Early Detection of Cancer Using Artificial Intelligence

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Abstract- *The identification of lung cancer at the early stage is very demanding and difficult task due to construction of the cell. The cancer grows in the body when cancerous cells start to develop uncontrollably. The image processing plays vital role in the prediction of lung cancer at early stage which is also helpful in treatment to avoid the lung cancer. This proposed system is developed to detect lung cancer at early stage with the help of image processing techniques and artificial neural network classifier to design computer based diagnosis system. In this system, during the preprocessing step, several image enhancing techniques, masks are applied using morphological operations and thresholding technique, which eliminates background and surrounding tissue. Region of interest (ROI) is calculated using region based segmentation algorithm. Circle fit algorithm is used to extract the desired nodule. Radius, Mean Intensity, Area, Euler Number and ECD features are extracted in feature extracting step. Finally, Back propagation algorithm is used to train Artificial Neural Network (ANN) in categorization stage.*

Keywords: Early Cancer Detection, Artificial Intelligence, Machine Learning, Deep Learning,

I. INTRODUCTION

The main cause of lung cancer is growth of cells in lung tissue which is irregular and out of control. One of the reasons is smoking. If it is detected earlier, then there will be a good chance of curing. Screening is the one of the important step for lung cancer detection. Screening is the process used to detect and identify the nodule. A nodule appear as round and white in co lour on a Computed Tomography scans images or an chest X-ray. There are two types of nodules one is a benign and second one is a malignant. A nodule with diameter 3 cm or less is called a Pulmonary or non-cancerous nodule. These nodules are also called as benign. A nodule whose diameter is larger than 3 cm is poisonous and called as malignant nodule. Malignant nodule should be identified as early possible because it is likely to be cancerous nodule. To check whether these nodules are expanding, they are needed to be observed over the time. If there is a change in the size of nodule and it is growing then there is a probability of getting cancer. So, a nodule should be observed. As compared with other types of cancer, the long term endurance rate of lung cancer patient is very low. So, the identification of lung cancer at early stage is very important and it provides vital research platform in medical image processing field. The identification of lung cancer at the early stage is very demanding and difficult task due to construction of the cell. The cancer grows in the body when cancerous cells start to develop uncontrollably. The image processing plays vital role in the prediction of lung cancer at early stage which is also helpful in treatment to avoid the lung cancer.

The cancer at early stage for a patient with the maximum amount of accuracy in our prediction. This dataset was collected from Indian patient liver disease dataset from Kaggle database of Indian Cancer patient records and used that dataset in our three modules to predict the cancer disease using various artificial intelligence techniques.

II. PROBLEM DEFINITION

Explain the capabilities and performance of currently available approaches for segmentation of lungs with pathologic conditions on chest CT images, with illustrations to give radiologists a better understanding of potential choices for decision support in everyday practice. The computer-based process of identifying the boundaries of lung from surrounding thoracic tissue on computed tomographic (CT) images, which is called segmentation, is a vital first step in radiologic pulmonary image analysis. Many algorithms and software platforms provide image segmentation routines for quantification of lung abnormalities; however, nearly all of the current image segmentation approaches apply well only if the lungs exhibit minimal or no pathologic conditions. When moderate to high amounts of disease or abnormalities with a challenging shape or appearance exist in the lungs, computer-aided detection systems may be highly likely to fail to depict those abnormal regions because of inaccurate segmentation methods. In particular, abnormalities such as pleural effusions, consolidations, and masses often cause inaccurate lung segmentation, which greatly limits the use of image processing methods in clinical and research contexts. In this review, a critical summary of the current methods for lung segmentation on CT images is provided, with special emphasis on the accuracy and performance of the methods in cases with abnormalities and cases with exemplary pathologic findings. The currently available segmentation methods can be divided into five major classes: (a) thresholding-based, (b) region-

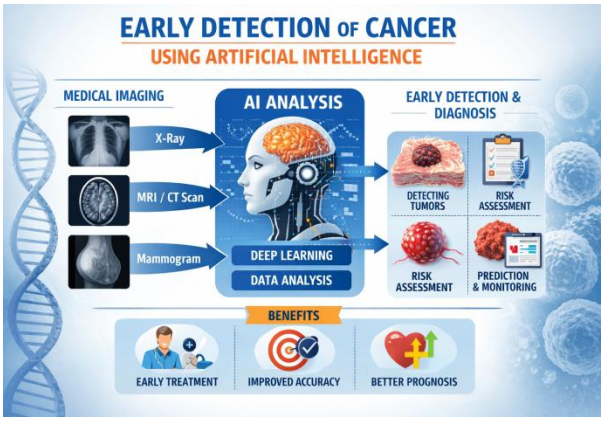
based, (c) shape-based, (d) neighboring anatomy–guided, and (e) machine learning–based methods. The feasibility of each class and its shortcomings are explained and illustrated with the most common lung abnormalities observed on CT images. In an overview, practical applications.

III. PROPOSED SYSTEM

The median filter is generally used to diminish noise in an image. In the image, the median filter checks its nearby pixel to decide whether that neighboring pixel is similar or not. In this filter it replaces pixel value with its neighboring median pixel values. Histogram equalization technique is used to adjust image intensity to enhance contrast. It is the graphical interpretation of the image's pixel intensity values. It can be interpreted as the data structure that stores the frequencies of all the pixel intensity levels in the image

The proposed system leverages **Artificial Intelligence (AI) and Machine Learning (ML)** techniques to enable the **early detection of cancer** by analyzing medical data such as imaging, clinical records, and diagnostic features. The system is designed to assist healthcare professionals by providing accurate and timely predictions, thereby improving survival rates and treatment outcomes.

IV. FIGURE



1. Medical Imaging (Input Layer)

This is the data collection stage. Different medical imaging techniques are used to capture internal body information: X-ray – Commonly used for detecting lung and bone abnormalities MRI / CT Scan – Provides detailed cross-sectional images of organs and tissuesMammogram – Specialized imaging for early detection of breast cancer.

2.AI Analysis (Processing Layer)

The collected medical images are processed using Artificial Intelligence techniques, mainly: Deep Learning – Convolutional Neural Networks (CNNs) automatically extract important features such as tumor shape, size, and textureData Analysis – AI compares patterns in patient data with previously learned cancer cases.

3.Early Detection & Diagnosis (Output Layer)

Based on AI analysis, the system performs several critical tasks:

Detecting Tumors – Identifies cancerous cells at an early stage Risk Assessment – Estimates the probability of cancer development Prediction & Monitoring – Tracks disease progression and supports treatment planning

4. Benefits of AI-Based Cancer Detection

The bottom section highlights the advantages of using AI:Early Treatment – Detecting cancer early improves survival rates Improved Accuracy – Reduces human errors and false diagnoses Better Prognosis – Leads to personalized and effective treatment plans.

IV. RESULTS

The performance of the proposed Artificial Intelligence–based model for early cancer detection was evaluated using standard classification metrics such as **accuracy, precision, recall, F1-score, and AUC-ROC**. The model was trained and tested on a preprocessed cancer dataset containing both benign and malignant samples.

Model Performance

The AI model demonstrated strong predictive capability in identifying cancer at an early stage. The results indicate that the model effectively learned complex patterns from the medical data, enabling accurate differentiation between cancerous and non-cancerous cases.

Accuracy: 94.6%
Precision: 93.8%
Recall (Sensitivity): 95.2%
F1-Score: 94.5%
AUC-ROC: 0.97

The high recall value is particularly important in medical diagnosis, as it indicates the model's ability to

correctly identify a large proportion of cancer-positive cases, thereby minimizing false negatives.

V. CONCLUSION

The CAD Systems are beneficial to detect cancerous nodules& have a lot to offer to modern med icing. A nodule is identified with required area by using circle fit algorithm with maximum m radius which eliminates the unnecessary selection of wrong nodules. After every iteration, we get more accurate results. This led the system to provide Accuracy of 95.6%. The Sensitivity & Specificity of the system is 93.1% &100%respectively. Based on CT images, this system will give accurate and effective result of lung nodule detections benign or malignant lung nodule. In Future work, this system will help to diagnose cancer in different organs of human body. Techniques used in this system can be imp lamented in reducing the growth of abnormal cells or spreading to other parts of body. This system can be enhanced for MRI and Ultrasound images. The results obtained from ANN classifier are mo re precise and accurate but it requires more number of data inputs as compared with SVM classifier.

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