

PNEUMONIA DETECTION IN CHEST X-RAY IMAGES USING DEEP LEARNING MODELS

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ABSTRACT:

Pneumonia is an acute pulmonary infection that can be caused by bacteria, viruses, or fungi and infects the lungs, there are 3 types of Pneumonia CAP (community-acquired pneumonia), HAP (hospital-acquired pneumonia) and VAP (ventilator-associated pneumonia). Chest X-ray imaging is the most frequently used method for diagnosing pneumonia. However, the examination of chest X-rays is a challenging task and is prone to subjective variability. Our main motive is to detect Pneumonia using CXR

Deep learning is an important artificial intelligence tool, which plays a crucial role in solving many complex computers vision problems. Deep learning models, specifically convolutional neural networks (CNNs), are used extensively for various image classification problems.

We are going to develop a computer-aided diagnosis system for automatic pneumonia detection using chest X-ray images. Our main objective is to avoid medical diagnosis procedure.

1.INTRODUCTION

Pneumonia is an infection in one or both lungs caused by bacteria, viruses, or fungi. The infection leads to inflammation in the air sacs of the lungs, which are called alveoli. The alveoli fill with fluid or pus, making it difficult to breathe. Both viral and bacterial pneumonia are contagious. This means they can spread from person to person through inhalation of airborne droplets from a sneeze or cough. Pneumonia is further classified according to where or how it was acquired.

- 1. Hospital-acquired pneumonia (HAP).**
- 2. Community-acquired pneumonia (CAP).**
- 3. Ventilator-associated pneumonia (VAP).**

2.Problem Statement:

Our main motive is to detect Pneumonia using CXR

Deep learning is an important artificial intelligence tool, which plays a crucial role in solving many complex computer-vision problems. Deep learning models, specifically convolutional neural networks (CNNs), are used extensively for various image classification problems.

We are going to develop a computer-aided diagnosis system for automatic pneumonia detection using chest X-ray images.

3.Objectives:

- Our main objective is to detect pneumonia using CXR images
- Accurate results and easy classification over existed methods.
- Not to address the medical diagnostic procedure.

4.Software requirements:

The system requirements or software requirements is a listing of what software programs or hardware devices are required to operate the program or game properly. System requirements are printed on their packaging, as shown in the image of the Windows 7 system requirements, or are found on the Internet. Here is the list of technologies used in this project.

4.1 python:

Python is the most powerful general-purpose programming language created by Guido Van Rossum. Python is interpreted and object-oriented.^[7] There are many languages other than python. According to the graph from Francois Puget^[8], Python is the major code language for Artificial intelligence and Machine Learning.

4.2 Numpy:

Numpy is a module for the Python programming language, adding support for large, multidimensional arrays and matrices, along with a huge collection of high-level mathematical

functions to work on these arrays. Numpy array is a multidimensional array that stores elements of the same type.

4.3 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. There is also a procedural “pylab” interface based on a state machine (like OpenGL), designed to resemble MATLAB, though its use is discouraged closely. SciPy makes use of Matplotlib.

4.4 Tensor flow:

TensorFlow is a Python library for fast numerical computing created and released by Google. It is a foundation library that can be used to build Deep Learning models directly or by using wrapper modules that simplify the process built on top of TensorFlow. TensorFlow is Google’s open-source machine learning platform that is most widely adopted by machine learning developers worldwide.

4.5 Tkinter:

Tkinter is the standard GUI library for Python. Python when combined with Tkinter provides a fast and easy way to create GUI applications. Tkinter provides a powerful objectoriented interface to the Tk GUI toolkit.

4.6 Jupyter notebook

The Jupyter Notebook is an open-source web application that allows you to create and share documents that contain live code, equations, visualizations and narrative text. Uses include: data cleaning and transformation, numerical simulation, statistical approx. g, data visualization, machine learning, and much more.

5.RESEARCH METHODOLOGY:

Deep learning is a machine learning technique that teaches computers to do what comes naturally to humans: learn by example. Deep learning is a key technology behind driverless cars, enabling them to recognize a stop sign, or to distinguish a pedestrian from a lamppost. It is the key to voice control in consumer devices like phones, tablets, TVs, and hands-free speakers.

5.1 Supervised learning:

Supervised learning is the types of machine learning in which machines are trained using well “labelled” training data, and on basis of that data, machines predict the output. The labelled data means some input data is already tagged with the correct output. Supervised learning can be further divided into two types of problems:

5.1.1 Regression:

Regression algorithms are used if there is a relationship between the input variable and the output variable. It is used for the prediction of continuous variables, such as Weather forecasting, Market Trends, etc.

5.1.2 Classification:

Classification algorithms are used when the output variable is categorical, which means there are two classes such as Yes-No, Male-Female, True-false, etc.

5.2.1 Clustering:

Clustering is a method of grouping the objects into clusters such that objects with most similarities remains into a group and has less or no similarities with the objects of another group. Cluster analysis finds the commonalities between the data objects and categorizes them as per the presence and absence of those commonalities.

5.3 Neural networks:

Neural networks are artificial systems that were inspired by biological neural networks. These systems learn to perform tasks by being exposed to various datasets and examples without any task-specific rules. The idea is that the system generates identifying characteristics from the data they have been passed without being programmed with a pre-programmed understanding of these datasets.

5.4 Convolutional Neural Network:

Convolution neural network contains a three-dimensional arrangement of neurons, instead of the standard two-dimensional array. The first layer is called a convolutional layer.

Propagation is uni-directional where CNN contains one or more convolutional layers followed by pooling and bidirectional where the output of convolution layer goes to a fully connected neural network. Convolution neural networks show very effective results in image and video recognition, semantic parsing and paraphrase detection.

5.5 Radial Basis Function Neural Networks:

Radial Basis Function Network consists of an input vector followed by a layer of RBF neurons and an output layer with one node per category. Classification is performed by measuring the input's similarity to data points from the training set where each neuron stores a prototype. This will be one of the examples from the training set.

5.6 Recurrent Neural Networks:

Designed to save the output of a layer, Recurrent Neural Network is fed back to the input to help in predicting the outcome of the layer. The first layer is typically a feed forward neural network followed by recurrent neural network layer where some information it had in the previous time-step is remembered by a memory function.

6.IMPLEMENTATION:

6.1 Data Pre-processing

Data pre-processing is the process of transforming raw data into an understandable format. Sometimes, the collected data dataset contains several different values, which lead to improper learning. For better learning, we have to pre-process the data.

6.2 Data Cleaning

Data cleaning is the process of preparing raw data by removing bad data, organizing the raw data, and filling in the null values for analysis.

Here we took chest x-ray images and converted it into Gray scale images then spots in x-ray images are stored in 1 dimensional array.

8.RESULT AND ANALYSYS:

The Classification Accuracy obtained for VGG16 ang VGG19 Models are :

```
loss: 0.1801 - accuracy: 0.9494 - val_loss: 0.6272 - val_accuracy: 0.8798
```

6.2.1 Accuracy for VGG16

```
loss: 0.2865 - accuracy: 0.9346 - val_loss: 0.4838 - val_accuracy: 0.9199
```

6.2.2 Accuracy for VGG19

```
In [23]: if result==0:
          print("Person is Affected By PNEUMONIA")
        else:
          print("Result is Normal")
```

Result is Normal

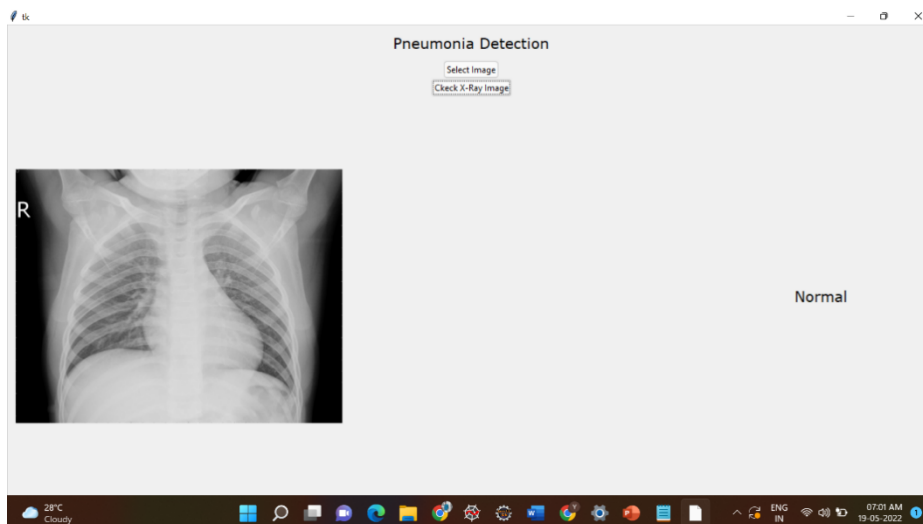
6.3.1 Person not affected by pneumonia

```
[28]: if result==0:
        print("Person is Affected By PNEUMONIA")
      else:
        print("Result is Normal")
```

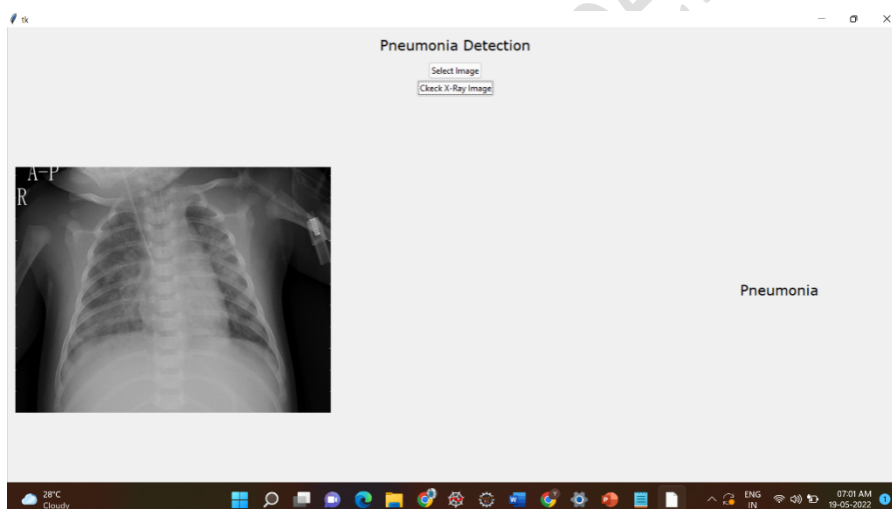
Person is Affected By PNEUMONIA

6.3.2 Person who affected by Pneumonia.

We create a GUI which easy easily identify by uploading chest X-ray



6.3.3 Normal person chest X-ray



6.3.4 Pneumonia person chest X-ray

9.CONCLUSION:

In This Project we focused on 2 Algorithms: VGG16, VGG19 and used the same data set for both algorithms and compared.

VGG19 has high accuracy than VGG16 thus the performance of VGG19 is greater than VGG16 for detecting pneumonia detection in chest X-ray.

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