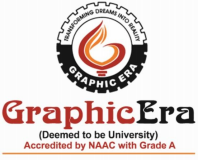
**Project Report**

**on**

**Medical Image Analysis using Deep Learning**

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**Abstract**

Localization of region of interest (ROI) is paramount to the analysis of medical images to assist in the identification and detection of diseases. In this research, we explore the application of a deep learning approach in the analysis of some medical images. Traditional methods have been restricted due to the coarse and granulated appearance of most of these images. Recently, deep learning techniques have produced promising results in the segmentation of medical images for the diagnosis of diseases. This project experiments on medical images using a deep learning architecture based on the Convolutional Neural Network-method for segmentation of medical images such as chest x-ray. The proposed method can efficiently identify the ROI on these images to assist in the diagnosis of diseases such as person is covid positive or suffering from viral pneumonia or normal. This system was evaluated on publicly available databases such as the COVID-19\_Radiography\_Dataset with over 96% accuracy.

This dataset is available on Kaggle.

**Introduction**

Technology today is extremely advanced and now physicians can call upon a variety of imaging techniques to help examine the inside of the body and therefore make an accurate diagnosis such as Scans and images of the body.

Bio-medical Image analysis and processing has great significance in the field of medicine, especially in Non-invasive treatment and clinical study.

There are many problems in medical image analysis and interpretation involve the need for a computer aided system to understand the images and image structure and know what it means.

The accurate interpretation and analysis of medical images often become boring and time consuming, because there is much detail in such images.

In modern medicine, medical imaging has undergone major advancements. Today, this ability to achieve information about the human body has many useful clinical applications. Over the years, different sorts of medical imaging have been developed, each with their own advantages and disadvantages.

In medical image analysis, confidently predicting something false can have devastating consequences. Apart from achieving high predictive accuracy, one needs to establish the circumstances under which algorithmic predictions generalize, or give appropriate error bounds. This is highly relevant to patient safety and the regulation of machine learning based medical software.

**Motivation**

Medical image segmentation, identifying the pixels of organs or lesions from background medical images such as CT or MRI images, is one of the most challenging tasks in medical image analysis that is to deliver critical information about the shapes and volumes of these organs. Many researchers have proposed various automated segmentation systems by applying available technologies.

Earlier systems were built on traditional methods such as edge detection filters and mathematical methods. Then, machine learning approaches extracting hand-crafted features have became a dominant technique for a long period. Designing and extracting these features has always been the primary concern for developing such a system and the complexities of these approaches have been considered as a significant limitation for them to be deployed. In the 2000s, owing to hardware improvement, deep learning approaches came into the picture and started to demonstrate their considerable capabilities in image processing tasks.

The promising ability of deep learning approaches has put them as a primary option for image segmentation, and in particular for medical image segmentation.

**Libraries and Modules**

**Tensorflow**

TensorFlow is a free and open-source software library for machine learning and artificial intelligence. It can be used across a range of tasks but has a particular focus on training and inference of deep neural networks.

**Keras**

Keras is an open-source software library that provides a Python interface for artificial neural networks. Keras acts as an interface for the TensorFlow library. Keras contains numerous implementations of commonly used neural-network building blocks such as layers, objectives, activation functions, optimizers, and a host of tools to make working with image and text data easier to simplify the coding necessary for writing deep neural network code.

**Matplotlib**

Matplotlib is a plotting library for the Python programming language and its numerical mathematics extension NumPy. It provides an object-oriented API for embedding plots into applications using general-purpose GUI toolkits like Tkinter, wxPython, Qt, or GTK.

**Software Required**

Windows 7/8/10

Google chrome for colab

**Hardware Required**

GPU-8 to 16 GB

RAM- 8GB(Min.)

**Methodology**

**Problem Statement**

We have to analyse Medical Image using Deep Learning and predict the disease person having .

**Data Understanding**

In this project I have taken chest X-rays dataset.

X-rays were invented by Conrad Rontgen in 1895 describing it as new kind of rays which can penetrate almost anything. He described the diagnostic capabilities of X-rays for imaging the human body and received the Noble Prize in 1901.

X-ray radiographs are the simplest form of medical imaging through the transmission of X-rays through the body which are then collected on a film. The attenuation or absorption of X-rays is described by the photoelectric and Compton effects providing more attenuation through bones than soft tissues or air.

**Chest Radiograph**

**X-ray of a person's chest

Description automatically generated with medium confidence**

**Data Pre-processing**

We first loaded our dataset into notebook, then imported all of the necessary libraries such as tensorflow, keras, and so on. Then, in our datset, we find various classes.

A picture containing text

Description automatically generated

A picture containing text, necktie, wearing, different

Description automatically generated

Following that, the dataset is divided into three parts:

Training: Dataset to be used while training

Validation: Dataset to be tested against while training

Test: Dataset to be tested against after we trained a model

I use 80% of the train dataset, 10% of the test dataset, and 10% of the validation test.

**Modelling**

Creating a Layer for Resizing and Normalization.

Before we feed our images to network, we should be resizing it to the desired size. Moreover, to improve model performance, we should normalize the image pixel value (keeping them in range 0 and 1 by dividing by 256). This should happen while training as well as inference. Hence we can add that as a layer in our Sequential Model.

This will be useful when we are done with the training and start using the model for predictions. At that time someone can supply an image that is not (256,256) and this layer will resize it.

Model Architecture-

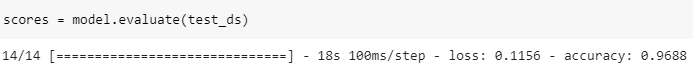
We use a CNN coupled with a Softmax activation in the output layer. We also add the initial layers for resizing, normalization and Data Augmentation.

We are going to use convolutional neural network (CNN) here. CNN is popular for image classification tasks.

**Result Analysis**

Compiling the Model-

We use adam Optimizer, SparseCategoricalCrossentropy for losses, accuracy as a metric.

Then I run the model for 50 epochs. As you can see above, we get 96.88 percent accuracy on our test dataset. This is considered to be fairly accurate.

Graph of Model Accuracy for training and testing dataset

Chart

Description automatically generated

**Output Sample**

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**X-ray of a person's chest

Description automatically generated with low confidence**

**Conclusion**

We have proposed a system which will help in the medical industry to detect a disease that a patient is having.

The main benefit of medical image processing is that it allows for in-depth, but non-invasive exploration of internal anatomy. 3D models of the anatomies of interest can be created and studied to improve treatment outcomes for the patient, develop improved medical devices and drug delivery systems, or achieve more informed diagnoses. It has become one of the key tools leveraged for medical advancement in recent years.

We used a deep learning technique called Convolutional Neural Network to analyse people's chest x-rays and determine whether they had covid, viral pneumonia, or were normal.

Our primary goal is to achieve the highest level of accuracy.

And we have a 96.88 percent accuracy rate.

The future of image processing will involve scanning the heavens for other intelligent life out in space. Also new intelligent, digital species created entirely by research scientists in various nations of the world will include advances in image processing applications. Due to advances in image processing and related technologies there will be millions and millions of robots in the world in a few decades time, transforming the way the world is managed.

**References**

<https://www.tensorflow.org/>

<https://keras.io/>

<https://www.youtube.com/channel/UCh9nVJoWXmFb7sLApWGcLPQ>  
<https://www.kaggle.com/tawsifurrahman/covid19-radiography-database>

<https://ieeexplore.ieee.org/document/6088923>