iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** V **Month of publication:** May 2021

DOI: https://doi.org/10.22214/ijraset.2021.34665

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue V May 2021- Available at www.ijraset.com

GPU Accelerated Lung Cancer Detection using Deep Learning Approach

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Abstract: ***This The researches hypothesize that the death rate of people due to lung cancer increases every year drastically. One of the major causes being smoking cigarette which posses carcinogens that damages the cells that line the lungs. To overcome this disease early diagnosis and treatment of the disease is a vital approach. The proposed paper discuss about different viewpoints on detecting the cancerous lung module through*** *trailblazing ideas. It aims on introducing a graphical processing unit(GPU) accelerated real- time detection of lung cancer using deep learning approach from x-ray, CT-scan and bronchoscopy images.*

Keywords: ***lung cancer, machine learning, x-ray, CT-scan, bronchoscopy images.***

I. INTRODUCTION

Lung cancer occurs when cells multiply in the lungs turbulently causing tumors to grow. This may reduce a person's ability to breathe, chest pain, bone pain, headache and spread to other parts of the body. Lung cancer is the third most common cancer and the main cause of cancer-related death at a global level. Smoking being one of the root cause for lung cancers, both in smokers and in people exposed to second hand smoke. By premature detection of the disease proper medical attention such as surgery, radiotherapy, chemotherapy and immunotherapy can be provided before it endangers the patients life. An X-ray image of your lungs may divulge an abnormal mass tissue or nodule. A CT scan can disclose small lesions in your lungs that an X-ray might not be able detect. Whereas bronchoscopy images are capable detecting tumors, signs of infection, excess mucus in the airways, bleeding, or blockages in the lungs. Other than these the use of MRI images, optical coherence tomography, confocal micro-endoscopy etc are some of techniques used to detect lung cancer. The treatment and detection of the disease is expensive and time consuming henceforth different studies were conducted in order to provide a satisfactory means to detect the disease. This paper comprises of a variety of methods in the literature review regarding the diagnosis and early detection of lung cancer through distinct techniques so as to reduce the mortality rate due to lung cancer. The paper also provides certain details about the proposed model.

II. LITERATURE REVIEW

An e P. Mohammed Shakeel et al. [1] in their paper, has introduced different image processing and machine learning techniques, which removes the unwanted signals in order to improve the quality of the signals by multilevel brightness preserving approach. This process enumerates mean value of the pixels. Now we have segmentation process which uses the technique of improved deep neural network which uses multiple layers which incorporates large amount of data with minimum computation gives an efficiency of 90%.

Muhammed Ishak Desa et al. [2] noticed that the major obstacle coming in the way of cancer cell detection is the noise signals which can be avoided by an approach called mean histogram equalization approach. Also the aim of improving the quality of image is by improved profuse clustering technique (IPCT) and deep learning instantaneously trained neural network (DITNN) to get an accuracy of 98.42%. This result also predicts the classification error to a minimum value of 0.038.

Ummadi Janardhan Reddy et al. [3] approached the framework of the project in two different phases. Initially we provide with CT images of cancerous cells which is subjected to binarization in order to change the two sided picture into separate pictures, for easiness, which is the first phase of the framework. It utilizes parallel thresholding in the initial stage. The second stage of the framework includes the main step : extraction which is all about extracting the some essential which is required in the preparation of a fuzzy neural network . After being executed, the output provides an accuracy of 96.67%.

Qianbiao Gu et al. [4] in this paper, proposed a method to detect the presence of non-small cell lung cancer (NSCLC). Using various machine learning methods including radiomic methodologies, the features that was reduced by using six different classifiers, which was extracted by MaZda software, have undergone different checks which provide an output to get compared with Delong test to get a sensitivity of 0.761 and specificity of 0.661 as the output of radiomics classifier based on random forest algorithm.

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S Baskar et al. [5] mentioned about the using delta radiomics method for the extraction of the region containing cancerous nodules in it along with the use of machine learning techniques. Differentiation among various types of cancerous nodules can be effectively contributed by support vector machine (SVM) which will make produce the result a more reliable one with accuracy of 90.9%.

Priyanka Basak et al. [6] introduced a method to find the different stages of lung cancer, as stage I, II,III and IV from the given CT scan images. The filtering methods are median filters and weiner filter, gabor filter, auto enhancement and fast fourier transform techniques for enhancement of cancerous images, segmentation done using threshold and marker- driven watershed approaches, and finally feature extraction and classification uses binarisation and masking method, and support vector machine respectively for the detection of lymphatic cells of a cancerous lung.

Kingsley Kaun et al. [7] discusses about the detection of cancerous lung nodules using deep convolution neural networks with 3D segmentation. This utilises the computer aided techniques to separate cancerous cells as benign and malignant, which takes data set containing CT scan from Kaggle Data Science Bowl, that uses region based convolution neural network (RCNN) for identifying the region of interest. They have mentioned the use of a ResNet which have been modified by them which incorporates ReLU units for increasing the performance.

Siddharth Bhatia et al. [8] focuses on finding the cancer cells from the CT scans using the deep residual approach. Here they have used XGBoost and random forest methods for classification and the uses of UNet and ResNet models is a highlight of this paper and have achieved an accuracy of 84% while performing the attempts on detection.

Emon Kumar Dey et al. [9]aimed for an intelligent semiautomated system with simple image processing techniques such as morphological operations, template matching etc that was implemented on Ubuntu Linux PC which incorporate Core i5 processor and 4GB ram.

Kornhamon Suttitanwat et al. [10] corresponded to the notion of ascertaining nodule locations by using the novel lung nodule detection algorithm elicited from interval type-2 fuzzy logic system. The technique was accomplished using D descriptors, the average intensity of the inside boundary, circularity ratio and HH diagonal component from wavelet transform.

Amit Kore et al. [11]contemplated that it is possible to detect Lung diseases from X-ray images by employing mobile net model which is a CNN based model capable of operating at low latency and low power. The app was deployed over Heroku server for lung cancer detection.

Worawate Ausawalaithong et al. [12] proposed a model that provides a heatmap to pinpoint the lung nodule location from chest X-ray using deep learning approach. A 121-layer convolution neural network along with transfer learning scheme is traversed giving a 74.43% accuracy.

Salim J. Attia et al. [13] discussed the image quality comparison amidst original images and image enhancement techniques such as imadjust, ,HE, and CLAHE leading to the conclusion that CLAHE is a cut above the other two image enhancement techniques.

Mokhled S. AL-TARAWNEH et al. [14]accentuated on the image quality and accuracy as the key feature of the paper .The image collation for accuracy are done by using pixels percentage and mask-labelling whereas the preprocessing techniques are carried out using Gabor filter within Gaussian rules also utilizing segmentation process as a region of interest for acquiring feature extraction.

u.Gordienko1 et al. [15] demonstrated an analysis of 2D CXRs by deep learning approach that provided high efficiency by determining lung segmentation and bone shadow exclusion techniques. The paper focused on showcasing the usefulness of pre-processing techniques like bone shadow elimination and segmentation techniques.

III.PROPOSED MODEL

A. Objective

1) To develop a Graphical Processing Unit assisted handheld device for lung cancer detection from X-ray, C T Scan, bronchoscopy images

2) Reducing the false positive rate while maintaining the overall accuracy.

3) Availing better services to the people for reducing inference cost by 60 to 70% with trained GPU.

4) Our system significantly reduces the risk of missed lesions during the diagnosis.

B. System Modelling

The hardware components mainly used is a GPU Module because the contemporary scenario highlights the urgency of handheld devices with Artificial Intelligence (AI) solution for the detection and prediction of lung cancer which is faster and accurate. To a great extent, the developed model is deployed in NVIDIA's 128 core Jetson Nano Graphical Processing Unit (GPU) development board.

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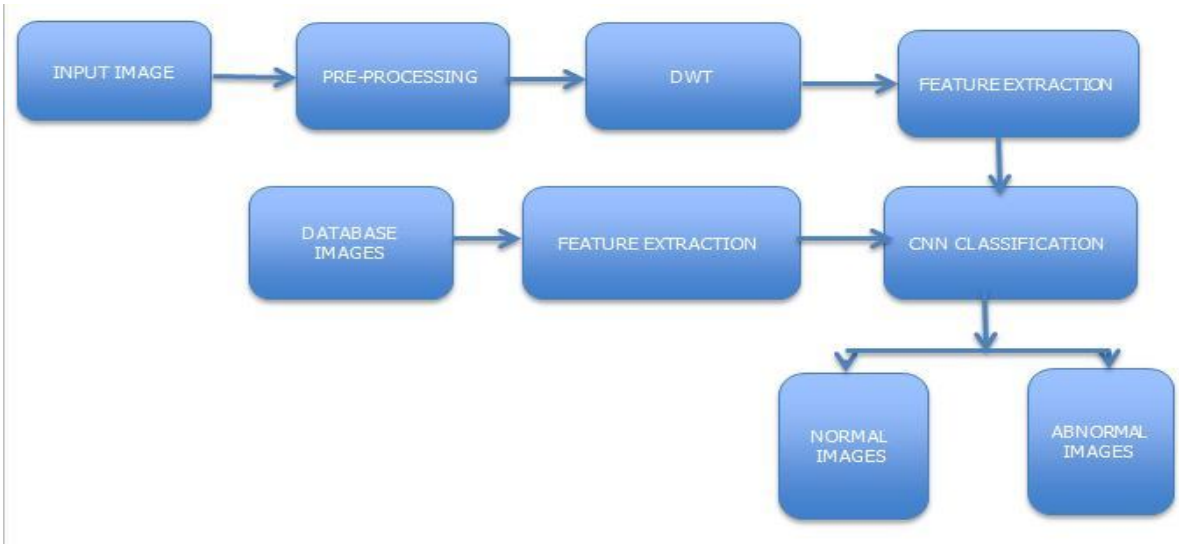
GPU or graphical processing unit is a main component used by gamers as the amount of images that could be incorporated into this module will be numerous improving the quality of gaming, in which we are using this same technology for lung cancer detection. Even though the number of task handled by GPU module is restricted to one, since it uses parallel computation we can use it in AI as it processes multiple data to train easily compared to other process. Also it could be used to reduce the cost effectively and is remotely accessible.

Our tenacious allusion is to provide a methodology to detect the lung cancer by utilizing computer vision and machine learning algorithms. We have accumulated various dataset of chest x-rays, CT scan, bronchoscopy from various online sites such as kaggle or cancer image archive (CIA) for training, testing and validation, among which 60-70% dataset were used for training and the remaining were allotted for testing and validation. We implemented the system and tested by using a powerful computing platform by employing GPU.

In our software part of the detection system, we can detect x-rays, ct scans and bronchoscopy, after collecting the data set; we provide a program for dividing the folder into 3 different sets respectively. Now we can provide names for each image that can be given the pixel number from 0-255, as the images we need it as black and white images. Our detection machine is working on the basis of convolution neural network thus we could only provide same sized images, which can be done by coding for a loop inside the program. All these images are converted to one hot encoding from label encoding which is a program to provide the name of images as numbers. Our requirement is to train and test the images using deep learning algorithm, for that assigning 90% images for training and 10% for testing, which could provide maximum accuracy for the machine. Then we could incorporate the functions for classification of images using tensor flow, then importing, splitting the features of the images and forming layers are the steps followed in order to build a machine to detect lung cancer, which will predict whether the patient is having lung cancer or not.

C. Block Diagram



IV. CONCLUSIONS

This paper provides an insight on various methods that can be used for lung cancer detection using deep learning algorithm. From the literature survey it is understood that each and every method detect lung cancer but each paper differs from each other based on the methods used and also in accuracy. So among the provided papers we have recognised maximum efficient method to detect lung cancer by comparing the pros and cons of each and every paper based on this. We are focusing on developing the machine using convolution neural network by deep learning approach, along with tensor flow for providing classification. By incorporating all these methods we could produce a better result with higher accuracy. The proposed system introduces a novel method for lung cancer detection from various images which are called as data set, includes X-rays, CT scans and bronchoscopy. Detecting tumours from these provided datasets after completing software part using python requires a GPU module, to provide more speed and the storage space to store more datasets to improve accuracy of the machine. The paper focuses on improving the accuracy and reduce the false positivity rate of lung cancer, thus we look into GPU module which uses parallel computation thus able to process multiple data. We use Python 3.6, OpenCV, TensorFlow to build software environment required for the experiment. With the transfer learning models of VGG16 and ResNet50 we can get almost 96.57% and 90.54% accuracy thru training and validation time.

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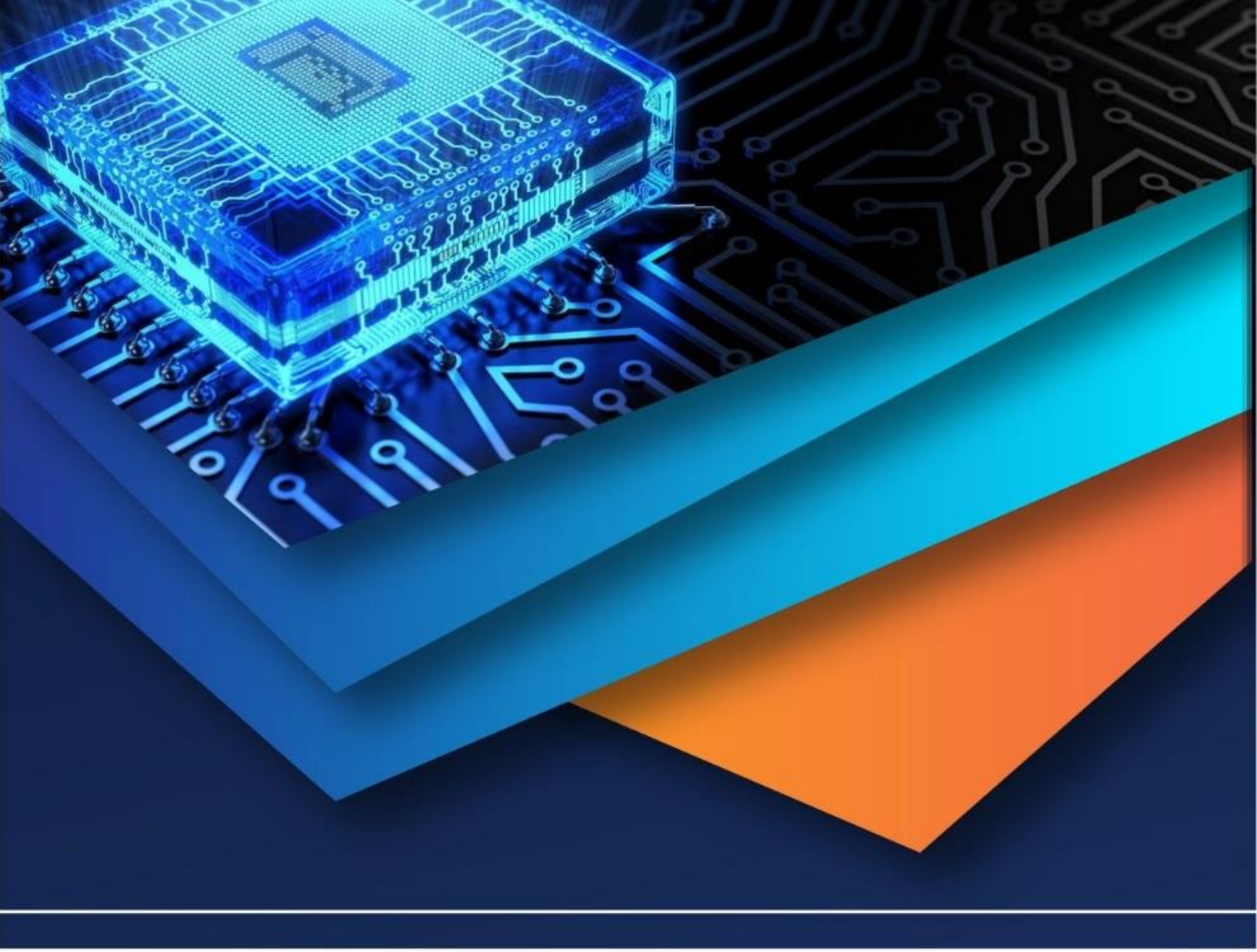

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