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Lung Cancer Detection and Classification Using CNN

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Abstract: Recognized for its severity and widespread impact, cancer remains a leading cause of death worldwide, claiming countless lives annually. Touching upon cancer genres, pleura tumor tops the list as the most widespread and deadliest form. In the detection of pleura tumor, CT scans (computed topography) play a crucial role by offering a detailed view of tumor presence and progression. Although CT scans function as primary choice pleura tumor determination, the subjective nature of visual analysis can introduce inaccuracies and obstacles. Thus, the use of image processing methods has become prevalent in medaical research, particularly for the early determination of pleura tumor. This paper presents a new methodology for determine pleura cancer from given inputs. This study presents an algorithm aimed at detecting pleura tumor, which incorporates methods such as median filtering to preprocess images and a set of techniques used in image processing and computer vision for analyzing and manipulating shapes within images are employed to divide the bronchial area of focus. Geometrical features derived from this segmented area are then utilized in a support vector machine classifier to discern between healthy and peculiar CT scan images
Keywords: Area of focus, Lung cancer, CT.

I. INTRODUCTION

The relentless increase in cancer-related deaths underscores the urgent need for effective interventions. Of all cancer types, lung cancer emerges as the most widespread and lethal, affecting both males and females. Lung cancer, also termed carcinoma, is marked by malignant growth of cells within bronchial region. The predominant causes of cancerous lung nodules are attributed to smoking and tobacco use. Survival rates for lung cancer patients, irrespective of disease stage, remain alarmingly low, with approximately 15% surviving beyond a period of 6 to 7 years. A major complication in managing lung cancer arises from the frequent detection of cases at later stages, complicating treatment options and severely limiting survival prospects. Early prediction of lung cancer offers a promising avenue optimizing survival prospects, with the scope to increase likelihood of survival to 66-75% by facilitating prompt intervention and mitigating death rates. The classification of pleura tumor encompasses: Compact cell pleura tumor (CCPT) and large cell pleura tumor (LCPT) are the two primary classifications of pleura tumor based on microscopic appearance, characterized by unique cellular and tissue traits. Non-small cell lung cancer predominates, representing roughly 88% of cases, while small cell lung cancer represents roughly 10-13% of diagnosed cases. Pleura tumor staging is determined by assessing the extent of cancer spread in the lungs and its dimensions. The classification system typically comprises four stages, with increasing levels of risk: In lung cancer staging, Stage I refer to cancer localized solely within the lung, whereas Stages II and III indicate cancer restricted to the thoracic cavity. Stage IV signifies the most advanced stage, characterized by the metastatic dissemination of lung cancer to distant parts of the body beyond the chest. The detection of pleural tumors can be achieved through various imaging modalities. Betwixt imaging techniques, common modalities include Sputum cytology, Bronchoscopy biopsy, Endobronchial ultrasound (EBUS), Endoscopic esophageal ultrasound (EUS).. Among these modalities, CT scan imaging is often favored as its reliability, superior accuracy, lower error rates compared to others. The process of visually analyzing data and studying databases is arduous, requiring substantial time and relying heavily on individual judgment. This dependency increases the likelihood of manual errors and may lead to disorganization in the classification of cancer cases. Consequently, the adoption of an automated methodology becomes essential to support radiologists in effective lung tumor identification. The procedural framework for this automated technique encompasses dataset gathering, preprocessing steps, lung segmentation, and feature extraction.

Fig.1. Cancer

II. LITERATURE SURVEY

1) *De-Ming Wong, Chen-Yu Fang, Li-Ying Chen, Chen-I Chiu, Ting-I Chou,Cheng-Chun Wu*

”Development of a Breath Detection Method Based E-nose System for Lung Cancer Identification”

This writing centers its attention on predicting pleura tumor through the analysis of inhale and exhale patterns. Pleura tumor ranks as the primary root of mortality among the top contributors to mortality. Alarmingly, over 70% of pleura tumor victims are treated at a point where diagnosis options are limited or ineffective. Radiologists encountered complexity in interpreting lung tumor cases, prompting the development of a breath detection system aimed at facilitating rapid screening for pleura tumor. Utilizing various algorithms, the researchers achieved an impressive accuracy of 85%.

2) *Sanjukta Rani Jena,Dr. Thomas George*

”Texture Analysis Based Feature Extraction and Classification of Lung Cancer”

Several researchers have contributed their knowledge for cancer detection. The quick diagnosis of tumor can be useful in curing the disease completely. Various applications such as SVM and image preprocessing approaches are largely used in tumor determination, as said in this paper. A multitude of techniques have been explored in studies and research endeavors for lung tumor detection. The detection of lung tumors represents a pivotal focus in scientific inquiry, given its significant impact as a disease. These papers hugely impact current lung cancer detection approaches available in the literature. A number of ideologies have been initiated in tumor detection methodologies to improve the accuracy of their prediction.

3) *Qing Wu and Wenbing Zhao*

”Small-Cell Lung Cancer Detection Using a Supervised Machine Learning Algorithm”

Analyzing expenditure on medical costs associated with cancer treatment and annual economic impact due to lost productivity or labor, they highlight the detrimental impact of late-stage detection, which accounts for most lung cancer-related deaths. Deaths attributed to lung cancer globally surpass 72,000 incidents each year, with 230,000 new incidents identified in the US in 2017 and 42, 00,000 in China in 2015. The training and testing data for the algorithm encompass high-resolution lung CT scans sourced from the National Cancer Institute. In this writing, they introduce a pioneering neural-network-based algorithm called the Entropy Degradation Method (EDM) for identifying small cell lung cancer (SCLC) from computed tomography (CT) images. Similar to other tumor, early identification of pleura tumor can be pivotal in preserving lives. This writing aims to contribute towards offering early detection of pleura tumor, potentially mitigating the significant health burden associated with the disease. To facilitate their research, they selected 13 lung CT scans from a library, including 7 healthy lung scans and 6 scans from patients diagnosed with SCLC.

III. OBJECTIVES

1) Improve prior determination of pleura tumour for accurate results.
2) Develop a highly accurate model to classify cancerous and non-cancerous lung CT scans.
3) Achieve high sensitivity and specificity to ensure dependable identification of positive cases and reduce false positives.
4) To harness pre-existing information from extensive datasets, particularly in situations where labelled medical data is scarce, consider applying transfer learning techniques.
5) Improve the transparency of the model's decision-making process using visualization approaches to identify key regions of interest in lung CT scans.

6) Calculate the system's performance by comparing it with current modalities for lung tumour determination.
7) Assess model's robustness under different imaging conditions, ensuring stability and generalizability.
8) Collaborate with healthcare professionals to integrate the model into clinical workflows, validating its efficacy in real-world medical settings.
9) Point ethical considerations, consisting of patient privacy and transparent communication of model limitations.
10) Design the system to be scalable for widespread deployment in healthcare institutions, considering computational efficiency and integration with current medical information systems.

IV. PROPOSED STRUCTURE

The flowchart in Figure 1 demonstrates the outlined method for identifying pleura tumor in CT images. This ideology involves five main steps, each of which is thoroughly discussed in the subsequent sections.

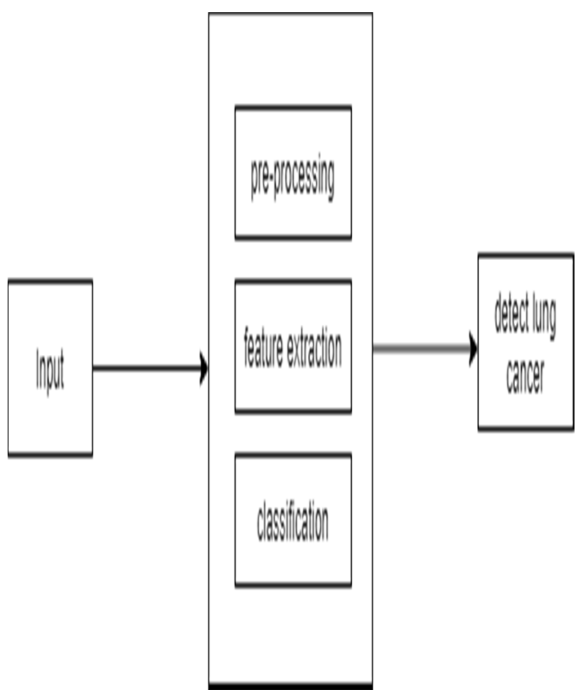

Fig.2. Block diagram of the proposed system [5]

1) Input Collection: In the initial stage of the process, lung CT scans of tumor victims are acquired. In this study, the scans were sourced through Kaggle. The input comprises CT scans depicting both abnormal as well as normal lungs.

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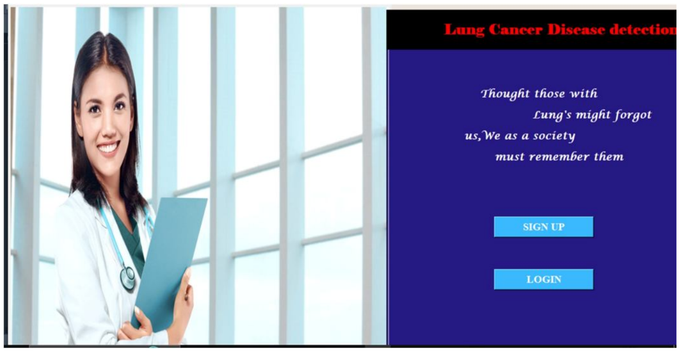

Fig.3. Login Interface

2) Image Pre-Processing [6]: Image enhancement methods aim to refine the resolution of images to yield superior outcomes for subsequent advancement. Given the susceptibility of CT scan images to salt and pepper noise, median filtering emerges as an exceptionally effective technique for eradicating this sudden noise while conserving image edges. The primary the goal of image enhancement is to eradicate undesirable distortions in the image and amplify features beneficial for subsequent processing. Smoothening aims to eliminate unwanted noise present in the image. Contrast adjustment stands as a pivotal aspect of image enhancement, augmenting image contrast by remapping input pixel values to new adjustments to ensure that 0.9% of the input is fully utilized at both lower and upper intensity levels of the input image data. Median filtering yields remarkable outcomes for image smoothening by eradicating noise without compromising image clarity. Adjusting contrast is paramount as image quality can be impacted by artifacts stemming from contrast variations in the image. This stage encompasses two principal phases: image smoothening and image enhancement.

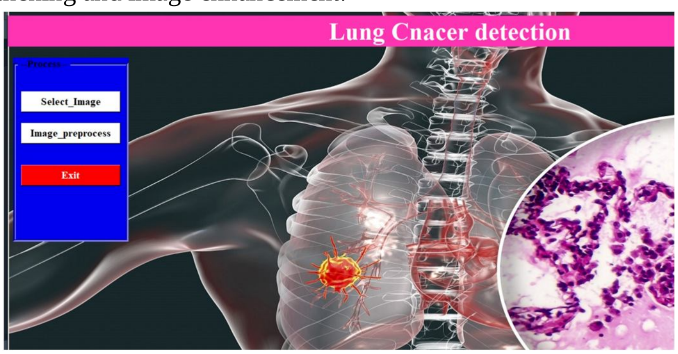

Fig.4. Image selection and preprocessing

3) Segmentation: In medical image analysis, it's critical to pinpoint the desired region within an image. Our method relies on utilizing mathematical morphological techniques as robust tools for extracting the lung area from binary images. Initially, we convert the preprocessed gray scale images into binary format. Next, employing a disk-shaped structuring element, we execute a morphological opening operation on the binary image, effectively eliminating unwanted elements. The resulting opened image is then inverted, followed by a clear border operation. This step facilitates lung mask extraction by filling any gaps or holes present in the lung regions. Finally, an exclusive OR operation is conducted on the output of lung mask and the output of clear border, resulting in the segmentation of the tumor region.

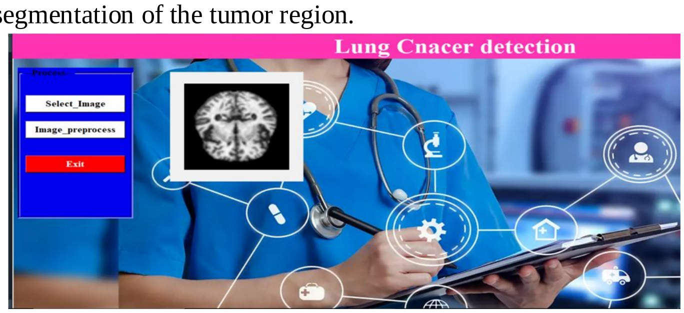

Fig.5. proposed system

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4) Characteristics Extraction: Characteristics extraction includes translating CT images to essential features necessary for subsequent analysis. This process involves identifying important characteristics of the segmented region of interest, which are then utilized as inputs for categorizing images. Estimating the dimensions of tumors within the lungs involves extracting coordinates of the lung regions.
5) Classification: The categorization step involves categorizing CT scan images as either abnormal or normal. In our approach, we employ the SVM algorithm for pleura tumor detection in CT scans. SVM distinguishers are trained models which study input and distinguish them based on predefined patterns. These classifiers construct a system using a dataset used for training purposes and classify it into distinct categories. Subsequently, new examples from a testing dataset are assigned to one of these classes. The SVM algorithm identifies the optimal hyper plane that divides the two clusters, effectively classifying the lung CT images. This hyper plane ensures that data points from one class are maximally differed from those of different class, yielding the most effective classification.

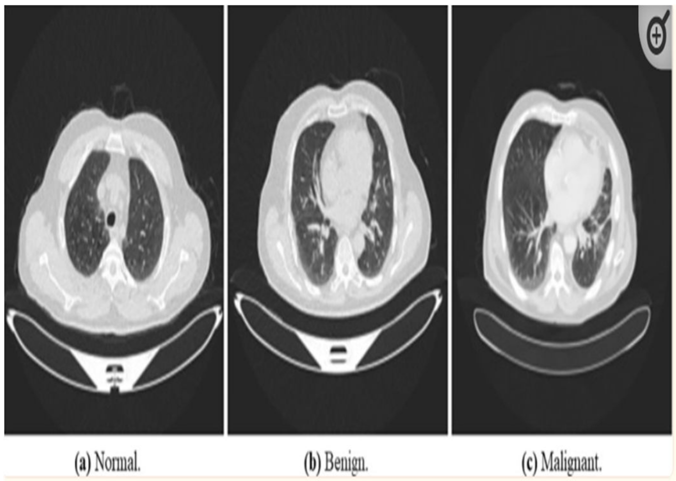

Fig.6. Classified types of Lung Cancer

V. APPLICATIONS

Early Prediction: One of the most crucial applications of a lung cancer detector is in early prediction. Identifying lung cancer in its initial phases can significantly improve treatment outcomes and increase the probabilities of survival. CAD systems can help radiologists in identifying cancerous nodules on chest X-rays or CT scans that may depict the spread of lung tumor.

Screening Programs: Lung cancer detectors can be deployed into screening programs for extreme-risk populations, such as current or former smokers or tobacco consumers. The objective of these programs is to detect lung tumor in its earliest stages, often before symptoms develop, allowing for easy diagnosis and treatment.

Assisting Radiologists: CAD systems can serve as a important system for radiologists by helping them with computer-generated analyses and highlighting areas of concern on medical images. This assistance can improve the accuracy and efficiency of radiological predictions, particularly in cases where slight abnormalities may be ignored by human observers.

Treatment Planning: Lung cancer detectors can aid in treatment planning by accurately categorizing the size, area, and characteristics of cancer. This data is essential for deciding the most dependable treatment approach, whether it involves surgery, chemotherapy, radiation therapy, or a combination thereof.

Monitoring Disease Progression: Following diagnosis and treatment initiation, lung cancer detectors can help monitor disease progression over time. By comparing serial imaging studies, clinicians can assess changes in tumor size, morphology, and response to therapy, allowing for adjustments to treatment plans as needed.

Research and Development: Lung cancer detectors are crucial in medical research by assisting the analysis of large datasets of imaging studies. Researchers can use CAD systems to identify patterns and trends related to lung cancer development, progression, and treatment response, ultimately contributing to the development of new diagnostic and therapeutic approaches.

Education and Training: Lung cancer detectors can be preferred as educational tools for medical students and practicing clinicians. By providing automated study and highlighting key features on medical images, CAD systems help students grow their skills in interpreting imaging studies related to lung tumor detection and treatment.

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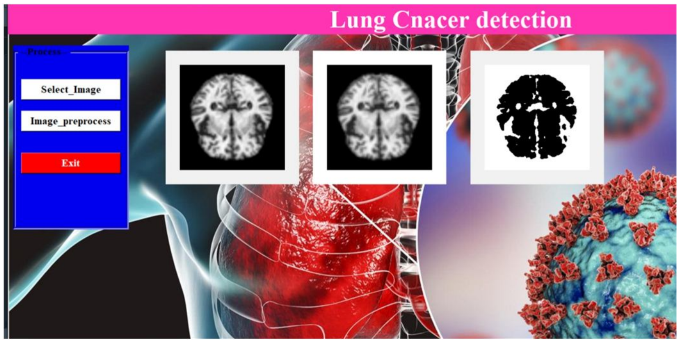

Fig.7. Processed image

VI. RESULTS

Utilizing the findings presented in this paper, an automatic system for detecting and classifying pleura tumor in CT scans can be effectively created using image preprocessing techniques. The proposed approach is anticipated to excel in improving, partitioning, and isolating characteristics from input. The application of Epoch's technique is expected to be particularly beneficial in removing sudden fluctuations in image intensity without compromising image clarity. Additionally, employing mathematical morphological operations should facilitate precise partition of lung and tumor regions. Geometric attributes derived from the focused tumor area will be utilized as input for the categorizer, enabling the distinguishing of inputs into Healthy, Benign, and Malignant categories, along with execution time assessment. Consequently, this proposed methodology holds promise for accurate and quick determination of pleura tumor.

VII. FUTURE SCOPE

Future range of lung tumor detection setup includes upgraded performance with more statistics, unification with upcoming technologies, continuous model purification, customized medicine, real-time treatment, expanded system to other tumors, increased interpretability, unification into healthcare systems, and worldwide alliance. Behavioral considerations will remain a crucial factor. The upcoming range of lung tumor prediction is huge and holds significant prospects for development in medical treatments and healthcare. As technology develops and our understanding of pleura tumor rises, the future of pleura tumor detection by applying CNN algorithms becomes more promising for improving better outcomes and transforming healthcare practices.

REFERENCES

[1] Shah, Asghar Ali, et al. "Deep learning ensemble 2D CNN approach towards the detection of lung cancer." Scientific Reports 13.1 (2023): 2987.
[2] Praveena, M., et al. "Lung cancer detection using deep learning approach CNN." 2022 7th International Conference on Communication and Electronics Systems (ICCES). IEEE, 2022.
[3] V. G. Biradar, P. K. Pareek, V. K. S and N. P, "Lung Cancer Detection and Classification using 2D Convolutional Neural Network," 2022 IEEE 2nd Mysore Sub Section International Conference (MysuruCon), Mysuru, India, 2022, pp. 1-5, doi: 10.1109/MysuruCon55714.2022.9972595.
[4] Wang, Lulu. "Deep learning techniques to diagnose lung cancer." Cancers 14.22 (2022): 5569.
[5] Rehman, Amjad, et al. "Lung cancer detection and classification from chest CT scans using machine learning techniques." 2021 1st International Conference on Artificial Intelligence and Data Analytics (CAIDA). IEEE, 2021.
[6] Nadkarni, Nidhi S., and Sangam Borkar. "Detection of lung cancer in CT images using image processing." 2019 3rd International Conference on Trends in Electronics and Informatics (ICOEI). IEEE, 2019.
[7] Cengil, Emine, and Ahmet Cinar. "A deep learning based approach to lung cancer identification." 2018 International conference on artificial intelligence and data processing (IDAP). Ieee, 2018.

[8] Katre, Pooja R., and Anuradha Thakare. "Detection of lung cancer stages using image processing and data classification techniques." 2017 2nd International Conference for Convergence in Technology (I2CT). IEEE, 2017.
[9] Kalaivani, S., et al. "Lung cancer detection using digital image processing and artificial neural networks." 2017 International conference of Electronics, Communication and Aerospace Technology (ICECA). Vol. 2. IEEE, 2017.
[10] Gopi, K., and J. Selvakumar. "Lung tumor area recognition and classification using EK-mean clustering and SVM." 2017 International Conference on Nextgen Electronic Technologies: Silicon to Software (ICNETS2). IEEE, 2017.
[11] Niranjana, G., and M. Ponnavaikko. "A review on image processing methods in detecting lung cancer using CT images." 2017 International Conference on Technical Advancements in Computers and Communications (ICTACC). IEEE, 2017.