



INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X

Impact Factor: 6.078

(Volume 7, Issue 3 - V7I3-1606)

Available online at: <https://www.ijariit.com>

Lung Cancer Detection using Image Processing and CNN

Anubha Gupta

ganubha30@gmail.com

SRM Institute of Science and Technology,
Kattankulathur, Chennai

V. L. Karthikeya Manda

vm5752@srmist.edu.in

SRM Institute of Science and Technology,
Kattankulathur, Chennai

B. Ida Seraphim

idaserab@srmist.edu.in

SRM Institute of Science and Technology,
Kattankulathur, Chennai

ABSTRACT

Cancer is known to be one of the most dangerous health problems in the world and among it, lung cancer is known to be the most serious cancer with the smallest survival rate. The lung cancer risk population is also very high as compared to other deadly diseases, for example, cardiovascular diseases. Therefore, early detection of lung cancer is a must for survival. Nowadays, a lot of research has been done using Convolutional Neural Networks in the medical field. Image classification is one of the methods to detect cancer at early stages. First, the datasets for CT scans are accessed from Kaggle. Images are refined with the pre-processing method. The image dataset will be trained on two different models namely~ Manual CNN and AlexNet. Further, the model producing the highest accuracy will be chosen and the processed images will be used to predict whether the CT scan image is malignant (cancerous), benign (non-cancerous) or normal.

Keywords— Lung Cancer Classification, Image Data Augmentation, 2D Convolutional Neural Network, AlexNet CNN

1. INTRODUCTION

On the planet, numerous people are influenced by man-made risks caused because of vehicular emanations or destructive gases produced from industrial facilities, and ordinarily, individual joy. This outcomes in hurtful results to the body, particularly to the lungs. Lung harm is apparently, quite possibly the most far reaching and an ordinary sort of generous among guys and the third-most among females. 85% of the absolute cases are straightforwardly connected to smoking and utilization of tobacco and furthermore represents 20% of the mortality, all things considered. Customary ways, for example, looking at CT-Scans by specialists have been utilized widely by and by it was very tedious. This prompted the development of cutting-edge self-sufficient discovery of disease utilizing Machine Learning and Big Data or just picture acknowledgment strategies. The customary and pre-contemporary methodologies continued in the location of malignancy utilizing different Machine learning calculations and deep learning lead our paper to zero in on increased recognition of cellular breakdown in the lungs utilizing convolution neural organizations. The overall technique end up being massively useful and appreciated across different areas. It enjoys different benefits. The model figures out how to remove highlights without anyone else which assists with yielding lucky outcomes. It utilizes convolution of picture and channels to set invariant highlights which are given to resulting layer. This cycle proceeds till it arrives at the ideal yield. The layers can be changed in like manner to hinder the model from being incorrect through hyper-boundary tuning. A number-crunching activity between two tasks which brings about another capacity is called convolution. The yield activity is capable to give us a non-literal thought of the degree to which the charts of the two info capacities match one another. The sources of info and bits in an AI calculation are by and large complex varieties of information.

1.1 Deep Learning

Deep learning is a member of AI which is wholly founded on neural organizations, as neural organization imitates the individual mind so deep learning is likewise a kind of model of human cerebrum. It's in attention these days in light of the evidence that earlier we never had much preparing capacity and a massive understanding of knowledge. A conventional connotation of deep learning is neurons. Deep learning is a definite kind of AI that achieves improbable effort and versatility by deciphering out how to address the planet as a settled progression of theories, with every concept describing corresponding to more straightforward concepts, and more conceptual portrayals processed as far as less theoretical ones. In human mind roughly hundred billion neurons all together this is an image of an individual neuron and every neuron is associated through great many their neighbors. The inquiry here is the manner by which it reproduces these neurons in a PC. In this way, it makes a counterfeit construction called a fake neural net where we have hubs or neurons. It has a few neurons for input worth and some for-yield esteem and in the middle, there might be heaps of neurons interconnected in the secret layer.

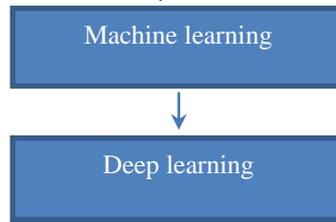


Figure 1: Introduction

It needs to analyze the certain complication in order to get the correct answer and it should be appreciated, the usefulness of the Deep Learning should also be confirmed. It needs to find out the applicable data which should coincide with the definite complication and should be arranged accordingly. Adopt the Deep Learning Algorithm properly. The dataset should be trained using this algorithm. The dataset must undergo a final testing process.

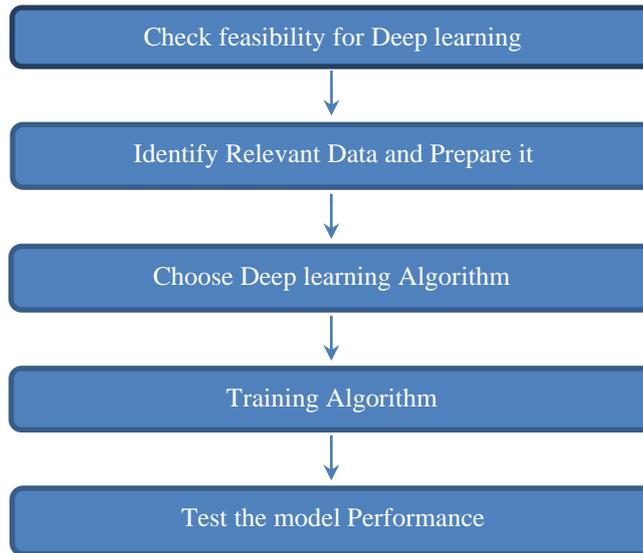


Figure 2: The process flow

1.2 Purpose

Table 1: Existing versus Proposed system

Existing system	Proposed system-
In the existing system, lung cancer dataset is trained on several models in the absence of a user interface.	The proposed model will be trained using the best accurate model which will be deployed on a web server as a user interface.

1.3 Problem Statement

The aim of this study is to use deep learning techniques to detect and classify lung cancer CT images into normal, malignant and benign and to develop a user interface where an individual will be able to upload an image as input and get a result.

1.4 Requirement Analysis

Software Requirements

Operating System: Windows / Linux

Simulation Tool: Anaconda with Jupyter Notebook

Hardware Requirements

Processor: Pentium IV/III

Hard disk: minimum 80 GB

RAM: minimum 2 GB

2. LITERATURE REVIEW

1. P. Monkam et. al, published a comprehensive analysis of numerous methods based on the developed Convolutional neural network that can classify and detect nodules in the medical images. The different CNN models such as: 3DCNN, 3D U-Net, 2DCNN, 2DCNNs, SVM, Naïve Bayes. The paper gives brief introduction about CNN and a detailed description of different medical image sources such as: LIDC/IDRI, LUNA16, Kaggle Data Science Bowl. It also states some of the existing challenges which affects the detection process including the gathering of well-labelled medical dataset with large number of cases. The paper shows that by applying CNN for the detection of nodules as well as their classification into malignant and benign produced exceptional results which makes the approach for early diagnosis more promising.

2. H. Guo et. al, proposed a method called KAMP-Net for prediction. KAMP-Net makes use of collective framework which consists of features that are extracted using clinical knowledge and feature exposed by the Dual-Stream network (DSN) for improved prediction. It does not completely rely on automatic feature extraction. It is shown that KAMP-Net can achieve superior

performance in compared to other methods. The paper introduces Low-Dose CT (LDCT) due to which accuracy of the lung cancer detection and its diagnosis increases and the cancer deaths reduced as compared to X-ray. Paper introduces a novel approach which combines the CNN and SVM model to get the final output.

3. Leukocytes which exist in marrowbone makes up approximately 1% of all erythrocytes. Untrammelled increase of the white erythrocyte will lead to the risk of hematologic cancer. In another paper by D.Kumaret., proposed a model that eliminates the likelihood of fallacy during the hand-operated by implementing deep learning strategy, convolutional neural network. The structure is trained on cell data (images). The images are extracted to draw out the best attribute and then pre-processed. The archetype with the enhanced Convolutional neural network (CNN) substructure is trained to predict the type of malignancy existing in the cells. The overall accuracy recorded "97.2%" is superior than machine learning technique such as SVM.

4. R. Y. Bhalerao et al., proposed a system that works with Convolution Neural Network. The proposed paper shows end to end process of image processing, starting from image data extraction from different sources like LIDC, Kaggle, LUNA16. The image pre-processing was executed in MATLAB. The pre-processed images were sent to the CNN model and then trained for prediction. The paper proposed CNN method because it provides a superior production compared to machine learning design like Naive Bayes and SVM. Overall precision of 94.34% was achieved from the proposed archetype.

5. M. B. Khumancha et al. introduced a unique method for the detection of Lung cancer. The methodology involves working with two datasets, data1 and data2. Data1 which is accessed from LIDC/IDRI used for detection of nodule whereas Data2, accessed from Kaggle used for Cancer detection. The paper developed two Convolutional module, first CNN module, which detect the nodule present in datasets and used the model for the second procedure which consist of detection of malignant symptoms in the dataset. The accuracy was calculated based on true count and found to be 90.78% whereas the precision calculated to be 89.24%.

6. Zheng, S. et al. published a paper which focuses on automatic detection of pulmonary nodule using Convolutional Neural Network and also make use of MIP images. The paper provides a system which will increase the probability of detecting the nodule. It introduced MIP- Maximum intensity projection images which enhance the noting of pulmonary nodules in magnetic resonance imaging assessment with computed tomography (CT) scans. Instead of the normal dataset of CT scan, this proposes to introduce MIP images which are sent to the CNN model. The MIP images which are taken their thickness was high and because of which the accuracy level is increased in the detection of a lung nodule. Thickness is directly related to accuracy of the system.

7. The detection of lung cancer at early stage is crucial for mortality, for the early detection, in another paper by Rajeswari worked on detecting the malignancy level U-Net. Respective paper mainly focuses on introducing a CAD system for the detection of the nodule. As nowadays there is a lot of CT data present, CAD is used to utilize the effective clinical support it provides. The raw CT dataset is extracted and then pre-processing is executed on the dataset. For segmentation ROI mask is used. All the pre-processed data is then sent to the CAD system, which performs individual nodule detection. The false-positive reduction is performed and nodule classification is done. After the classification, the result will be either cancerous or noncancerous.

8. Yutong Xie et al., introduced MV-KBC model which isolated benign from malignant nodules on chest CT by taking into consideration the image of the nodule on nine view planes. An adaptive weighting scheme was applied for nodule heterogeneity which would be able to train the model in a multi-channel manner [8]. In MV-KBC, the archetype train itself 3-D lung nodule attribute by decaying a 3-D nodule. The results show that the model is more accurate than current approaches on the LIDC-IDRI dataset. When the prediction is completed, it is shown that model is more accurate than the normal machine learning model outlook on LIDC dataset. It provides knowledge about the MV-KBC archetype to detach cancerous from non-cancerous in CT scans. The total 91% accuracy is shown by using the LIDC dataset.

3. SYSTEM DESIGN AND ARCHITECTURE

3.1 General

The expression "design" alludes to a significant designing portrayal of something that will be developed. The system design is shown below which describe the whole architecture of the model.

3.2 Design architecture

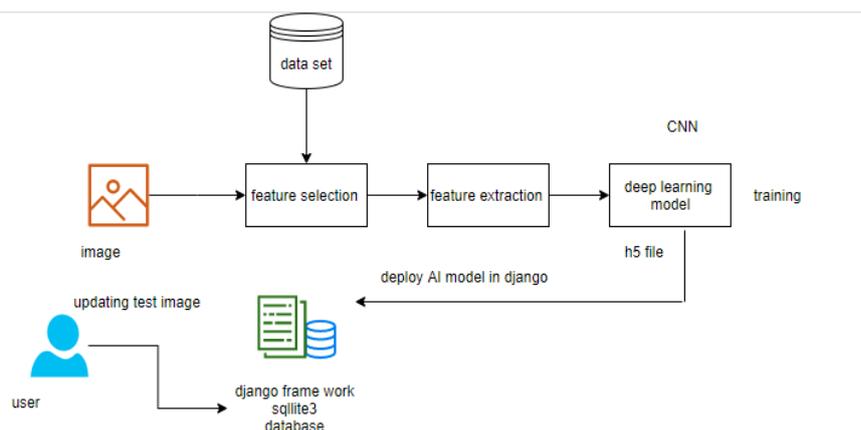


Figure 3: Design architecture of detection process

The dataset which is collected is of “The Iraq-Oncology Teaching Hospital (IQ-OTH/NCCD)”. The dataset of lungs was collected and interpreted by radiologists in the above-mentioned hospital over a period of 3 months. The dataset was found on Kaggle website. It is a labeled image dataset which includes both train and test folders. The dataset contains 1190 images (.png format) in total. Each folder contains three classes. These cases are grouped into three classes namely: normal, malignant and benign cases. The dataset is used to train both the Models, 2D CNN and AlexNet. The best model with high accuracy is further sent to Django framework which is user interface.

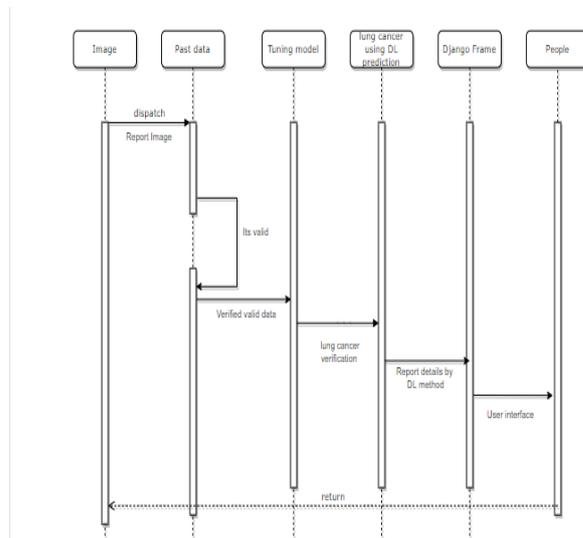


Figure 4: Sequence Diagram of lung cancer detection

3.3 CNN Model steps

To identify the test image, the model (CNN) is trained using the trained dataset. Convolution2D, Dropout, Dense, Flatten, MaxPooling2D and Flatten are some of the different layers of CNN. The classification of the lung cancer images contained in the dataset can be done once the model is successfully trained. Test image and the trained model are compared to predict the disease after training and processing the dataset successfully.

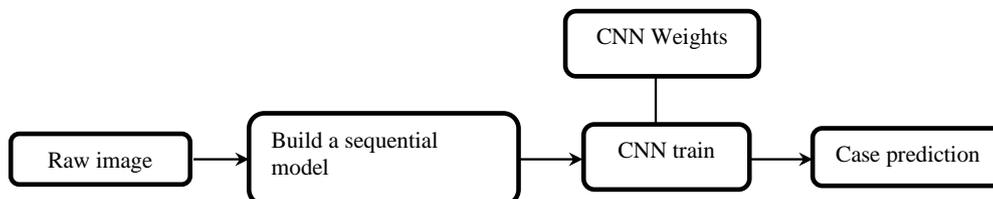


Figure 5: Model Architecture

Conv2D: A layer in which a single image is convoluted into various pictures activated by activation function.
MaxPooling2D: The values from a given calculated matrix is max pooled and the same is done for the next two layers.
Flatten: Used to even out the components of the image got in the wake of convolving it.
Dense: It is utilized to make this a completely associated model and is the secret layer.
Dropout: It is used to avoid over fitting on the dataset and thick is the yield layer contains only a solitary neuron which decide to which characterization picture has a spot.
Image Data Generator: It is that rescales the image, applies shear in some range, zooms the image and levels flipping with the image. This Image Data Generator joins all possible course of the image.
Training Process: `train_datagen.flow_from_directory` is the limit that is used to design data from the train_dataset inventory `Target_size` shows the target size of the image. `Test_datagen.flow_from_directory` is used to design test data for the model and everything is tantamount as above. `fit_generator` is used to fit the data into the model made above, various parts used are `steps_per_epochs` edifies us concerning the events the model will execute for the planning data.
Epochs: It unveils to us the events model will be set up in forward and in invert pass.
Validation Process: `validation_data` is used to deal with the endorsement/test data into the model. `Validation_steps` implies the amount of endorsement/test tests.

3.4 Architecture

Output layer, input layer, fully connected layer and convolutional layers are some of the typical elements which are a part of a convolutional neural network. **Input Layer:** Before the image can be fed into the layer, it needs to be preprocessed. Therefore, input layer is used which has fixed dimensions which can be set up manually. For training, testing and validation of the model, dataset which contains gray scale images of the size 48X48 are used.

Convolution and Pooling (ConvPool) Layers: The processing takes place in batches where convolution and pooling is done. The batches containing N images have CNN filter weights which are updated. Four dimensions N x width x color-channel x tallness are taken as image batch input for each convolution layer. Highlight guide or channel for convolution is additionally four

dimensional. In every convolution layer, four dimensional convolutions are determined between picture bunch and highlight maps. Image width and height are the only parameters which change after convolution.

Image width = initial picture width – channel width + 1

Image tallness = initial picture stature – channel tallness + 1

Dimensionality reduction is accomplished after every convolution layer is down tested/ sub-sampled which is called pooling. Two famous pooling methods are Average pooling and max pooling. After every convolution, max pooling is used in this project. To split an image into blocks of each size of 2 x 2, pool size of 2 x 2 to is taken which takes maximum of four pixels. Width and height are the only dimensions affected after pooling. In this architecture, two pooling layers and convolution layers are utilized. The dimensions of the input image are N x 1 x 48 x 48 at the first convolution layer. Both the width and height of the image are 48 pixels. The number of color channel is one and the size of each image batch is N. An image batch size of N x 20 x 44 x 44 is the result of a convolution with map 1 x 20 x 5 x 5. An image size of N x 20 x 22 x 22 is the result after pooling of convolution is done with a pool size of 2 x 2. A result image size of N x 20 x 18 x 18 is achieved by the second convolution layer which is followed later. An image size of N x 20 x 9 x 9 is generated by the pooling layer which is followed after the second convolution layer.

Fully Connected Layer: The brain which transmits signals through neurons is the motivation of this layer. Input features are taken in large numbers. The trainable weights which are connected with the layers transform the features. Fully connected layers use 2 hidden layers of 300 and 500 unit in size Forward propagation of data is done to train the weight of the layers and its errors are rectified through backward propagation.

Calculating the difference between the true value and the predicted value is the first step of backward propagation. At every layer, it evaluates the weights to be adjusted. Network density and learning rate are a few of the many hyper-parameters which are tuned to control the complexity and training speed of the architecture. Momentum, regularization, learning rate and decay are the hyper-parameters which are included in this layer. The yield from the second pooling layer is of size Nx20x9x9 and contribution of first secret layer of completely associated layer is of size Nx500. A image size of N x 1620 is flattened which is the output of the pooling layer. Later, it is fed to the first hidden layer. The second hidden layer is fed by the output of the first hidden layer. A size of N x 300 is assigned to the second hidden layer. A number equal to the number of classes is assigned to the output layer where the image is fed for classification.

Output Layer: There are 3 distinct classes are a part of the output layer which is connected with the second hidden layer's output. The probability of the output of the 3 distinct classes is used. The predicted class is decided by the class which has the maximum probability.

3.5 Modules

Module 1: Import the given picture from dataset

We need to import our informational index utilizing keras preprocessing ImageDataGenerator function additionally we make size, rescale, range, zoom range, flat flip. At that point we import our picture dataset from organizer through the information generator work. Here we set train, test, and approval likewise we set objective size, bunch size and class-mode from this capacity we need to prepare.

Module 2: To prepare the module by given picture dataset

To prepare our dataset utilizing classifier and fit generator work likewise we make preparing steps per age's at that point absolute number of ages, approval information and approval steps utilizing this information we can prepare our dataset

Module 3: Working interaction of Layers in CNN model

An algorithm in the field of Deep Learning which can take image as an input, assign biases and weights to multiple characteristics of a picture and classify one picture from the other is called a Convolutional Neural Network. Other classification algorithms require humongous pre-processing unlike ConvNet, which does not require much of processing. ConvNets do not require filters that are hand-engineered, the algorithm can learn on itself if it's trained properly unlike the traditional methods.

The Visual cortex present in the human brain is the organization which is synonymous and highly inspired for the working and architecture of ConvNet. Receptive Field is the area which consists of neurons which respond only in contained regions. Their association involves four layers with 1,024 data units, 256 units in the chief concealed layer, eight units in the subsequent mystery layer, and two yield units.

Input Layer: Image knowledge is contained in this layer of convolutional neural network. Picture information is addressed by three dimensional frameworks. The input layer is responsible to reshape the image dimension into a singular column. Assume there is an image of measurement "28x28=784", this dimension needs to be converted into a singular column before it is fed into the input.

Convolution Layer: Convolution layer is also known as the "feature extractor layer" since highlights of the pictures removed inside this layer. As a matter of first importance, a piece of image is associated with Convo layer to execute complexity activity as witnessed before. It computes the speck item between open fields and the channel. Consequence is an individual whole number of the yield quantity. At that point, channel throughout following responsive field of a similar information picture by a Stride and do a similar activity once more. It will rehash a similar interaction and again until it goes through the entire image.

Pooling Layer: The reduction of spatial volume of the image after convolution is done by the pooling layer. Pooling layer is used halfway through two convolution layers. Without applying pooling layer while fully connected layer is applied after convolution

layer, it could require heavy computation power. Hence, the spatial volume of an input image can only be curtailed by the use of max pooling. With a stride of two, in a single depth slice max pooling has been applied. We can observe that a 4 x 4 input is curtailed to a 2 x 2.

Fully Connected Layer (FC): Completely associated layer includes loads and inclinations. Fully connected layer associates neurons in an individual layer to subsequent layers. By training, it is used to classify images among different classes.

Output Layer: A one-hot encoded principle is followed which contains the name in the output layer.

Module 4: Deploying the model in Django Framework and anticipating yield

In this module the prepared deep learning model is changed over into various leveled information design document (.h5 record) which is then conveyed in our django system for giving better UI and foreseeing the yield whether the given Benign cases, Malignant cases, Normal cases.

4. IMPLEMENTATION

4.1 Algorithm

The model will adopt CNN (convolution neural networks) which has proven to yield better, efficient, accurate, and enviable results correlated to other machine learning algorithms like Naive Bayes, Support Vector Machine (SVM), Random Forest, and other such algorithms. The feature extraction is automatically done by the CNN algorithm based on the information provided to the model which in our case is a set of CT-Scan images and an output tag. For training, the convolutional layers define the features and parameters.

4.2 Image Data Augmentation

Data augmentation is a technique which is used to increase the number of sample images in a dataset in order to reduce class imbalance. This technique is used to increase the number of samples of each image in the dataset to prevent the model from being undertrained. The diversity of the training set can be increased by applying several different transformation techniques to our image dataset such as flipping, rotating, stretching the image.

4.3 Convolution Neural Network (Manual CNN)

The Convolution Neural Network (CNN) bands characterize the specifications for training. The veracity of Convolution Neural Network (CNN) based operations can be upgraded by enhancing the nature of input data and by being contingent upon exceptional training. The Convolution Neural Network exemplified also plays a dominant aspect in enhancing results. Additional bands suggest exceptional training. Few important parts of a Convolutional Neural Network are as follows:

1. **Input Layer-** The data which is pushed into the networks is called the input layer which is a box like array of pixels
2. **Convolutional Layer-** The main responsibility the convolutional layer has is, extract the highlight from the image which is pushed into the layer from the input layer. It is one of the most supreme parts of CNN. The convolutional layer comprises kernels arranged in series which have to execute convolution. The initial layers extract lessened features from the input and as the profundity increases, higher and intricate-level characteristics are extracted
3. **Activation Layer-** Intermittence in the system is introduced by the activation layer which supports the learning of complex data. The basic function for this model is ReLu which endows the pace of how the CNNs are being trained by gradient supervision which is constant at all network layers.
4. **Max-Pooling Layer-** In this layer degradation of the dimensionality is done. It allows assumptions for the area where max-pooling has to be done. MPL is applied on the initial sector by applying a max filter on the non- intersecting region. Attribute extraction is implemented by coupling various steps which are alike, comprising of cascading layers specifically Convolutional, Activation, and Max-pooling. The proposed CNN model will predict whether the input image is a malignant (cancerous), benign (non-cancerous) or normal.

4.4 AlexNet Deep Learning Model

AlexNet is a complex and a successfully pre-trained model which is trained over ImageNet dataset containing 15 million labelled images categorized under 21,000 classes. AlexNet contains 5 convolutional layers and 3 fully connected layers which totals to 8 total layers. It originally performs on 2 GPUs. However, researchers nowadays tend to use only one GPU for the implementation of AlexNet.

Relu-Nonlinearity: AlexNet makes use of the ReLu function instead of the tanh function.

ReLu function makes the model more time efficient. Numerous GPUs: AlexNet allows to put one half of the neurons in one GPU and other half in another GPU owing to the large dataset. This allows to train larger models and cut down on processing time. A rigorous comparison will be established between the two models: Manual CNN and AlexNet. The model with the highest accuracy and negligible loss will be chosen for the further classification of the input image into malignant, benign or normal Equations.

4.5 Steps

4.5.1 Preparing from Scratch: To prepare a profound organization without any preparation, you assemble a huge marked informational index and plan an organization design that will become familiar with the highlights and model. This is useful for new applications, or applications that will have an enormous number of yield classes. This is a more uncommon methodology on

the grounds that with the huge measure of information and pace of learning, these organizations regularly require days or weeks to prepare.

4.5.2 Transfer Learning: Exchange learning approach is used by many deep learning applications. A cycle that includes adjusting a pretrained model. You start with a current organization, like AlexNet or GoogLeNet, and feed in new information containing beforehand un-labelled classes. Subsequent to making a few changes to the organization, you would now be able to play out another undertaking, for example, sorting just canines or felines rather than 1000 unique items. This likewise enjoys the benefit of requiring considerably less knowledge (preparing a great many pictures, instead of millions), so processing time drops to less than few hours or even minutes.

4.5.3 Feature Extraction: A somewhat more uncommon, deep learning can be dealt more particularly by making use of the organization as a component extractor. As specific features are extracted from each one of the layer, at the time of preparation cycle, we can get these features out of the organization. The features can thus be used to contribute to an AI model like support vector machine.

4.6 Libraries

numpy: To handle the picture grids

os: To get to the record framework to peruse the picture from the train and test catalog from our machines

random: To rearrange the information to defeat the biasing

matplotlib: To show the consequence of our prescient result.

tensorflow: Just to utilize the tensor board to think about the misfortune and adam bend our outcome information or acquired log.

4.6.1 NumPy: NumPy is a shortening for "Numeric Python" or "Numerical Python". It is an open-source development module for Python, which gives fast precompiled abilities to mathematical and numerical timetables. Plus, NumPy improves the programming language Python with amazing data structures for useful computation of multi-dimensional bunches and organizations. The execution is regardless, zeroing in on colossal cross sections and displays. Other than that, the module supplies a colossal library of huge level mathematical abilities to chip away at these lattices and displays. It is the significant pack for sensible enrolling with Python. It contains various features including these critical ones, A fantastic N-dimensional display object, Sophisticated (broadcasting) limits, Useful direct polynomial math, Fourier Transform, and sporadic number capacities, Numpy Array. A numpy bunch is a cross section of characteristics, the total of a comparative kind, and is requested by a tuple of nonnegative numbers. The number of estimations is the situation of the group. The condition of a group is a tuple of entire numbers giving the size of the display along every estimation.

4.6.2 SciPy: Both, Scipy and Numpy are consistently referred simultaneously to each other. Minimization, backslide, Fourier-change and multiple others are possible with Scipy which extends the capacities of Numpy. Two modules are heavily relied by Numpy. Numeric is a module in for tip top, numeric enrolling, anyway it is extremely old. NumpyArray is another model of Numpy which is a completed modify of Numeric anyway is despised moreover. The union of these two models builds the foundation of Numpy. For example, Numpy depends on the back-end of Numeric and the characteristics of numarray.

4.6.3 TensorFlow: Google is responsible for speedy mathematical figuring which is executed through a python library called Tensorflow. It is an formulation library that can be applied to create Deep Learning models straightforwardly or by forming covering libraries that improve on the interaction based on top of TensorFlow.

4.6.4 Django Templates: Django gives an advantageous method to create dynamic HTML pages by utilizing its format framework. Django is a web application structure; it gets client demands by URL finder and reacts back. To deal with URL, django.urls module is utilized by the structure. The view contention is a view work which is utilized to return a reaction (format) to the client.

Models A class which is used and has core fields and strategies is called a model in Django. Every class guides to a solitary table in the information base. django.db.models is a subclass of Model class. A data set field is addressed by the model and it's subclasses. A data set reflection API is provided by Django which enables to create, recover, delete a record from an organized table.

Urls.py The django.urls module contains different capacities, way (route,view,kwargs,name) is one of those which is utilized to plan the URL and call the predetermined view.

Views.py A view is where we put our business rationale of the application. The view is a python work which is utilized to play out some activity and return a reaction to the client. This reaction can be the HTML substance of a Web page, or a divert, or a 404 error.

5. RESULT AND ANALYSIS

5.1 Output

The two CNN model namely 2D CNN and AlexNet are trained with the same set of input images. After the training, model with better recorded accuracy is further deploy in Django framework to classify different cases like Benign cases, Malignant_cases, Normal_cases.

The end result of implementation of the model is used for detection and classification of lung cancer.

Table 2: Validation accuracy of each model

MODEL	ACCURACY
Manual CNN	96.88%
AlexNet Architecture	51.56

- After training of the CNN model, the validation accuracy results to be 96.88.
- Once the AlexNet model is trained, the accuracy results to be 50.79.

MANUAL CNN METRICS

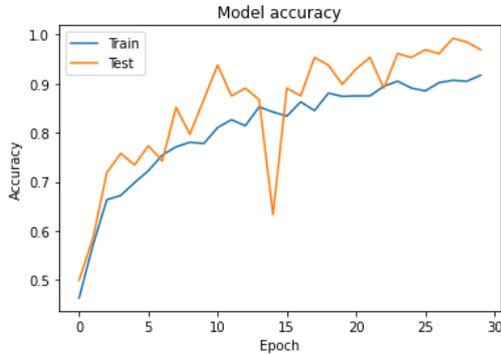


Figure 6: Manual CNN: Epoch versus accuracy graph

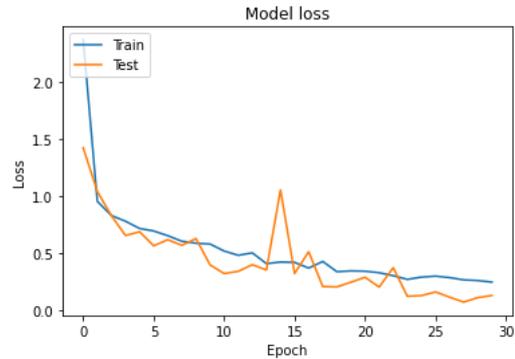


Figure 7: Manual CNN: Epoch versus loss graph

The two graph shown above represents Manual CNN accuracy and model loss upon training and testing. It can be seen that the accuracy of the model is increasing gradually with epoch while the loss is decreasing upon training and testing.

ALEXNET CNN METRICS

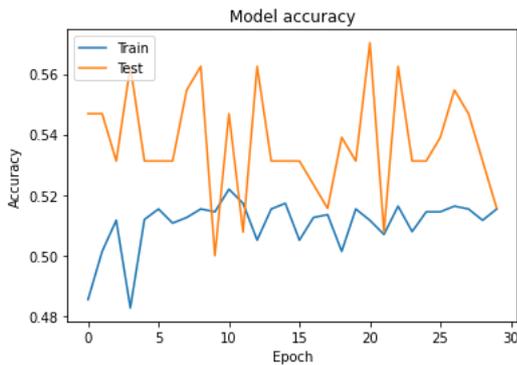


Figure 8: AlexNet CNN: Epoch versus accuracy graph

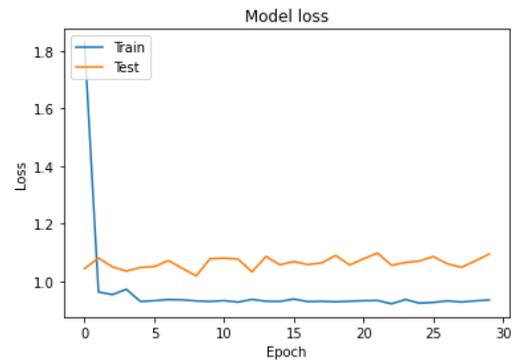


Figure 9: AlexNet CNN: Epoch versus loss graph

AlexNet CNN model show fluctuating accuracy throughout the training and testing. The model’s accuracy increases and decreases but value fluctuates between 0.54 to 0.56. On the other hand ,model loss upon training and testing came out to be constant throughout the process and value remains between 1.0 -1.2.

DJANGO FRAMEWORK

The trained deep learning model with best accuracy which is found to be Manual CNN after implementation, will further converted into hierarchical data format file ie h5 file and is deployed in Django framework for user interface and predicting the output. The framework run as follows:

- 1: Input CT Image
- 2: Upload test image
- 3: Click upload
- 4: Image data visualization will be done
- 5: Click on Result

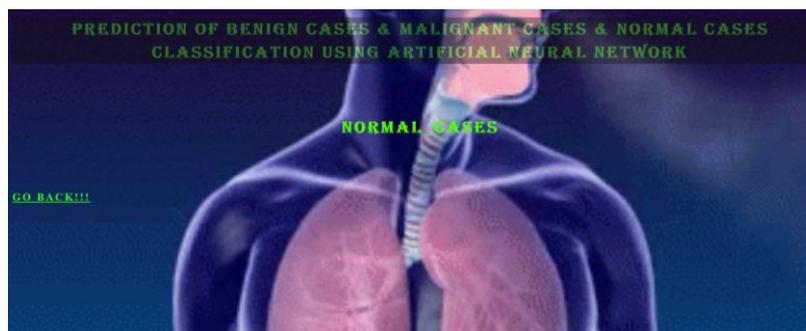


Figure 10: Django-based user interface result template

6. CONCLUSION AND FUTURE WORK

6.1 Conclusion

The accurate and precise classification and detection of lung cancer is the best a way to lessen the death rate due to lung cancer. Two CNN based algorithms have been introduced for analyzing nodules in CT images (Medical images). The paper aims to select the best model for the detection of lung cancer and deploying it in to user interface framework. The CT images are extracted from Kaggle and Image augmentation is done to provide a better quality of data to our model. Both Manual and AlexNet CNN model is trained in order to predict cancer. Deep Learning is a contemporary wing of Artificial Intelligence exploration which will maneuver improved operation in Convolution Neural Network-based systems. The projected strategy will also take into consideration the transforming capacity and time law of the cancer detection mechanism for competency.

The proposed system works on CNN model which aims to increase the accuracy and will also consider the time delay and processing power of the process of detection of cancer for increased efficiency. It was analysed that Manual CNN used for the detection of the nodule shows remarkable accuracy which makes it a promising method for the diagnosis that can be done early. Accuracy and loss is hence calculated and it is found that Manual CNN gives the highest accuracy of about 96.88 val accuracy compared to AlexNet which iis about 51.56 only .The best model having highest accuracy and minimal loss is further chosen for prediction. The Django framework deploy the Manual CNN and showed the result.

6.2 Future Scope

For the Improvement of the early detection and management of lung cancer that will hypothetically reduce its censorious death rate, more development can we made on CNN models. Several different knowledge based models canbe trained on a larger dataset with effective hyperparameter tuning and the model with optimal accuracy can be used for prediction. AlexNet CNN model can be trained on large dataset in order to further increase the accuracy of the model. Designing AlexNet CNN model with hyperparameter tuning and new architecture solely for analysis. Further more advanced techniques can be added in the implementation process. More detailed image processing can be done which will improve the dataset quality. For deploying the model in real time, prediction result can be shown in web application or desktop application. The further implementation can be done in Artificial Intelligence environment in order to optimize the work. Furthermore, the CNN model can be compared with various transfer-learning models on a larger scale.

7. REFERENCES

- [1] P. Monkam, S. Qi, H. Ma, W. Gao, Y. Yao and W. Qian, "Detection and Classification of Pulmonary Nodules Using Convolutional Neural Networks: A Survey," in *IEEE Access*, vol. 7, pp. 78075-78091, 2019, doi:10.1109/ACCESS.2019.2920980.
- [2] H. Guo, U. Kruger, G. Wang, M. K. Kalra and P. Yan, "Knowledge-Based Analysis for Mortality Prediction From CT Images," in *IEEE Journal of Biomedical and Health Informatics*, vol. 24, no. 2, pp. 457-464, Feb. 2020, doi:10.1109/JBHI.2019.2946066.
- [3] D. Kumar et al., "Automatic Detection of White Blood Cancer From Bone Marrow Microscopic Images Using Convolutional Neural Networks," in *IEEE Access*, vol. 8, pp. 142521-142531, 2020, doi:10.1109/ACCESS.2020.3012292.
- [4] R. Y. Bhalerao, H. P. Jani, R. K. Gaitonde and V. Raut, "A novel approach for detection of Lung Cancer using Digital Image Processing and Convolution Neural Networks," 2019 5th International Conference on Advanced Computing & Communication Systems (ICACCS), Coimbatore, India, 2019, pp. 577-583, doi:10.1109/ICACCS.2019.8728348.
- [5] M. B. Khumancha, A. Barai and C. B. R. Rao, "Lung Cancer Detection from Computed Tomography (CT) Scans using Convolutional Neural Network," 2019 10th International Conference on Computing, Communication and Networking Technologies (ICCCNT), Kanpur, India, 2019, pp. 1-7, doi:10.1109/ICCCNT45670.2019.8944824.
- [6] Zheng, S., Guo, J., Cui, X., Veldhuis, R. N. J., Oudkerk, M., & van Ooijen, P. M. A. (2019). Automatic Pulmonary Nodule Detection in CT Scans Using Convolutional Neural Networks Based on Maximum Intensity Projection. *IEEE Transactions on Medical Imaging*, 1-1. doi:10.1109/tmi.2019.2935553
- [7] Tekade, R., & Rajeswari, K. (2018). Lung Cancer Detection and Classification Using Deep Learning. 2018 Fourth International Conference on Computing Communication Control and Automation (ICCUBEA). doi:10.1109/iccubea.2018.8697352
- [8] Xie, Yutong; Xia, Yong; Zhang, Jianpeng; Song, Yang; Feng, Dagan; Fulham, Michael; Cai, Weidong (2018). Knowledge-based Collaborative Deep Learning for Benign-Malignant Lung Nodule Classification on Chest CT. *IEEE Transactions on Medical Imaging*, (), 1-1. doi:10.1109/TMI.2018.2876510
- [9] G. L. F. da Silva, T. L. A. Valente, A. C. Silva, A. C. de Paiva, and M. Gattass, "Convolutional neural network-based PSO for lung nodule false positive reduction on CT images," *Comput. Methods Programs Biomed.*, vol. 162, pp. 109-118, Aug. 2018
- [10] C. Qin, D. Yao, Y. Shi, and Z. Song, "Computer-aided detection in chest radiography based on artificial intelligence: A survey," *BioMed*.
- [11] Eng. On Line, vol. 17, p. 113, Aug. 2018 R. Yamashita, M. Nishio, R. K. G. Do, and K. Togashi, "Convolutional neural networks: An overview and application in radiology," *Insights Imag.* vol. 9, pp. 611-629, Aug. 2018.
- [12] O. Ronneberger, P. Fischer, and T. Brox, "U-net: Convolutional networks for biomedical image segmentation." pp. 234-241.