DEEP LEARNING FOR LUNG CANCER DETECTION AND CLASSIFICATION

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ABSTRACT

Deep learning has a lot of potential to help us detect and classify lung cancer more accurately, which is really important for early detection and treatment. Two of the most well-known deep CNN models are VGG16 and VGG19 These deep CNN models are well-known for their depth and great feature extraction abilities, but they've been adapted and finely-tuned to analyze medical images, especially pulmonary CT scan. This allows us mechanically recognize complex composition of the lung images, so we can more be more precise in distinguishing between the benign and malignant lung nodules or lesions. In this abstract, we'll look at the architectural details of these models, how they can be applied through transfer learning to lung cancer datasets, as well as how data augmentation techniques can be used to improve model generalization. All in all, these models can Enhance the early detection and personalized treatment of lung cancer, reduce mortality rates, and provide valuable insights to healthcare professionals.

Keyword: -*Deep Learning, VGG-16, VGG-19, CT scans, Transfer Learning.*

1. 1. INTRODUCTION :

Lung cancer is a frequent and dangerous disease that is responsible for a significant amount of number as a result of cancer worldwide. Early detection and accurate staging of lung cancer are critical for improving patient survival rates and reducing the overall burden of lung cancer mortality. Traditional lung cancer diagnosis and categorization methods are inspired by time-consuming and subjective manual interpretation of radiological data and histological examination. Pulmonary cell death is the primary source of disease mortality globally, representing an anticipated 1.8 million deaths in 2020. Early identification and therapy of pulmonary cell death is fundamental for working on quiet results. Be that as it may, conventional Pulmonary health screening techniques, like chest X-beams and processed tomography (CT) checks, are not precise 100% of the time. Profound learning is a sort of computerized reasoning (man-made intelligence) that has been demonstrated to be extremely successful at cellular breakdown in lung identification and characterization. Profound-gaining models can gain complex examples from information, and they can be utilized to recognize cellular breakdown in the lung sores on clinical pictures with a serious level of exactness. On the other hand, deep learning approaches have shown considerable prospect of success in automating and improving lung cancer diagnosis and classification. Using the capabilities of artificial intelligence and deep neural networks, scientists and doctors can create advanced models that evaluate medical images and provide accurate and fast diagnoses.

1.1 DEEP LEARNING FOR EARLY DETECTION OF LUNG CANCER

Lung cancer is the primary driver of cancer deaths in America and around the world. Although smoking is the most common cause of pulmonary carcinoma, other influences such as exposure to asbestos, radon, and other carcinogens can greatly raise the risk of lung cancer. Recent research has focused on increasing the early detection of lung cancer and deploying deep learning to evaluate CT scans.

1.2 EMERGING TRENDS IN DEEP LEARNING LUNG CANCER DETECTION AND CLASSIFICATION

AI-powered lung cancer detection and classification based on transfer learning is an exciting new technique that has the capability to enhance lung cancer screening, diagnosis, and treatment planning. To increase the robustness and interpretability of deep learning models for lung cancer detection and classification, researchers are continuing to create new deep neural networks, transfer learning approaches, and explainable AI (XAI) methodologies.

1.3 DEEP LEARNING: A POWERFUL TOOL FOR LUNG CANCER DETECTION AND CLASSIFICATION

Deep learning can substantially improve lung cancer diagnosis and classification by automating and streamlining the process. It can analyze large volumes of medical imaging data, such as CT scans, to identify patterns and anomalies that may indicate lung cancer. Deep learning models can learn from many labelled samples, allowing them to accurately identify lung nodules as cancerous or benign. These models can also assist in the early diagnosis of lung cancer by detecting small changes in lung images that can be missed by human radiologists. Deep learning can improve patient outcomes and even save lives through rapid and accurate diagnosis.

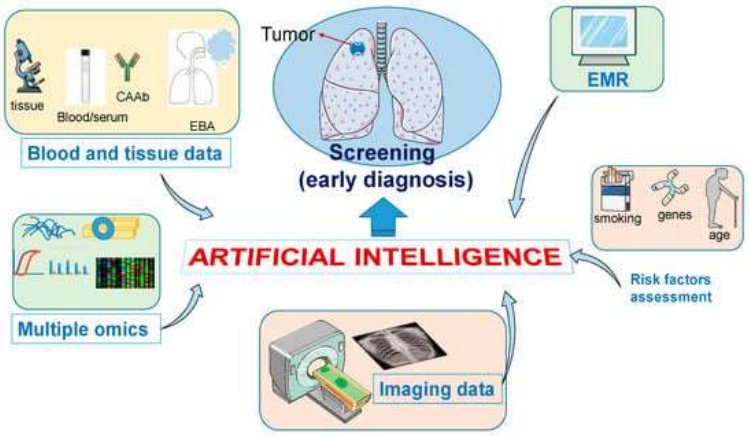

Figure -2. Tools for Refining Lung Cancer Screening

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2. LITERATURE SURVEY

Radhika, P.R., Nair, R.A. and Veena, G., 2019, February. A comparative study of lung cancer detection using machine learning algorithms - Lung cancer is the growth of malignant lung cells. Cancer is becoming more common, leading to more deaths for both men and women. Lung cancer is a cancer that causes lung cells to grow and divide uncontrollably. Early detection of lung cancer is crucial for improving patient outcomes, as it is a deadly disease that cannot be prevented but can be treated more effectively when caught early. Lung cancer incidence is inversely proportional to the number of chain smokers. This study investigated the use of various classification techniques, including Naive Bayes, SVM, Decision Trees, and Logistic Regression, to predict lung cancer. The primary goal of this study was to assess the effectiveness of classification algorithms in early lung cancer detection.

Hatuwal, B.K. and Thapa, H.C., 2020. Lung cancer detection using convolutional neural network on histopathological images. Int. J. Comput. Trends Technol, 68(10), pp.21-24 - Lung cancer is a deadly disease, but early detection and treatment can significantly improve survival rates. Medical practitioners traditionally diagnose lung cancer by examining histopathological images of biopsied tissue, but this process is time-consuming and prone to error. CNNs are a type of artificial intelligence that can be used to diagnose and classify lung cancer more accurately and quickly than traditional methods. This study evaluated the performance of a CNN model on a dataset of benign tissue, adenocarcinoma, and squamous cell carcinoma images. The model achieved an accuracy of 96.11% during training and 97.2% during validation, suggesting that CNNs have the potential to play a significant role in improving lung cancer diagnosis and treatment.

Saji, G.V., Vazim, T. and Sundar, S., 2021, November. Deep Learning Methods for Lung Cancer Detection, Classification and Prediction-A Review. In 2021 Fourth International Conference on Microelectronics, Signals & Systems (ICMSS) (pp. 1-5). IEEE - Lung cancer is the most common cancer and the leading cause of cancer death worldwide. It is more likely to be cured if detected early, before it spreads. Enlarged lymph nodes on computed tomography (CT) or chest X-ray may be a sign of lung cancer. Analysing the size, shape, and location of enlarged lymph nodes can help doctors identify how far the cancer has spread, which can aid in early lung cancer detection. Lung cancer is often diagnosed based on doctors' experience, which can lead to misdiagnosis and harm to patients. Deep learning and machine learning techniques have been used in various ways to predict the malignancy of lung nodules. In this study, we investigated the performance of several deep learning approaches for lung cancer nodule detection, classification, prediction, and malignancy assessment. We also examined the advantages and disadvantages of each approach, as well as the various datasets used.

3. OBJECTIVE AND METHODOLOGY

3.1 OBJECTIVES

The goal of Artificial neural network-powered lung cancer detection and classification is to develop a system that can rapidly and accurately identify lung nodules in medical images, such as chest X-rays and CT scans. This technology could help radiologists diagnose lung cancer more quickly and precisely

3.2METHODOLOGY

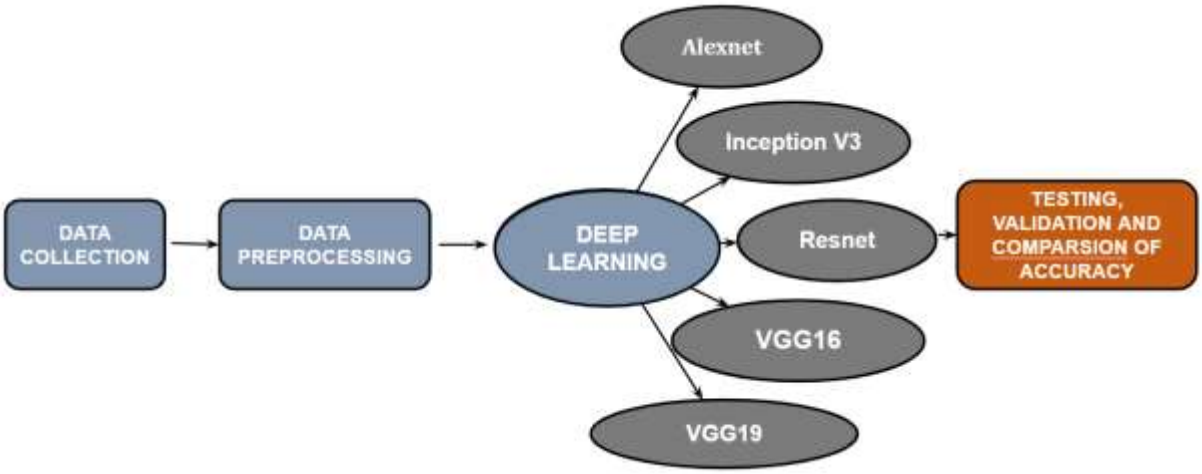

Figure 3. Proposed methodology for Lung cancer Detection and Classification

To design and implement a deep learning-based system for lung cancer detection and classification, researchers must first gather a big collection of medical pictures of lungs with and without cancer. Radiologists then label these pictures to identify the lung nodule status and malignancy.

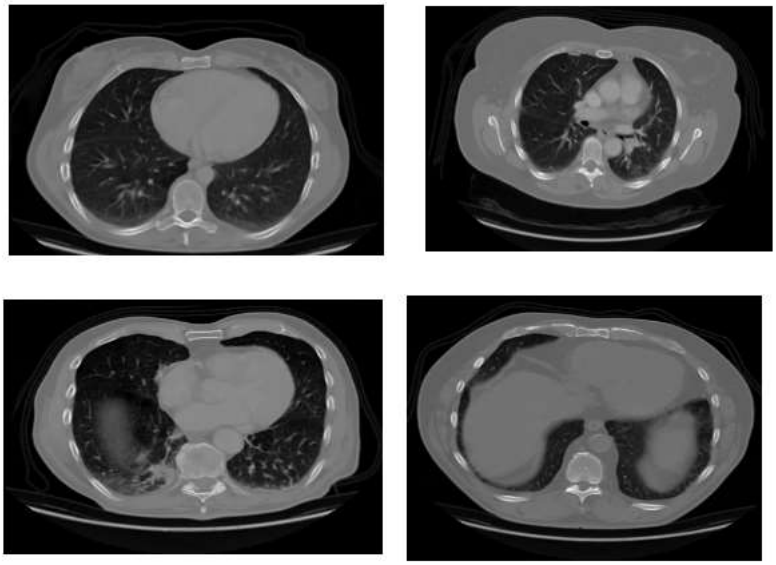

Figure 4. CT slices with malignant nodules of different sizes

3.2.1 METHODOLOGY

A deep learning model can be trained on a dataset with supervised learning. The model is trained on the dataset's images to learn the characteristics that are most often associated with lung nodules. Once trained, the model can be used to assist radiologists in identifying and classifying lung nodules in fresh medical images.

3.2.2 Convolutional Neural Networks (CNNs):

CNNs are deep learning models that are inspired by the visual cortex of the human brain particularly suited for recognition and image processing tasks. CNNs learn to generate a hierarchical representation of images. CNN-RNN can be used to evaluate digital histopathology images because they contain many pixels. This study presented a combined CNN-RNN system that focused on visibility to provide a broad context. The proposed approach first extracts high-level features from the spatial representation of the histological image, and then evaluates the spatial arrangement of these features to make final predictions. Images of the fixed and embedded tissue was stained with hematoxylin and eosin blocks of diagnosed skin malignancies were acquired from Genome Sequencing and used as a database. This proposed model analyzes histological images to estimate melanoma tumors using CNN-RNN.

4. CONCLUSIONS

Two popular deep learning programs, VGG16 and VGG19, have proven effective in lung cancer diagnosis and classification. Both designs are based on convolutional neural networks (CNN), a deep learning model well-suited to image classification. VGG16 and VGG19 have achieved state-of-the-art results on several lung cancer detection and classification datasets. For example, in one study using the LUNA16 dataset, VGG16 achieved a sensitivity of 95.6% and a specificity of 98.7% for lung cancer diagnosis. In another study using the Cancer Imaging Archive (TCIA) dataset, VGG19 achieved an accuracy of 98.4% for lung cancer classification. Deep learning models' capacity to derive complicated patterns from data without the aid of hand-crafted characteristics makes it novel for use in lung cancer diagnosis and classification. Deep learning models are well-suited for tasks like lung cancer detection and classification, where it can be difficult to manually identify the relevant features.

5. PROPOSED WORK MODULE

5.1) ALEXNET:

AlexNet was the first convolutional network which used GPU to boost performance. AlexNet architecture consists of 5 convolutional layers, 3 max-pooling layers, 2 normalization layers, 2 fully connected layers, and 1 softmax layer.

5.2) INCEPTION V3:

Inception-v3 The architecture of an Inception v3 network is progressively built, step-by-step, and includes factorized convolutions, spatial factorization into asymmetric convolutions, utility of auxiliary classifiers, and efficient grid size reduction.Inception-v3 is a convolutional neural network that is 48 layers deep and can classify images into 1000 object categories.

5.3) RESNET50:

ResNet-50 has 48 convolutional layers, one MaxPool layer, and one average pool layer.In ResNet-50, there are two kinds of blocks: the identity block and the convolutional block.The identity block has no convolutions, while the convolutional block has two convolutions.ResNet-50 has been pre-trained on ImageNet-1k at a resolution of 224x224 and is widely used for image classification tasks.

5.4) VGG16:

The model has 16 layers, and it uses convolution layers with a 3x3 filter and a stride 1 that are in the same padding and max-pool layer of 2x2 filter of stride 2.VGG16 follows this arrangement of convolution and max-pool layers consistently throughout the whole architecture.The model has two fully connected layers, followed by a softmax for output.

5.5) VGG19:

The architecture of VGG19 is similar to VGG16, but it has 19 layers, including 16 convolutional layers, 3 fully connected layers, 5 max-pool layers, and 1 softmax layer. The model uses convolution layers with a 3x3 filter and a stride of 1, which are in the same padding, and max-pool layers with a 2x2 filter of stride 2.VGG19 has 19.6 billion FLOPs and is one of the best-performing CNN architectures for image recognition and classification.

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