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# Lung cancer detection using CNN

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*Abstract : The analysis and study of lung diseases has been the most intriguing investigation zone of medical experts from early days to the present day. The lung cancer detection project is an innovative solution that utilizes advanced convolutional neural network (CNN) algorithms to enable early and accurate detection of lung cancer. By analyzing medical images, the project aims to address the challenges of late-stage diagnosis, misdiagnosis, and limited accessibility to screening facilities. The unique features of the project include real-time on-site screening using Raspberry Pi, automated image analysis, seamless integration with existing healthcare systems, and a user-friendly interface. The project holds promise in improving patient outcomes by facilitating timely interventions and personalized treatment plans. With its potential to enhance the efficiency, accuracy, and accessibility of lung cancer detection, the project has significant implications for the healthcare industry and the well-being of individuals at risk of lung cancer. To put it concisely, machine learning approach can give an unprecedented opportunity to improve decision support in lung cancer treatment at low cost.*

***IndexTerms*– CNN, Image processing, Lung cancer, Raspberry pi.**

## I. Introduction

Lung cancer is one of the leading causes of cancer-related deaths worldwide, with a high mortality rate due to late detection and lack of effective treatment options. In the fight against lung cancer, early detection is the key to saving lives. Our groundbreaking project combines the power of Convolutional Neural Networks (CNN) and the versatility of Raspberry Pi to revolutionize the way lung cancer is detected. By leveraging advanced image analysis techniques and on-site screening capabilities, we are paving the way for accurate, efficient, and accessible lung cancer detection. for developing automated systems for medical image analysis, including the detection of lung cancer. Convolutional Neural Networks (CNN) have shown remarkable performance in image classification and object detection tasks, making them a promising approach for detecting lung cancer from medical images such as CT scans.

## II. LITERATURE REVIEW

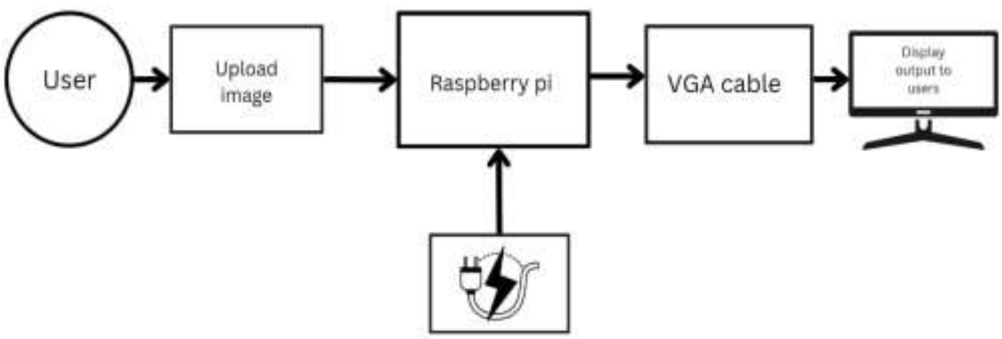
Anuradha D. Gunasinghe; Achala C. Aponso; Harsha Thirimanna, “Early Prediction of Lung Diseases” [1]- In this research it is stated that one of the primary causes of death is lung illness. Early diagnosis and prediction of lung disorders are now essential in research since they can help with the subsequent clinical care of patients. A decision support system built on machine learning helps doctors make decisions about their diagnoses. The project took into account patients' breathing issues as well as those caused by lung cancer, asthma, chronic obstructive pulmonary disease (COPD), tuberculosis, and pneumothorax. Yet, the majority of the time, a chatbot's knowledge is preserved in a database that a human expert created. Initially, study and analyse the data set, then apply Machine Learning and Deep Learning to forecast if the patient has a lung illness or not.

K.S. Devan; P.A. Venkatachalam; A.F.M. Hani, "Expert system with an embedded imaging module for diagnosing lung diseases" [2]-In this study, it appears that Lung problems are among the leading causes of death worldwide. If the diseases can be discovered in their early stages, the survival percentage will increase. Complex lung disease diagnosis frequently necessitates the use of sophisticated diagnostic imaging techniques including X-rays, MRI, CT Scan, etc. The majority of radiologists and medical consultants are located in large hospitals in cities, making them difficult to find in rural areas. This work has constructed a rule-based expert system with an embedded image module. This approach can help general practitioners identify lung problems early. For the analysis of chest X-ray pictures, a fuzzy inference system (FIS), imaging functions, and a modified greyscale top hat function are integrated into a chest X-ray image processing tool.

Shubhangi Khobragade; Aditya Tiwari; C.Y. Patil; Vikram Narke, "Automatic detection of major lung diseases using Chest Radiographs and classification by feed-forward artificial neural network" [3]- This study article apprised that initial requirement for identifying lung illnesses is a chest radiograph. Lung disorders include tuberculosis, pneumonia, and lung cancer pose serious health risks. According to a recent WHO report, millions of people die each year as a result of lung disorders that are detected too late. The death rate can be reduced by early detection of certain disorders. In order to identify lung diseases like tuberculosis, lung cancer, and pneumonia, this research suggests lung segmentation, lung feature extraction, and lung disease categorization using artificial neural networks. To identify lung boundaries, we have applied straightforward image processing approaches including the intensity-based method and the discontinuity-based method. It extracts geometrical and statistical properties. Major lung disorders can be detected by image classification using feed forward and back propagation CNN.

## III. RESEARCH METHODOLOGY

### 3.1 SYSTEM ARCHITECTURE




The project focuses on lung cancer detection using a Convolutional Neural Network (CNN) implemented on a Raspberry Pi. The process begins with a dataset of lung images, which are fed into the Raspberry Pi. The Raspberry Pi reads each pixel value and converts the images to RGB format for further processing. User feds input image to model trained on raspberry pi which is powered by charger and the output whether the stage is normal, benign or malignant is displayed on monitor with the help of VGA cable.

3.2 METHODOLOGY

• **Image processing:**

Image preprocessing techniques are applied to enhance the quality, analyze, and extract information from digital images. Several libraries and frameworks in Python provide comprehensive support for image processing tasks. Some commonly used libraries are PIL(python image library), OpenCV(Open Computer vision), Scikit images , numpy.

Images undergo preprocessing to improve their quality by correcting distortions, reducing noise, and adjusting color balance. Image enhancement techniques are then applied to improve the visual appearance by adjusting contrast, brightness, and sharpness

.• **Segmentation**:

The lung images are subjected to segmentation techniques to isolate the lung region or specific area of interest. This step involves identifying and separating the lung area from the background and other non-lung structures. The result is a segmented image that contains only the lung region or the targeted structures.

• **Feature extraction:**

Once the lung region or structures are segmented, feature extraction is performed on the segmented image. Various techniques and algorithms are used to extract meaningful features from the segmented region. These features capture relevant information about the shape, texture, intensity, or other characteristics of the segmented structures.

• **Model training and CNN :**

Model is trained using a machine learning model, CNN a classification algorithm, such as a convolutional neural network (CNN), is applied to classify the lung images into benign, malignant, or normal categories. The CNN model is trained using libraries like TensorFlow and Keras, leveraging the power of deep learning algorithms to learn patterns and identify cancerous regions in the lung images.CNNs consist of multiple layers, including convolutional layers, pooling layers, and fully connected layers. . CNNs excel at capturing spatial hierarchies and local patterns in images, making them well-suited for image classification tasks. The network learns to recognize and discriminate between different image features at different levels of abstraction. While training the model we provided a total of 4000+ lung images where we landed up with 90% model ouput accuracy during training process.

• **Model Output :**

The extracted features are used as inputs to the classification model, which has been trained on a labeled dataset to learn the patterns and characteristics associated with each class. The classification model assigns a probability or confidence score to each class, indicating the likelihood of the image belonging to that category. The model learns the patterns and relationships between the extracted features and the corresponding classes during the training process. The architecture is designed to automatically learn and extract relevant features from input images through the application of convolutional filters. The learned features are then fed into fully connected layers, followed by a final classification layer that outputs the predicted class probabilities.

In the context of lung cancer detection using CNN, the CNN model is trained to classify lung images into different cases like benign, malignant or normal .

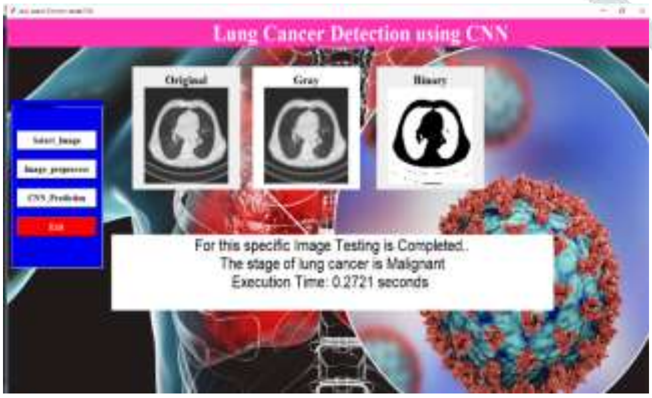
• **Model Testing :**

Testing the model involves evaluating its performance on a separate set of images that were not used during the training phase. The testing phase helps assess the model's ability to generalize and make accurate predictions on unseen data.The model is used to predict the classes of the test images, and performance metrics such as accuracy, precision is calculated. The results provide insights into the model's ability to classify lung images accurately.

## IV. RESULTS

4.1 HARDWARE IMPLEMENTATION


4.2 IMAGE PROCESSING RESULT




4.3 CNN RESULT

## V. CONCLUSION

In conclusion, the lung cancer detection project utilizing CNN and Raspberry Pi offers a promising solution for early detection and classification of lung cancer. By leveraging image processing techniques, including segmentation and feature extraction, the project effectively analyzes lung CT scan images. The project's objectives of improving early detection, reducing misdiagnosis, and facilitating timely treatment align with the pressing need to combat lung cancer. The successful implementation of this project holds the potential to significantly improve patient outcomes and save lives. The trained model has achieved 90% accuracy in training process. The trained model demonstrates the ability to closely ,accurately classify lung images into benign, malignant, or normal stages, providing valuable insights for medical professionals.

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