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Smart Lung Cancer Detection System using Deep Learning and CT Image Databases

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ABSTRACT: A Lung cancer detection is critical because late diagnosis and delays in manual analysis often lead to high mortality rates. To address this problem, the proposed system uses a Convolutional Neural Network (CNN) based deep learning approach to analvze lung images and improve the accuracy of detection. In this system, image preprocessing techniques are applied to enhance the quality of the images, which helps in better feature extraction and increases the reliability of the classification process. The trained CNN model analyzes the processed lung images and determines whether cancer is present or not. After the detection process, the output is transmitted to a microcontroller and displayed on an LCD screen. enabling real-time monitoring of the results. This system aims to support faster and more accurate lung cancer detection, assisting medical professionals in early diagnosis and improving patient outcomes.

KEYWORDS: power supple Arduine NANO LCD display

I. INTRODUCTION

Lung cancer is one of the most life-threatening diseases, making early and accurate diagnosis extremely important. Traditional diagnostic techniques rely heavily on expert analysis, which can increase both the time required and the risk of human error. With advancements in technology, image processing and deep learning have emerged as effective solutions for automated and reliable diagnosis. In particular, Convolutional Neural Network (CNN)-based models enable efficient feature extraction and learning from lung images, improving the accuracy of cancer detection.

II. OBJECTIVES

The objective of this project is to design an automated lung cancer detection system using image processing and deep learning techniques. It aims to implement a Convolutional Neural Network (CNN) model for the accurate classification of lung images into normal and cancerous cases. Additionally, the system is developed to interface the detection results with a microcontroller for real-time processing and control. Finally, the outcomes of lung cancer detection are displayed clearly on an LCD, enabling quick and easy medical interpretation.

III. PROBLEM STATEMENT

Late detection of lung cancer significantly reduces patient survival rates worldwide. Manual interpretation of lung images is time-consuming and often prone to human error, which can affect diagnostic accuracy. Additionally, advanced diagnostic systems are expensive and not easily accessible in rural or low-resource areas. Therefore, there is a strong need for an automated, low-cost, and real-time lung cancer detection system to improve early diagnosis and make healthcare more accessible.

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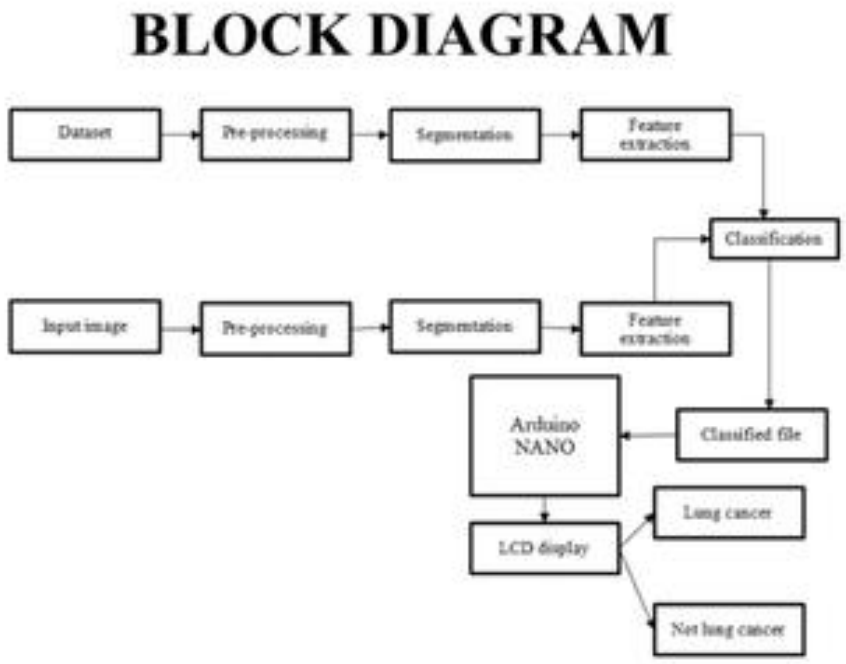
IV. PROPOSED SYSTEM

The proposed system utilizes CNN-based deep learning techniques for automated lung cancer detection. Image preprocessing is applied to improve clarity and enhance the extraction of relevant features, thereby increasing the accuracy of the detection process. The detection results are then transferred to a microcontroller for system-level integration. Finally, an LCD display is used to provide real-time visualization of the cancer detection outcomes.

V. BLOCK DIAGRAM



VI. DESIGN AND SELECTION OF COMPONENTS

MICROCONTROLLER (Arduino Nano) :
The microcontroller acts as the central processing unit of the system. It receives the classification results from the deep learning model and controls the overall operation. It manages communication between different components and ensures proper functioning. It plays a key role in displaying the final detection result.

DATASET:
The dataset contains lung CT scan or X-ray images used to train the model. It helps the system learn patterns related to lung cancer. A well-structured dataset improves the accuracy of detection. It is essential for building a reliable deep learning model.

LCD DISPLAY
The LCD display shows the final result to the user. It provides real-time output such as “Lung Cancer” or “Not Lung Cancer.” It is easy to read and improves user interaction

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SOFTWARE REQUIREMENTS

• ARDUINO IDE – Arduino Programming

Arduino IDE is an open-source software used to write, compile, and upload code to Arduino microcontrollers. It supports C/C++-based programming and is widely used for developing embedded systems, hardware interfacing, and real-time applications.

• Python Language

Python is a high-level, easy-to-learn programming language known for its simplicity and readability. It is widely used in data analysis, machine learning, artificial intelligence, and automation, making it suitable for tasks like image processing in medical applications.

• Front End (HTML, CSS)

HTML (HyperText Markup Language) is used to structure web pages, while CSS (Cascading Style Sheets) is used to style and design them. Together, they create user-friendly interfaces for displaying data and results in web-based applications.

• Back End (MySQL)

MySQL is a relational database management system used to store, manage, and retrieve data efficiently. It is commonly used in backend development to handle large amounts of structured data, such as patient records and detection results in healthcare systems.

VII. RESULTS AND ANALYSIS

The proposed lung cancer detection system using CNN successfully classifies CT images into normal and cancerous cases with improved accuracy. Image preprocessing enhances feature extraction, and the results are displayed in real-time using an Arduino and LCD. The system reduces manual errors and provides faster diagnosis compared to traditional methods, making it cost-effective and suitable for real-time applications. However, its performance depends on the quality of training data and may face challenges such as data imbalance and overfitting.

VIII. CONCLUSION

The proposed smart lung cancer detection system using CNN-based deep learning provides an efficient and reliable solution for early diagnosis by accurately classifying lung images and reducing dependence on manual analysis. Image preprocessing enhances feature extraction, while the integration of a microcontroller and LCD enables real-time result display, making the system practical and user-friendly. Overall, it offers a cost-effective, fast, and automated approach compared to traditional methods, with strong potential for healthcare applications, especially in resource-limited areas, and can be further improved with larger datasets and advanced technologies.

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