International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 03 | Mar 2021 www.irjet.net p-ISSN: 2395-0072

Lung Cancer Detection using 3D Convolution Neural Network

Sidakpal Singh[1], Sanket Patil[2], Manas Patil[3],Dr. J.E. Nalavade[4]

[1,2,3]Department of Informtion Technology Engineering, Pillai HOC College of Engineering and Technology, Rasayani, Maharashtra, India
[4]Head of Department,Department of Information Technology Engineering, Pillai HOC College of Engineering and Technology, Rasayani, Maharashtra, India.

Abstract -*Lung cancer happens once cells divide within the lungs uncontrollably. Carcinoma is the third commonest cancer. The employment of routine chest radiographs for the screening has well-tried ineffective, and on reports that false-positive check results are common and may result in a supererogatory worry, testing, and surgery. In this paper, we tend to propose a way to trace cancer nodules in lungs mistreatment Convolutional Neural Network. Dataset used here is LUNA16 that carries with it 754975 sample slides. The CNN is going to be trained until we tend to get loss <0.1.*

Key Words: Lung cancer, Convolutional Neural Network, LUNA16, GoogLeNet, LeNet.

1. INTRODUCTION

Cancer could be a cluster of diseases involving abnormal cell growth with the potential to invade or unfold to different elements of the body. This distinction with benign tumors, that don't unfold. The unfold of cancer ought to be in check to save lots of lives. Carcinoma is the second commonest cancer in each boy and girl. It's conjointly the leading reason behind death from cancer. Most cancers that begin within the respiratory organ, referred to as primary respiratory organ cancers, are carcinomas. The overwhelming majority (85%) of cases of carcinoma square measure because of long-term tobacco smoking. Concerning 10–15% of cases occur in those who haven't preserved. The increasing rate has been declining since the middle Nineteen.

Lung cancer is split into a pair of main types: non-small cell carcinoma and tiny cell carcinoma. These sorts grow and unfold otherwise. Concerning eighty-fifth to ninetieth of respiratory organ cancers are non-small cell. This cancer has three major types: carcinoma, Squamous cell malignant neoplastic disease, massive cell malignant neoplastic disease. They're classified by the type of respiratory organ cell cancer started in and by, however, the cells look below a magnifier. They need slight variations among them. Solely about one in ten to three in twenty individuals with carcinoma have little cell respiratory organ cancer. It's conjointly referred to as oat cell cancer. It's nearly solely found in smokers. It grows and spreads additional quickly than non-small cell carcinoma. It usually spreads to different components of the body at an early stage. Lung cancer, like all cancers, will act otherwise in all and sundry, looking at the type of carcinoma it's and also the stage it's in. However, once carcinoma spreads outside the lungs, it usually goes to an equivalent place. The primary place carcinoma typically spreads to is the lymph nodes within the center of the chest. These lymph node area units referred to as medistinal lymph nodes. Carcinoma might also unfold to the lymph nodes within the lower neck. In its later stages, carcinoma could unfold to distant components of the body, just like the liver, brain, or bones.

A number of things could increase your risk of carcinoma. Some risk factors may be controlled, for example, by quitting smoking. Different factors embrace exposure to secondhand smoke, previous radiation, Exposure to inert gas, family history of carcinoma. The carcinoma may be cured if it's detected at an early stage. During this system, we have used machine learning algorithms to find cancer. We have used a 3D convolutional neural network to enhance the accuracy of the system.

2. METHODOLOGY AND IMPLEMENTATION

A. System Design

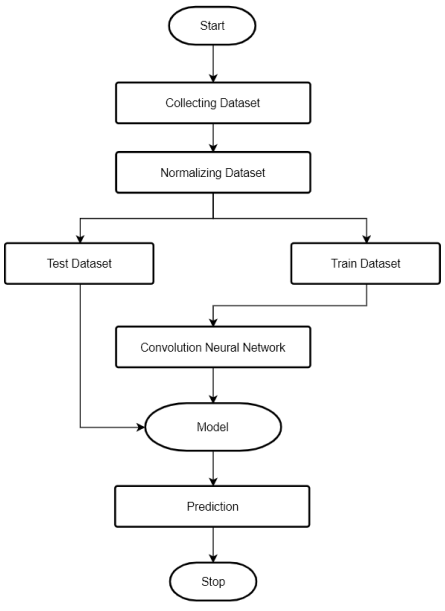

Fig. 1: Proposed System

This projected system uses a convolution neural network for early detection of cancer mistreatment CT Scan pictures. Making an internet-based mostly user interface application that permits the user to move with our carcinoma detection model. Users can ready to input the CT Scan image and to sight, in a period of time whether a patient or user has carcinoma or not. An internet application has been developed to demonstrate a signal of conception. The application needs a user to transfer a CT Scan. The uploading then processes the file and displays the pictures to the user. The user then chooses that scan he or she desires to predict then applying pre-processes the CT Scan and infers the image to the prophetical model. The output of the model is then presented to the user. In this project, the user would be medical professionals who work in identification of carcinoma.

A. Collecting and Normalizing Datasets

In this system, we've used the Luna16 dataset. The Luna16 encompasses 754975 samples.

Machine learning algorithms tend to perform higher or converge quicker once the various options area unit on a smaller scale. So it's required to normalize the info before coaching the machine learning models on that. Standardization additionally makes the coaching method less sensitive to the size of the options. This leads to recuperating coefficients when coaching.

The formula for normalization is:

$$x_{norm} = \frac{x - x_{min}}{x_{max} - x_{min}}$$

B. *Training and Testing Model*

In this system, the model has been trained using Convolution Neural Network Technique. A Convolutional Neural Network is a Deep Learning algorithmic program that may take an input image, assign importance to various objects within the image and be able to differentiate one from the opposite. The pre-processing needed in an exceedingly CNN is way lower in compared to alternative classification algorithms. Whereas in primitive ways filters are hand-engineered with enough training, CNN has flexibility to find out this characteristics.

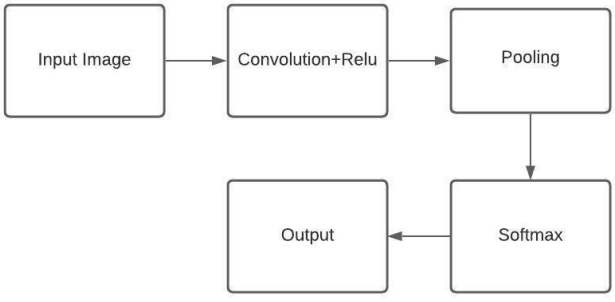

Fig. 2: Convolution Neural Network

In input image, we've got a RGB image that has been separated by its 3 color planes — Red, Green, and Blue. There area unit variety of such color areas during which pictures exist — Grayscale, RGB, HSV, CMYK, etc. You can imagine how computationally intensive things would get once the image reach dimensions, say 8K i.e 7680×4320. The role of the CNN is to cut back the image into a form that is less complicated to method, while not losing options that are a vital for obtaining an honest prediction. This can be necessary once we area unit to style an design that isn't solely smart at learning options however is also accessible to huge datasets.

The convolutional layer computes the convolutional operation of the input pictures exploitation kernel filters to extract elementary options. The kernel filters square measure of an equivalent dimension, however, with smaller constant parameters as compared to the input pictures. The rectified linear activation operate or ReLU for short may be a piecewise linear function which will output the input directly if it's positive, otherwise, it'll output zero. It has become the default activation function for many types of neural networks because a model that uses it is easier to train and often achieves higher performance.

The pooling layer is answerable for reducing the spacial size of the convolved feature. This is often used to decrease the computational power needed to method the data through spatial property reduction. Also, it's helpful for extracting dominant features which square measure movement and point invariant, therefore maintaining the method of effectively training of the model. There are 2 varieties of Pooling layer i.e Max pooling, Average pooling.

Max pooling: Max pooling may be a pooling operation that selects the utmost part from the region of the feature map lined by the filter. Thus, the output when max-pooling layer would be a feature map containing the foremost outstanding options of the previous feature map. Average pooling: Average pooling computes the common of elements present in the region of the feature map lined by the filter. Thus, whereas max pooling offers the foremost outstanding feature in a very explicit patch of the feature map, average pooling offers the common of options elements present in a very patch.

The softmax function is a generalization of the logistic function to multiple dimensions. It's used in multinomial supply regression and is commonly used as the last activation function of a neural network to normalize the output of a network to a probability distribution over foreseen output categories. Softmax assigns decimal chances for every category in a very multi-class drawback. Those decimal chances should add up to 1.0. This extra constraint helps training quickly than it otherwise would.

GoogLeNet is said to be a 22-layer deep convolutional neural network that's a variant of the origin Network.GoogLeNet is employed for different computer vision tasks like face detection and recognition, adversarial coaching, etc. GoogLeNet design was designed to be a powerhouse with raised machine potency compared to a number of its predecessors or similar networks created at the time. GoogLeNet was the winner at ILSRVRC 2014 taking 1st place in each classification Associate in Nursing detection task. It has top-5 error rate of 6.67% in the winning task.

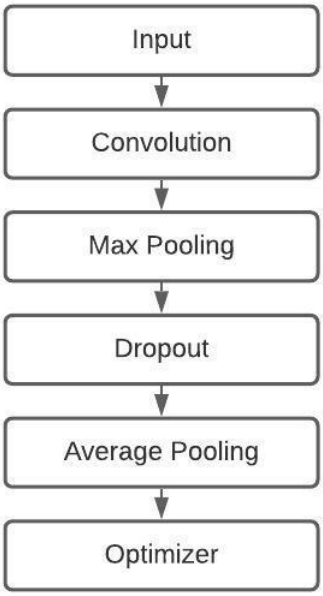

Fig. 3: GoogLeNet Architecture

The LeNet architecture is a very great first architecture for Convolutional Neural Networks. LeNet is small and easy to understand but still it is big enough to provide interesting results. Now, the combination of LeNet and MNIST is able to run on the CPU, making it easy for beginners to take their first step in Deep Learning and Convolutional Neural Networks.

In our proposed system, we have used the LeNet function to predict the stage level of the lung cancer.

3. RESULT

In this system, the user needs to upload the CT scan report. After uploading the image, the system will analyze and then display the cancerous lung nodules if found.

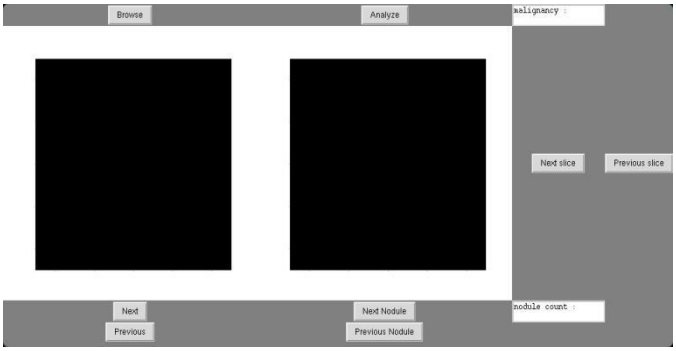

Fig.4: Initial Page

As shown in Fig.4, when the application is executed it allow the user to upload the CT scan report inorder to analyze the report.

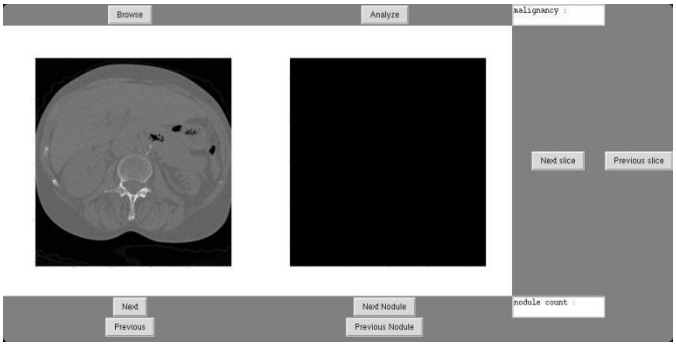

Fig.5: Analyzing Report

The user successfully uploaded the CT scan report as shown in Fig.5. The end-user needs to click the analyze button for determining whether the uploaded CT scan report consists of cancerous nodules or not.
The system will then start analyzing the report using Convolutional Neural Network technique. The report will undergo the process of GoogLeNet architecture and LeNet architecture.

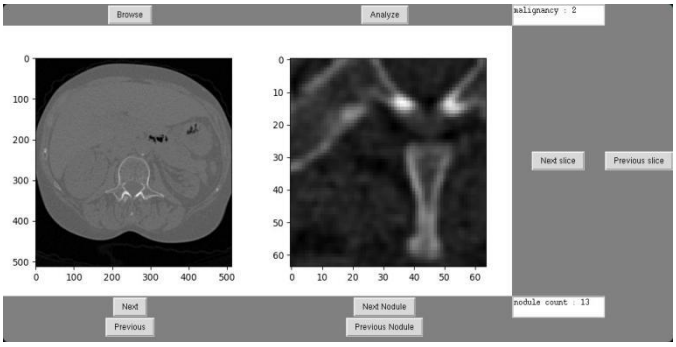

Fig.6: Output Page

After analyzing the CT scan report, the system will show the found lung nodules and respective cancer stage. The user will be allowed to check all the lung

nodules found in the report. The system is capable of accepting 3D CT scan slide for image processing with the help of 3D CNN.

4. CONCLUSION

In this paper, we developed an automatic deep learning based method for early detection of lung nodules containing cancer. We have used GoogLeNet architecture and LeNet architecture which is better than VGG16 and ResNet50 architecture. Using GoogLeNet architecture for CNN, we have achieved a higher accuracy rate for lung nodule detection. The system is capable of analyzing 3D images as input. The CNN layers process the image and analyze each pixel of the image more clearly and detect lung nodules more efficiently. The CNN technique resolves the real time object detection problem.

5. REFERENCES

[1] J. Alam, S. Alam and A. Hossan (2018,February), "Multi-Stage Lung Cancer Detection and Prediction Using Multi-class SVM Classification," Proc. International Conference on Computer, Communication, Chemical, Material and Electronic Engineering, pp. 1-4, 2018.

[2] W. Rahane, H. Dalvi, Y. Magar, A. Kalane and S. Jondhale (2018,March), "Lung Cancer Detection Using Image Processing and Machine Learning HealthCare," Proc. International Conferenceon Current Trends towards Converging Technologies (ICCTCT), Coimbatore, pp. 1-5, 2018.

[3] D. Wong, C. Fang, L. Chen, C. Chiu, T. Chou, C. Wu, S. Chiu, K. Tang (2018,April), "Development of a breath detection method based E-nose system for lung cancer identification," Proc. IEEE International Conference on Applied System Invention (ICASI), Chiba, 2018, pp. 1119-1120, 2018.

[4]Nidhi S. Nadkarni, "Lung Cancer Detection on CT Images using Image Processing", Third International conference on trends in Electronics and Information , IEEE, 2019.

[5]Fatema Tuj Johora, Mehdi Hassan Jony, Parvin Khatun and Humayan Kabir Rana, "Early Detection of Lung Cancer from CT Scan Images Using Binarization Technique",2018.

[6] Wasudeo Rahane, Himali Dalvi, Yamini Magar, Anjali Kalane, Satyajeet Jondhale, "Lung Cancer Detection Using Image Processing and Machine Learning HealthCare" Proceeding of 2018 IEEE International Conference on Current Trends toward Converging Technologies,2018.

[7] Moffy Vas , Amita Dessai, "Lung cancer detection system using lung CT image processing",2018.

[8] Matko Sari ˇ c, Mladen Russo, Maja Stella, Marjan Sikora, "CNN-based Method for Lung Cancer Detection in Whole Slide Histopathology Images",2019.

[9] Janee Alam , Sabrina Alam , Alamgir Hossan, "Multi-Stage Lung Cancer Detection and Prediction Using Multi-class SVM Classifier",2018.

[10] Sanjukta Rani Jena, Dr. Thomas George, "Texture Analysis Based Feature Extraction and Classification of Lung Cancer",2019.

[11] Kyamelia Roy, Sheli Sinha Chaudhury, Madhurima Burman, Ahana GangulyA, "Comparative study of Lung Cancer detection using supervised neural network"2019.