PROJECT REPORT

COVID-19 DETECTION WITH CHEST X-RAY DATASET USING CNN

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1.ABSTRACT:

This project covers the basic concepts of convolutional neural networks (CNN). It also helps us to understand the advantages and applications of CNN .It also shows how deep learning techniques can be used in the medical field .As the number of cases are increasing with unprecedented many parts of world are facing shortage of resources and testing tools .As a result many engineers and scientists are encouraging the development of deep learning model to detect COVID-19 from chest X-Rays and to determine the severity of the infection in very short time with low cost .On this conquest a CNN model is proposed to detect COVID-19 from chest X-rays

2.INTRODUCTION:

Nowadays, automatic disease detection has become a crucial issue in medical science due to rapid population growth. An automatic disease detection framework assists doctors in the diagnosis of disease and provides exact, consistent, and fast results and reduces the death rate.

The coronavirus pandemic that has spread across the world has placed all sectors on lockdown for many months. Many different approaches have been taken towards detecting Covid-19.On such method is to diagnose covid-19 infections using radiological images such as x-rays.This project is focused on making a deep learning based system which utilizes cnn to detect covid-19 from xray images.It is capable of learning from imperative experiences with long term states.

3.CURRENT TRENDS:

Convolutional neural networks have been around for ages and were inspired by biological processes - particularly the way how brain understands the signals it receives from the eyes. The state of the art visual recognition systems today use CNN algorithms to perform image classification, localization and object detection.

The interest in convolutional neural networks has been renewed because it's been heavily used for smart surveillance and monitoring, social network photo tagging and image classification , robotics, drones, and self-driving cars. The data scientists at Google, Amazon, Facebook etc. use this to do all sorts of image filtering and classification.

A closely related field is deep learning for computer vision which is what powers a barcode scanner's ability to "see" and "understand" the stripes in a barcode. That's also how Apple's Face ID recognizes you when it sees your face.

4.POTENTICAL FOR WORK IN THE AREA:

Convolutional Neural Networks (CNNs) have a lot of potential to revolutionize the field of Medical Imaging Diagnostics due to their capabilities of learning by using only raw data. However, CNNs can only learn when trained using thousands of data points, which is not always available when dealing with medical data

5.PROBLEM STATEMENT:

This project deals with the implementation of convolutional neural networks to detect COVID-19 from chest X-Rays .It involves the use of deep learning technology which takes input samples to detect COVID-19. The more number of samples given, the more efficiency and accuracy of diagnosis.

6.OBJECTIVES:

Our main objective is to use CNN to detect COVID-19 from chest X-Rays by using concepts of deep learning and image processing

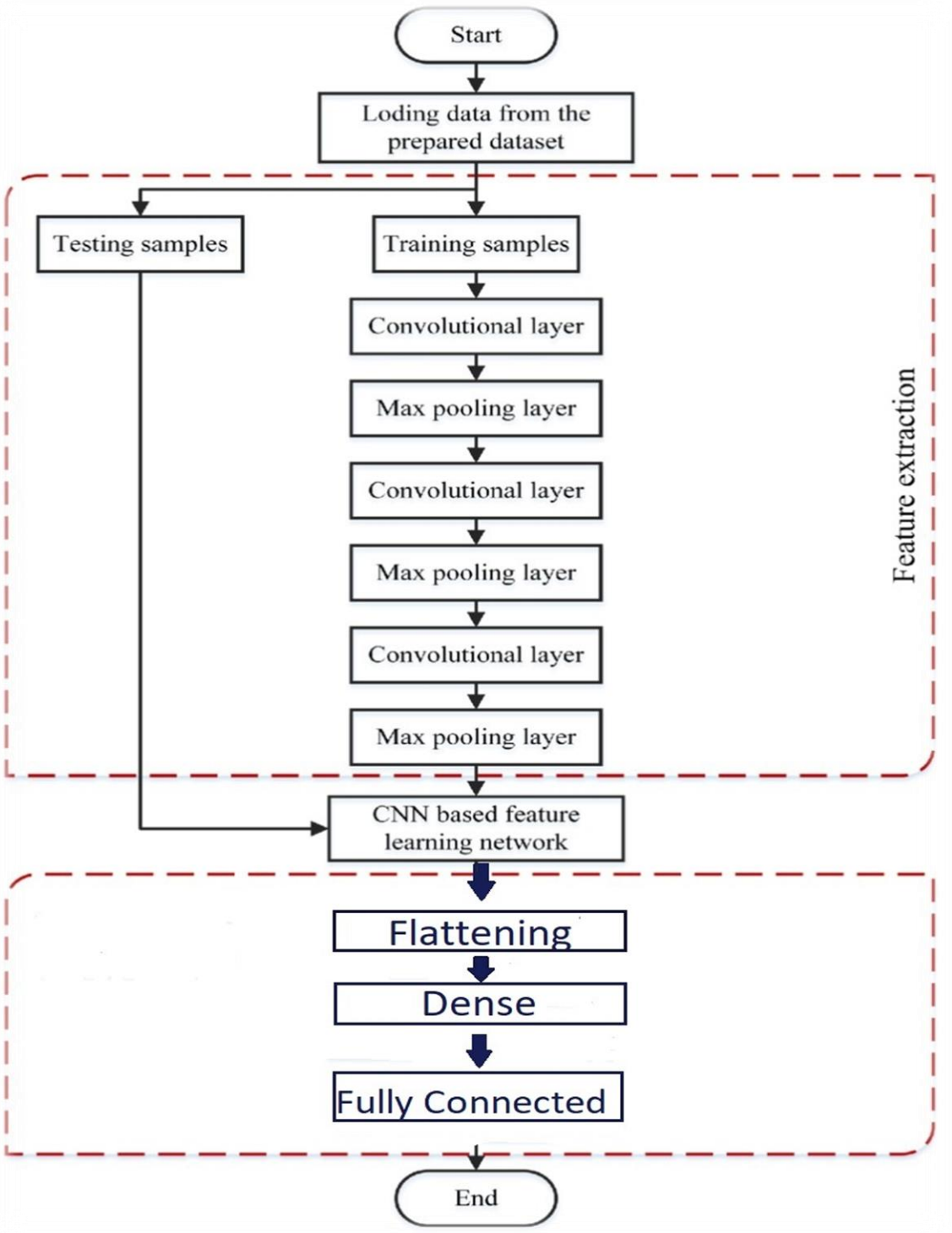
7.LITERATURE SURVEY:

COVID-net: a tailored deep convolutional neural network design for detection of COVID-19 cases from chest x-ray images. (Wang L., Lin Z.Q. and Wong A):
Motivated by the need for faster interpretation of radiography images, a number of artificial intelligence (AI) systems based on deep learning21 have been proposed and results have shown to be quite promising in terms of accuracy in detecting patients infected with COVID-19 via radiography imaging

Detection of coronavirus disease (COVID-19) based on deep features. (Kumar P. and Kumari S).
The support vector machine classifies the corona affected X-ray images from others using the deep feature. The methodology is beneficial for the medical practitioner for diagnosis of coronavirus infected patient

Automated detection of COVID-19 cases using deep neural networks with X-ray images. (Ozturk T, Talo M, Yildirim EA, Baloglu UB, Yildirim O, Acharya UR):
Recent findings obtained using radiology imaging techniques suggest that such images contain salient information about the COVID-19 virus. Application of advanced artificial intelligence (AI) techniques coupled with radiological imaging can be helpful for the accurate detection of this disease, and can also be assistive to overcome the problem of a lack of specialized physicians in remote villages.

8.METHODOLOGY:(FLOWCHART)



PROBLEMS FACED:

For this method to be efficient and accurate we need to input lot of samples into the code for preprocessing purpose

9.TOOLS USED TO COMPLIE ,DEBUG:

Simulation used :

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 modeling, data visualization, machine learning, and much more.

Libraries used:

Numpy: is a Python library used for working with arrays. It also has functions for working in domain of linear algebra, fourier transform,and matrices. It is an extension of numeric and numarray

TensorFlow: is a Python library for fast numerical computing created and released by Google. It is a foundation library that can be used to create Deep Learning models directly or by using wrapper libraries that simplify the process built on top of Tensorflow

10.DESCRIPTION OF PROJECT WITH BLOCK DIAGRAM

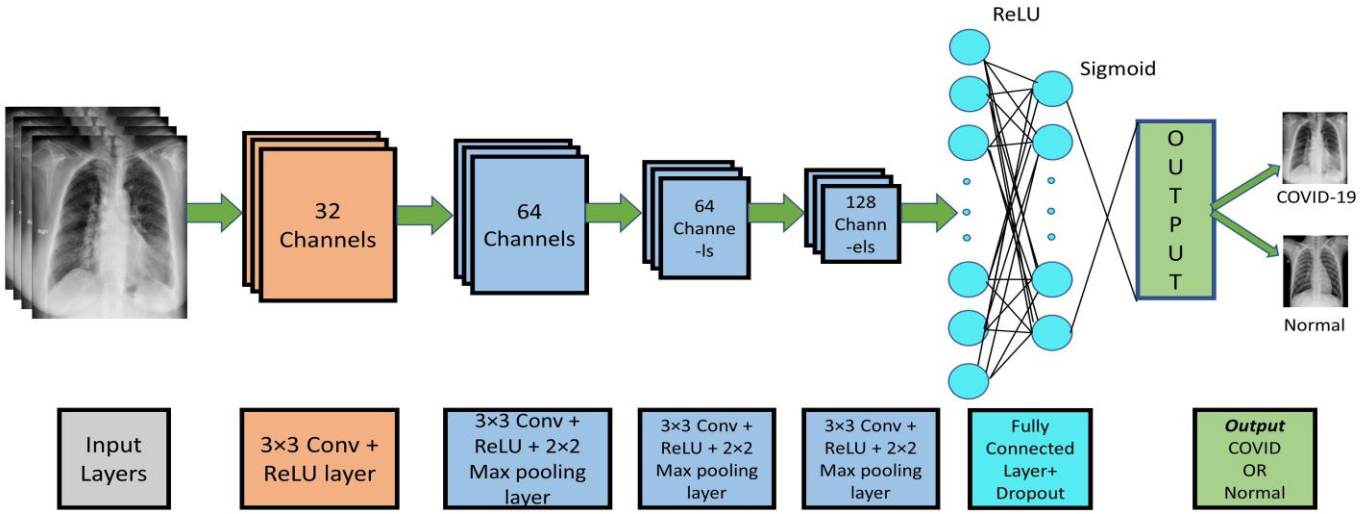


FIG: BLOCK DIAGRAM OF CNN

CONVOLUTION OF NEURAL NETWORKS(CNN):

CNN has been playing a great role in classifying images,particular medical images. This opened new windows of opportunities and made the disease detection process more
convenient. It also successfully detects Covid-19 with higher accuracy. One of the constraints that researchers encounter is a limited dataset for training their model. Being a novel disease, the chest X-ray dataset of COVID-19 positive patients is also limited. Therefore, to avoid overfitting, a sequential CNN model is proposed for classifying X-ray images.

The tuned data set is fed into the input layers of the model. This model is trained on 284 X-ray images of each category: normal and COVID-19. It has four convolutional layers, first one is a 2D convolutional layer with 3×3 kernels and Rectified Linear Unit (ReLU) activation function. ReLU is one of the most popular and effective activation functions that are being widely used in DL. ReLU does not activate all the The next three layers are 2D convolutional layers,the ReLU activation function and Max pooling. Max pooling accumulates the features of the convolutional layer by convolving filters over it. It reduces the computational cost

as it minimizes the number of parameters.In each of three layers a 2×2 Max pooling layer is added after the convolutional layer to avoid overfitting and to make the model computationally efficient.

In the next step of the model, the output of the convolutional layers is converted to a long 1D feature vector by a flatten layer. This output from the flatten layer is feed to the fully connected layer with dropout.

In a fully connected layer, every input neuron is connected to every activation unit of the next layer. All the input features are passed through the ReLU activation function and this layer categorizes the images to the assigned labels. The Sigmoid activation function makes the classification decision depending on the classification label of the neurons. Finally, in the output layer, it is declared if the input X-ray image is COVID-19 positive or normal.

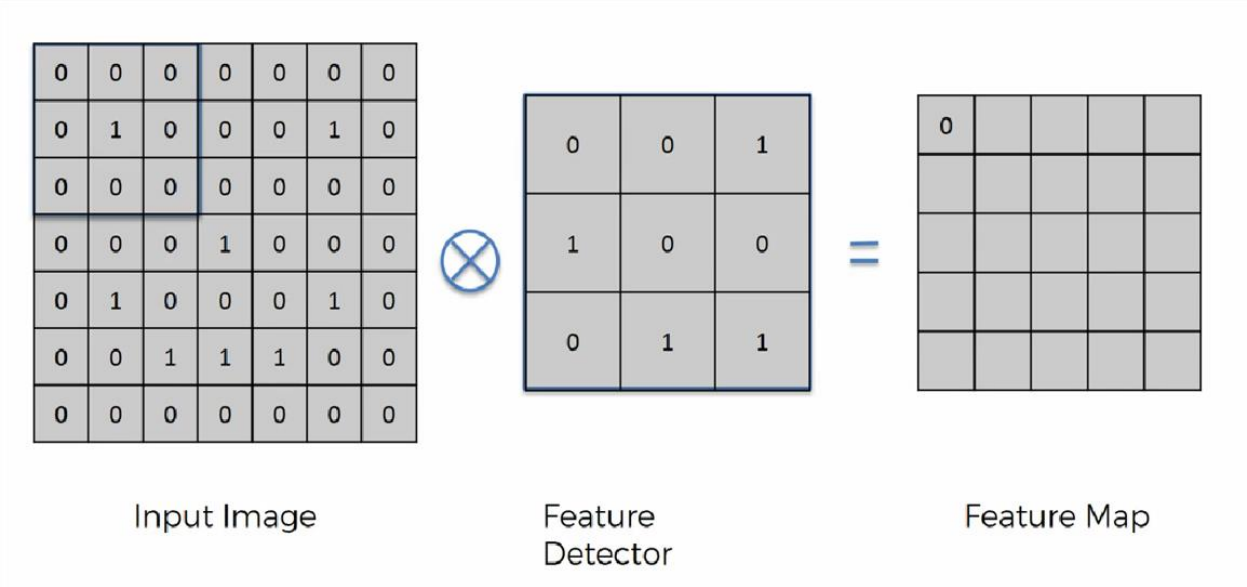
STEPS INVOLVED IN CNN:

CONVOLUTION
RELU
POOLING
FULL CONNECTION

CONVOLUTION:

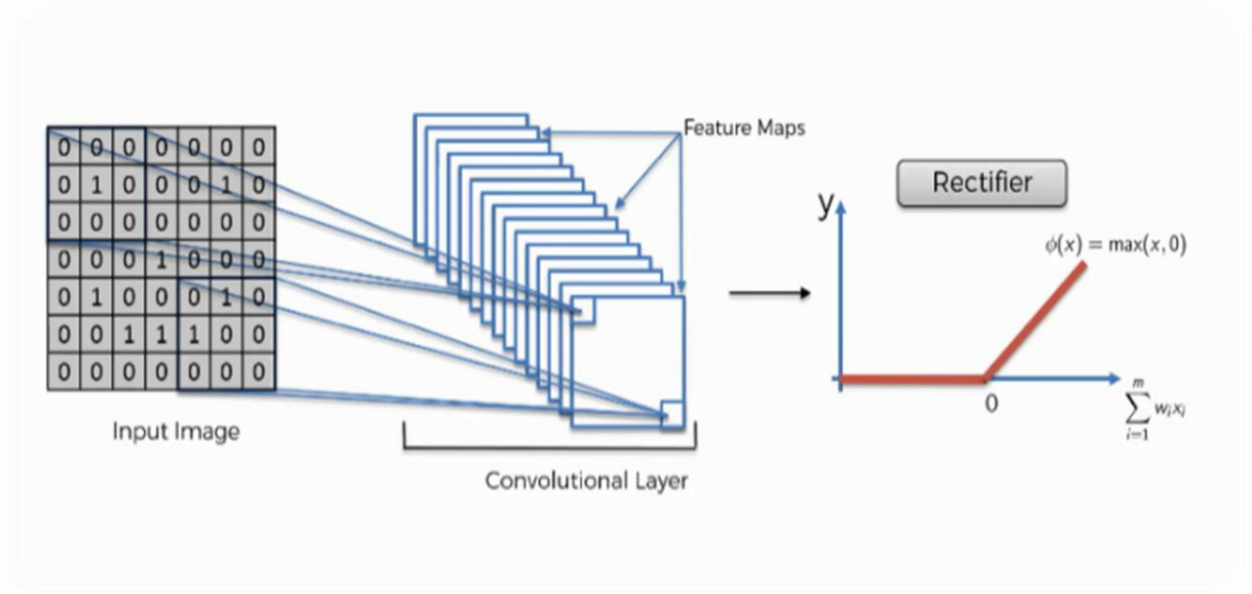
The convolution is performed on the input data with the use of a **filter** or **kernel** (these terms are used interchangeably) to then produce a **feature map**.

We execute a convolution by sliding the filter over the input. At every location, a matrix multiplication is performed and sums the result onto the feature map.



RECTIFIED LINEAR UNIT (RELU)

The purpose of applying the rectifier function is to increase the non-linearity the images.This is because images are naturally non-linear.
When you look at any image, you'll find it contains a lot of non-linear features (e.g. the transition between pixels, the borders, the colors, etc.).
The rectifier serves to break up the linearity even further in order to make up for the linearity that we might impose an image when we put it through the convolution operation.

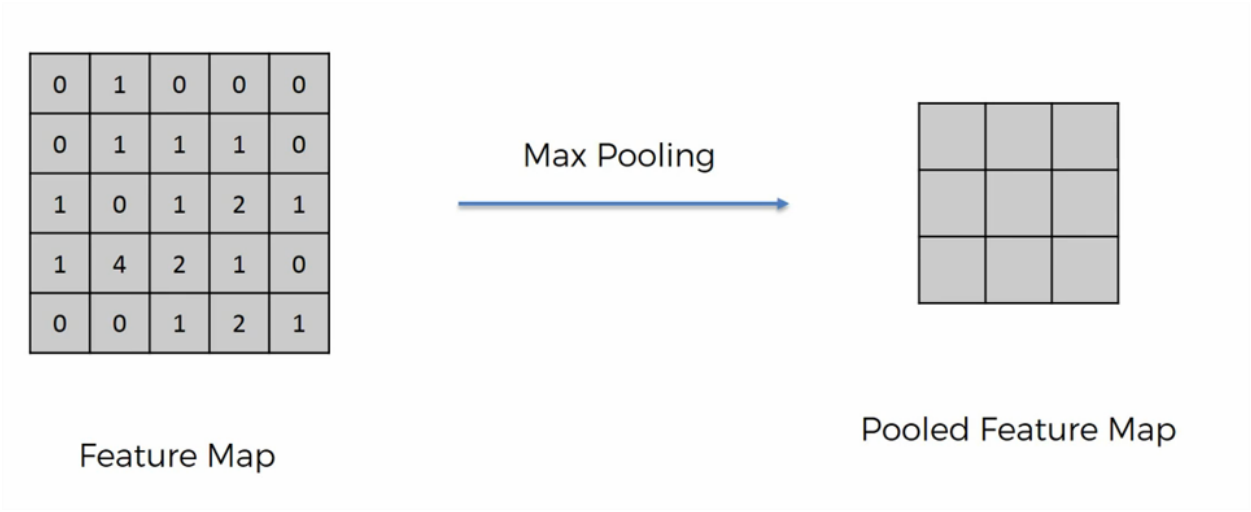


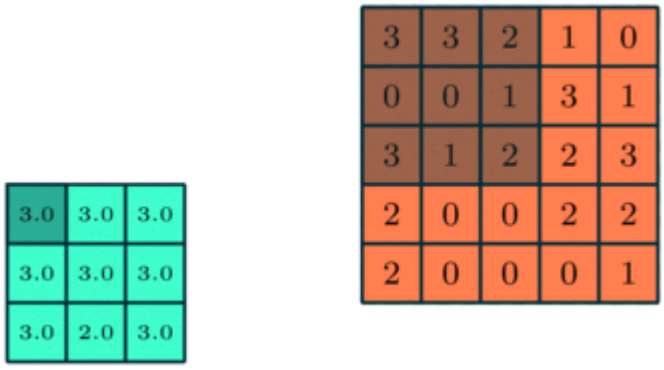
POOLING

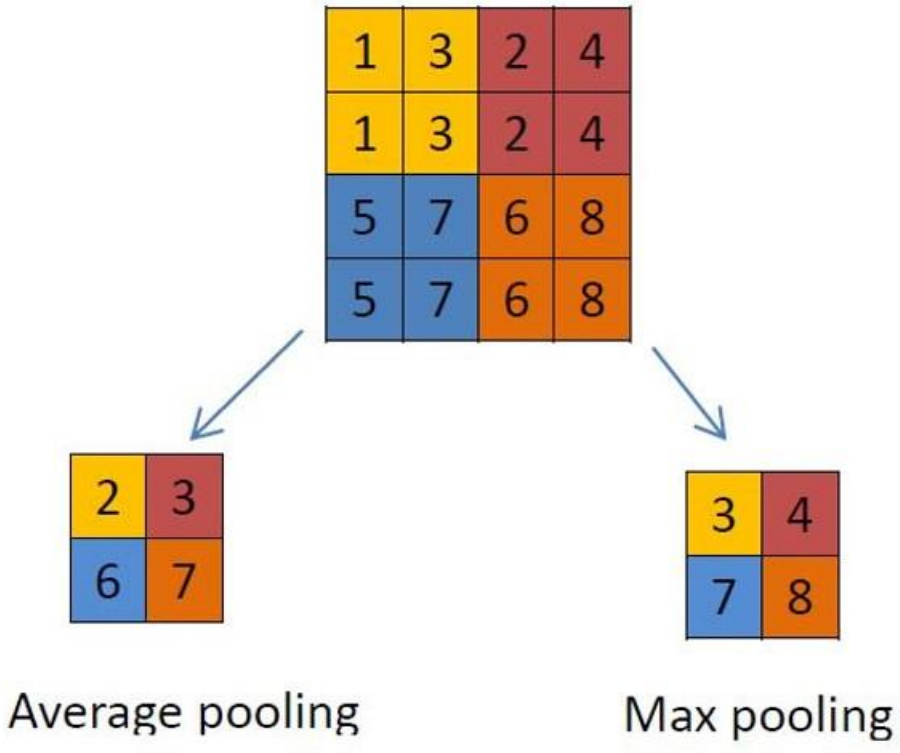
A pooling layer is another building block of a CNN. Its function is to progressively reduce the spatial size of the representation to reduce the amount of parameters and computation in the network. Pooling layer operates on each feature map independently.

The most common approach used in pooling is max pooling.

There are two types of Pooling: Max Pooling and Average Pooling. **Max Pooling** returns the **maximum value** from the portion of the image. On the other hand, **Average Pooling** returns the **average of all the values** from the portion of the image

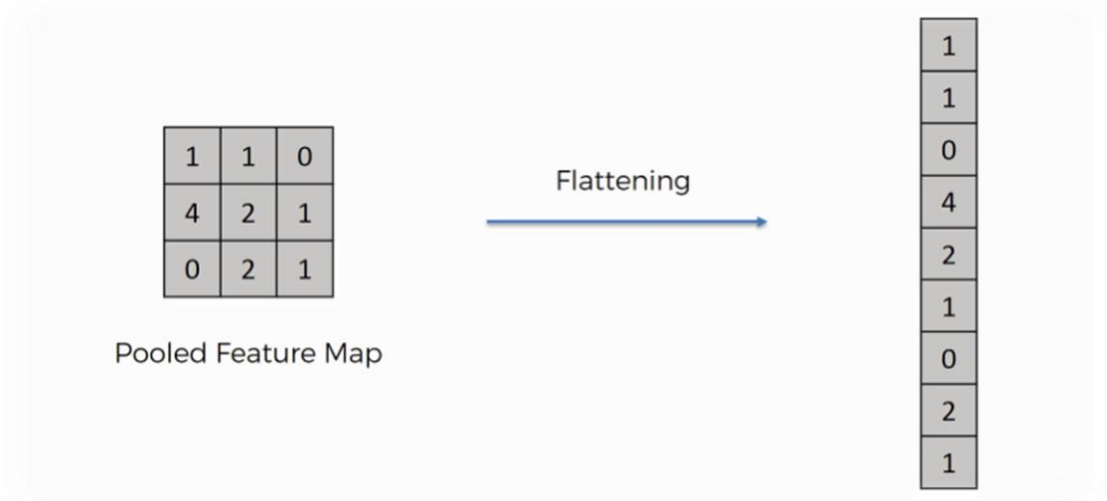






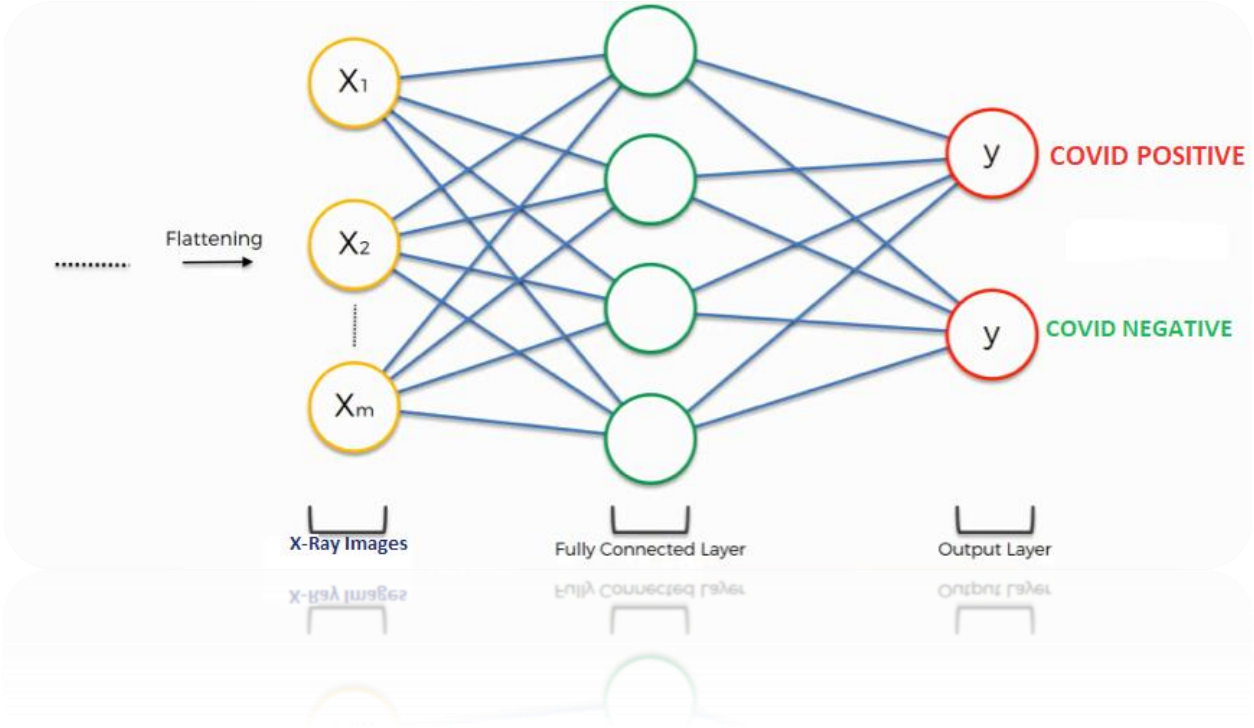
FLATTENING:

After obtaining the pooled feature map,the next step is flattening the feature map into a column as shown in the image below.This is done to insert this data into an artificial neural network



FULL CONNECTION:

The input layer contains the vector of data that was created in the flattening step. The features that are distilled throughout the previous steps are encoded in this vector. At this point, they are already sufficient for a fair degree of accuracy in recognizing classes. The level of complexity and precision must be increased now.



11.PROJECT OUTCOME:

With the detection of this disease at an early stage, the prevalence of COVID-19 disease will decrease

Detection of covid-19 using x-ray images is an accurate and efficient method for fast diagnosis

It can be used to develop a smart healthcare system which is beneficial

12.APPLICATION AREAS:

Progress in this area could be a catalyst for breakthroughs in many areas. CNN technology can be used in natural language processing ,CNN in self driving cars,decoding facial recognition and analysing documents .A great deal of research is being conducted towards this technology and this can lead to a great number of contributions

13.CONCLUSION:

Mass testing and early detection of COVID-19 play an important role in preventing the spread of the global pandemic. Time, cost, and accuracy are the few major factors in any disease detection process especially COVID-19. To address these issues, a CNN can play a huge role in detecting COVID-19 cases from patients' chest Xrays. A set of 284 chest X-ray images are used
for training the model.This model can be improved further with the availability of the larger dataset. So, CNN has great prospects in detecting COVID-19 with very limited time, resources, and costs. Though the proposed model shows
promising results, it is in no way clinically tested. This model
needs further improvements and clinical testing for it to work
in clinical diagnosis

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