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Lung Cancer Detection using YOLO CNN Algorithm

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ABSTRACT—

The main objective of this research is, to create a computer vision algorithm which uses the YOLO (You Only Look Once) convolutional neural network (CNN) architecture to identify lung cancer in medical photographs. A series of computed tomography (CT) scan pictures will be used as the input for the proposed method, which will then output the likelihood that lung cancer is present in the input image. The input photos will be subjected to object detection using the YOLO CNN architecture, allowing for the location of possible malignant spots. In order to further refine the discovered areas and categorize them as cancerous or non-cancerous, the output of the YOLO network will be processed through further layers of convolutional neural networks. A sizable collection of CT data will be used to train the suggested method.

Keywords—YOLO, CNN, CT,

I. Introduction

Big data in health has grown over the past few years due to the quick advancement of computer technology and medical data. The use of technology in medicine has become more prevalent in recent years. Numerous domains that merge medical, computer science, biology, mathematics, and other sciences are involved in this technique of employing medicine. It is supported by vast biological data and sophisticated computer technologies. It makes use of artificial intelligence to uncover the underlying principles and physiological causes of human illnesses by examining vast volumes of data. Following that, clinical diagnoses are made using this knowledge, and medical services are provided.

Contrary to conventional machine learning methods, deep learning does not require human feature extraction, which boosts time and resource efficiency. Deep learning is carried out via neural networks, which are composed of neurons. In neural networks, including many neurons in each layer, the input of the following layer is regarded as the upper layer output. The neural network may use nonlinear processing and connections between layers to change the input into the output. More importantly, the high-level network automatically learns more abstract and generalized characteristics from the input, overcoming the limitation that machine learning requires explicit feature extraction.

II. Proposed Methodology

The Model Process Contains 4 Phases of work:

1. Image Preprocessing

2. VGG16 Implementation

3. Comparison of VGG16 with ML Algorithms

4. Deployment of Model in App

1. Image Preprocessing:

The initial stage of our model is this. Our dataset on CT pictures of lung cancer was taken from Kaggle. The data set was divided into three categories: adenocarcinoma, squamous cell carcinoma, and normal.

Test, Train, and Validate categories are used to categorize each sort of cancer cell picture. We executed picture data augmentation procedures including rescale, horizontal flip, and rotation of the photos after resizing them to 350*350.

2. *VGG16 Implementation:*

In addition to the input and output layers, CNN also has a number of hidden layers. An instance of CNN is VGG16. The model's creators studied the networks and increased the depth using an architecture with extremely tiny (3x3) convolution filters, which demonstrated a considerable advancement over the state-of-the-art setups. The depth was raised to 16–19 weight layers, or around 138 trainable parameters.

VGG16 USED FOR-

VGG16 is an object identification and classification approach that, when used to classify 1000 images into 1000 separate categories, has an accuracy rate of 92.7%. It is a popular method for categorizing photos and is easy to use with transfer learning.

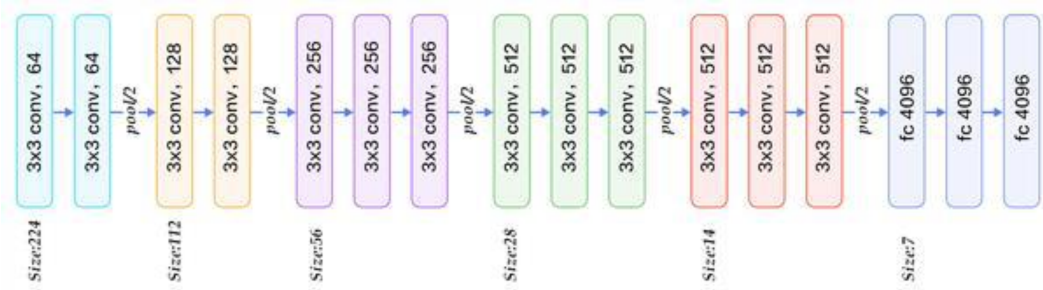

Fig.1.1. VGG16 Architecture

1. In VGG 16, the number 16 denotes 16 weighted layers. VGG16 consists of 21 layers overall—13 convolutional layers, 5 max pooling layers, 3 dense layers—but only 16 of them are weight layers, also referred to as learnable parameters layers.

2. The input tensor for VGG16 has three RGB channels and a size of 224, 244.

3. The unique characteristic of the VGG16 model is that it constantly uses the same padding from a 2x2 filter with a stride 2 and uses a 3x3 filter of convolution layers with stride 1 rather than a lot of hyper-parameters.

4. Both convolution and max pool layers are distributed equally across the design.

5. Conv-1 Layer has 64 filters, Conv-2 Layer has 128 filters, and Inv-3 Layer has 256 filters in Conv-3, and 512 filters in Conv-4 and Conv-5.

6. Three layers of fully connected neural networks are followed by a stack of convolutional layers. The first two layers have 4096 channels each, while the third layer has 1000 channels and performs 1000-way ILSVRC classification. The final layer is a soft-max layer.

3. Comparison of VGG16 with ML Algorithms:

Algorithms constructed: We have constructed the following models:

1. Support Vector Machine (SVM)

2. K-Nearest Neighbours (KNN)

3. Random Forest Classifier (RFC).

We employed numerous ML algorithms and compared their accuracies and various parameters with VGG16 (CNN model).

3. *Deployment of App:*

To use tensor flow converter function libraries to deploy our model in an application, we transformed it to tensor flow light. The app was developed using Android Studio, and after deploying a tensor flow model and using a CT picture as input, it can detect the kind of cancer and display some of its symptoms and therapies. The app also includes information on lung cancer and its many kinds.

III. Merits and Demerits

S. No.	Research Paper	Proposed Method
1.	Deep Learning Predicts Lung Cancer Treatment Response from Serial Medical Imaging	In order to predict lung cancer, this study employed techniques like recurrent neural networks (RNN) and convolutional neural networks (CNN). However, the Paper was only able to look into a particular type of scanner from a single CT provider.
2.	Pancreatic Ductal Adenocarcinoma: Machine Learning Based Quantitative Computed Tomography Texture Analysis For Prediction Of Histopathological Grade	The authors of this work employed the Support-vector +machine (SVM) and Logistic Regression Analysis methods. But, Due to the small number of enrolled patients, overfitting may result. Here, the CT imaging parameters vary.
3.	Lung Cancer Detection: A Deep Learning Approach	In this study, they presented a method for applying deep residual learning to identify lung cancer from CT images. To determine the possibility that a CT scan contains cancer, they combined the predictions from various classifiers, including XGBoost and Random Forest.

Tab. 1.1 Literature survey

Recurrent Neural Network, Logistic Regression Analysis, Support Vector Machine (SVM), and Linear Discriminate Analysis (LDA) are some of the current methodologies utilized for lung cancer prediction.

Recurrent Neural Network

Recurrent neural networks (RNNs), a type of neural network, use the outcome from the previous stages as the input for the following phase. In this scenario when it is important to predict the following word in a phrase, modern neural networks contain separate inputs and outputs. As a result, RNN was created, and it utilized a Hidden Layer to discover a resolution to this issue. The basic and most important property of RNNs is that the hidden state will preserve part of the sequence's information.

Logistic Regression Analysis

Using prior observations from a data set, a statistical analysis method known as logistic regression predicts a binary result, such as yes or no. A logistic regression model predicts a dependent data variable by looking at the association between one or more already existing independent variables.

Support Vector Machine

The classification process uses the ML algorithm SVM. It is an algorithm for supervised learning. SVM is mostly employed to create a hyperplane between two classes that may categorize n-dimensional space. Future datapoint plotting in the appropriate category is simple.

For instance, I need to separate my two courses efficiently. A class can carry out several duties. If you group them according to only one attribute, there could be some overlap, as the graph below shows. As a result, we will continue to add traits to ensure accurate classification. We are obtaining improved accuracy while using the deep learning methodology in comparison to other ML techniques. Our algorithm performs effectively even with smaller data sets since we enhance the supplied dataset with picture data. The model cannot accurately predict the kind of cancer if the CT scan images are not acquired properly or if the image is not clear. Only one CT picture viewpoint is presently supported by the model.

IV. Conclusion

We used machine learning methods in this study and compared the outcomes to the VGG16 model. To find the most effective algorithm for determining if a CT picture contains cancer or not, we calculated the Accuracy and Precision of every machine algorithm as well as the Accuracy of VGG16.This model may be used to forecast real-time CT scans. As a result, we employed Android Studio to create an app for user experience.

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