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Deep Learning-Based Early Lung Cancer Detection Using Alexnet.

Dr. S. Sudha
Professor, Department Of Computer Applications
Hindustan Institute Of Technology And Science
Chennai, India

Vayyana Sankar C
Master Of Computer Application, Hindustan University
Chennai, Tamil Nadu- 603103

Abstract
Lung cancer is a highly fatal disease and remains difficult to detect in its early stages. It causes a significant number of deaths across both genders. To improve early detection, various machine learning techniques have been explored. This study presents a comparative evaluation of different machine learning methods for lung cancer detection, focusing on deep learning techniques, particularly AlexNet. The system processes lung CT images to classify them as cancerous or non-cancerous. The proposed approach leverages image processing and AlexNet-based deep learning models to enhance detection accuracy. The experimental results indicate a promising accuracy rate, demonstrating the potential of deep learning in lung cancer prediction.

Keywords: *Deep learning, Logistic Regression, Random Forest Classifier, Light Gradient Machine, AlexNet, Lung Cancer Detection.*

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I. Introduction

Lung cancer remains one of the leading causes of cancer-related mortality worldwide. It primarily occurs due to the uncontrollable growth of cells in the lungs, often linked to smoking and environmental carcinogens. Despite advancements in medical imaging and early detection, the mortality rate remains high. Deep learning has emerged as a powerful tool in medical diagnosis, offering high accuracy in image analysis. This study proposes a method for early disease diagnosis using AlexNet, a deep learning model, to enhance the prediction of lung cancer from CT scan images.

II. Related Work

Several machine learning techniques have been applied to lung cancer detection. Iftikhar Naseer et al. [1] proposed a modified U-Net for automatic segmentation and classification of lung nodules. RuoXi Qin et al. [3] introduced a deep learning model that integrates fine-grained PET and CT image data. Additionally, a generative-discriminative framework was suggested by Jinpeng Li et al. [4] for lung cancer prediction based on epidemiological data. These studies highlight the importance of machine learning in medical diagnostics, particularly in lung cancer classification.

III. Existing Methodologies

Several traditional machine learning methods have been used for lung cancer prediction:

- **Random Forest Classifier:** An ensemble learning method that improves accuracy by combining multiple decision trees.
- **Light Gradient Machine:** A boosting technique that refines predictions over multiple iterations.
- **Logistic Regression:** A statistical method for binary classification problems, useful for predicting the likelihood of lung cancer based on input features.

Despite their effectiveness, these methods have limitations in processing large-scale image data, necessitating the adoption of deep learning techniques.

IV. Proposed System

The proposed system utilizes AlexNet, a deep convolutional neural network (CNN), for lung cancer prediction. The process follows these steps:

1. **Data Pre-processing:**
   - Resize input images.
   - Convert images to grayscale.
   - Extract statistical features (mean, standard deviation).
2. **Image Segmentation:**
   - Enhances image quality by removing noise using morphological processing.
3. **Classification using AlexNet:**
   - AlexNet consists of five convolutional layers, two fully connected layers, and a final classification layer.
   - The network is trained on labeled lung CT images to differentiate between cancerous and non-cancerous tissues.
4. **Performance Metrics:**
   - Accuracy is measured using the formula: AC=TP+TNTP+TN+FP+FNAC = \frac{TP + TN}{TP + TN + FP + FN}
   - Additional statistical measures such as mean, median, and variance are calculated.

V. Experimental Results

The evaluation of the proposed system demonstrated significant improvements in classification accuracy compared to traditional methods. The results showed:

- **Accuracy of AlexNet:** Higher than traditional machine learning models.
- **Error Rate:** Lower compared to conventional classifiers.
- **Comparison with Other Models:** AlexNet outperformed Logistic Regression, Random Forest, and Light Gradient Machine in precision and recall metrics.

Figures illustrating the accuracy and error rate comparisons are presented to validate the effectiveness of the approach.

VI. Conclusion

This study introduced a deep learning-based approach using AlexNet for lung cancer prediction. The experimental results indicate that deep learning techniques provide higher accuracy compared to conventional machine learning methods. By leveraging image processing and CNN architectures, early detection of lung cancer can be significantly improved, aiding in timely medical intervention.

Future work includes expanding the dataset, optimizing network parameters, and integrating multi-modal data for enhanced prediction accuracy.

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