-art accuracy on ImageNet

with fewer floating-point operations per second (FLOPs). PyTorch supported the EfficientNet network up to the B5 version at the time this study was conducted. Hence, EfficientNet-B5 was adopted for the histopathological classification task with its last fully connected layer replaced by a Softmax layer that output a six-dimension vector. To train and optimize the networks, we randomly divided the slides at the slide level into the disjoint training, validation, and testing. ResNet is another popular CNN architecture that frequently appeared in research articles. Therefore, we also fine-tuned a ResNet-50 network using the same data and settings as EfficientNet-B5 and threw the same testing slides to conduct a fair comparison between the two network models [28].

V. CONCLUSION

In this survey paper discuss survey it seems that the paper aims to explore the use of machine learning techniques in identifying cases of lung cancer. The analysis likely involves collecting and processing large amounts of data related to lung cancer, including clinical and imaging data, as well as developing and testing machine learning algorithms to identify patterns in the data that are indicative of cancer.The conclusion of the paper would likely summarize the findings of the analysis, including any insights gained through the use of machine learning techniques. It might also discuss the potential implications of these findings for the diagnosis and treatment of lung cancer. Without further information on the specific paper in question, it is difficult to provide a more detailed analysis or conclusion.

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