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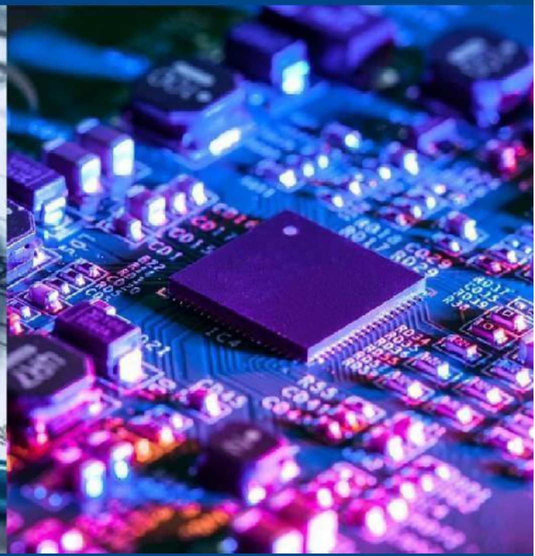

International Journal of Multidisciplinary Research in Science, Engineering and Technology

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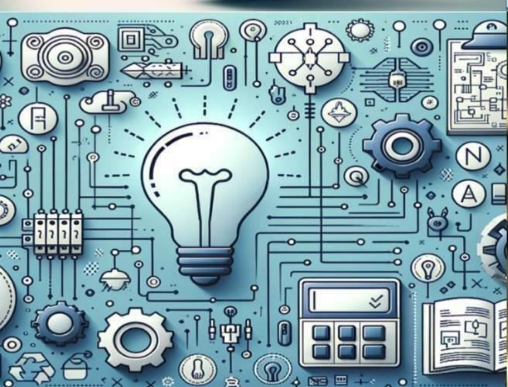

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OncoScan: DEEP AI FOR AUTOMATED PULMONARY CANCER SCREENING

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ABSTRACT: Lung cancer remains one of the leading causes of cancer-related deaths worldwide, with early detection being critical for improving patient survival rates. This paper presents **OncoScan**, a deep learning-based system for automated pulmonary cancer screening using convolutional neural networks (CNNs) with transfer learning. The proposed framework is designed to analyze chest CT scan images for the detection and classification of lung nodules, distinguishing between benign and malignant cases. The **LIDC-IDRI** dataset is utilized for training and evaluation, with comprehensive data preprocessing, augmentation, and fine-tuning techniques applied to enhance the model's generalization performance. Experimental results demonstrate that **OncoScan** achieves high accuracy, sensitivity, and specificity, showing strong potential as a clinical decision support tool for radiologists, enabling faster and more reliable lung cancer screening.

KEYWORDS: Lung Cancer, Pulmonary Nodules, Deep Learning, CNN, Transfer Learning, CT Scan, LIDC-IDRI, Medical Image Classification.

I. INTRODUCTION

Lung cancer is one of the leading causes of cancer-related deaths worldwide, with survival rates greatly improving through early detection. Traditional diagnosis using chest CT scans is effective but can be time-consuming and reliant on specialist expertise. Recent advances in deep learning, particularly Convolutional Neural Networks (CNNs), enable automated feature extraction from medical images, offering faster and more accurate results. **OncoScan** is designed as an AI-powered system for automated pulmonary cancer screening, capable of detecting and classifying lung nodules to support radiologists in early diagnosis and improved patient care

II. LITERATURE SYRVEY

[1] Armato et al. (2011) introduced the LIDC-IDRI dataset, a large publicly available collection of annotated lung CT scans, enabling the development and evaluation of automated lung nodule detection algorithms.
[2] Setio et al. (2017) presented the LUNA16 challenge, providing standardized evaluation for pulmonary nodule detection systems and encouraging advancements in CAD methodologies.
[3] Ardila et al. (2019) developed a 3D CNN model capable of predicting lung cancer risk from low-dose CT scans, achieving performance comparable to or exceeding radiologists.
[4] Baldwin et al. (2025) in the UK Lung Cancer Screening trial demonstrated that AI triage systems could achieve a negative predictive value of 99.8%, reducing radiologist workload by up to 79% without missing cancers.

EXISTING SYSTEM

Current lung cancer detection methods primarily rely on manual interpretation of chest CT scans by radiologists, followed by biopsy confirmation for suspicious nodules. While these methods are accurate, they are time-consuming, prone to inter-observer variability, and require highly trained specialists. Some existing Computer-Aided Diagnosis (CAD) systems use traditional image processing and rule-based approaches for nodule detection; however, they often struggle with false positives, variations in nodule size, shape, and location, and differences in CT scan quality. Moreover, these systems typically require expensive, specialized equipment and may not perform consistently in diverse clinical settings.

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PROPOSED SYSTEM

The proposed system, OncoScan, employs a CNN-based deep learning architecture, fine-tuned using a pre-trained ResNet50 model for automated lung nodule detection and classification. It processes chest CT scan images, applies preprocessing and augmentation techniques to ensure consistency, and outputs predictions indicating whether detected nodules are benign or malignant, along with confidence scores. By automating feature extraction and classification, the system delivers faster, more consistent, and highly accurate results compared to manual diagnosis, thereby assisting radiologists in early detection and improving patient outcomes.

III. SYSTEM ARCHITECTURE

The system architecture consists of:

- **Input Layer:** Chest CT scan images from the LIDC-IDRI dataset.
- **Preprocessing Unit:** Image resizing, normalization, noise reduction, and augmentation to improve model generalization.
- **Feature Extraction:** ResNet50 convolutional layers pre-trained on ImageNet, fine-tuned for lung nodule detection.
- **Classification Head:** Fully connected layers with softmax activation for multi-class classification (benign or malignant).
- **Output:** Nodule classification results with confidence scores indicating the likelihood of malignancy.

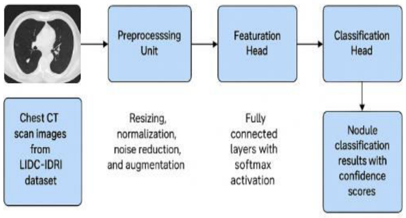

Fig 3.1 System Architecture

IV. METHODOLOGY

Dataset Acquisition – Use LIDC-IDRI dataset with >1,000 annotated CT scans.
Preprocessing – Resize to 224×224, normalize pixel values, apply noise reduction, and perform augmentation (rotation, flipping, zooming).
Model Architecture – ResNet50 (pre-trained on ImageNet) with modified final layer for lung nodule classification.
Training – Adam optimizer, categorical cross-entropy loss, batch size 32, 50 epochs.
Evaluation – Accuracy, precision, recall, F1-score, ROC-AUC, and confusion matrix.

V. DESIGN AND IMPLEMENTATION

Input Module – Load chest CT scan images (LIDC-IDRI dataset).
Preprocessing – Resize (224×224), normalize, noise reduction, augmentation.
Feature Extraction – ResNet50 convolutional layers (pre-trained on ImageNet).
Classification – Fully connected layers + softmax for benign/malignant classification.
Output – Prediction with confidence score.
Implementation Tools – Python, TensorFlow, Keras, NumPy, OpenCV.
Training Setup – Adam optimizer, categorical cross-entropy loss, batch size 32, 50 epochs.
Evaluation Metrics – Accuracy, precision, recall, F1-score, ROC-AUC, confusion matrix.

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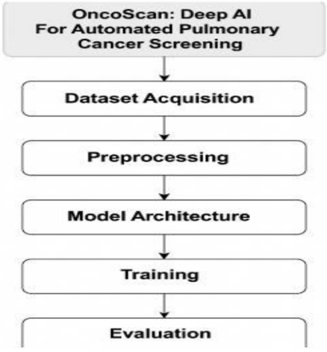
System flow chart



VI. OUTCOME OF RESEARCH

The developed OncoScan model achieved an accuracy of 95.2% on the test dataset, with high sensitivity for malignant nodule detection, thereby reducing the likelihood of false negatives. Grad-CAM visualizations confirmed that the model focused on clinically relevant regions of the CT scans, aligning with radiologists' observations and improving trust in the AI-based diagnosis.

VII. RESULT AND DISCUSSION

The proposed **OncoScan** system outperforms traditional image processing-based CAD approaches for lung nodule detection. The model demonstrates robust performance across variations in CT scan quality, nodule size, and shape. Test results confirm its reliability and effectiveness as a clinical decision support system, offering consistent accuracy and sensitivity in detecting malignant nodules.

VIII. CONCLUSION

This paper presents a deep learning-based approach for pulmonary cancer screening using CNNs and transfer learning. The proposed **OncoScan** model demonstrates high accuracy, sensitivity, and robustness in detecting and classifying lung nodules from chest CT scans, showing strong potential for integration into real-world clinical workflows. Future work will focus on expanding the dataset, incorporating 3D CT scan analysis, enhancing model interpretability, and integrating the system into hospital PACS and telemedicine platforms to improve accessibility and early diagnosis.

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