Diagnosis and Treatment of Covid19 using AI & Deep Learning

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Abstract - *The severe acute respiratory syndrome coronavirus (SARS CoV-2) is detected using chest X-ray images (SARS CoV-2) using chest X-ray images, principally accountable for coronavirus disease 2019 (COVID-19), is critical for both patients and doctors. Furthermore, this becomes even more important in regions where experimental kits cannot be purchased. We focused on presenting the advantage of deep learning for the high-accuracy detection of COVID-19 using chest X-ray images. Thirty-eight experiments were distributed using deep neural networks, ten experiments using five machine learning models, and fourteen experiments using state-of-the-art pre-trained networks for transfer learning. Images and statistical data were considered separately within the experiments to gauge model performance, and eightfold cross-validation was used. We use Keras [2], which uses TensorFlow for the backend. A convolutional neural network with preprocessing and reduced layers can detect COVID-19 in a minimal number of imbalanced chest X-ray images. This project aims to boost the healthcare system in hospitals through AI.*

Key Words: Machine Learning, Convolutional Neural Network, HOG, MADF.

1. INTRODUCTION

COVID-19 is currently considered the foremost threatening and lethal disease for human beings caused by a novel coronavirus. Early detection of COVID-19 through accurate diagnosis, particularly in cases with no apparent symptoms, may reduce the patient's mortality rate. Chest X-ray images are accustomed to indicate the most purpose of identifying this disease.

1.1 Existing System

Even though point-of-care COVID-19 tests are expected to be utilized in clinical settings at some point, for the time being, turnaround times for COVID-19 test results range from three to over forty-eight hours, and not all countries will likely have access to those test kits that provide results quickly. One of the key recommendations within the Fleischer Society's recently published multinational consensus statement is to use chest radiography for patients with COVID-19 when access to computed tomography (CT) is limited [3]. The financial cost of laboratory kits used for diagnosis, particularly in developing and underdeveloped countries, could be a significant issue when fighting the illness. Using X-ray image data for automated COVID-19 detection may be especially beneficial for regions and healthcare facilities that cannot afford to shop for a laboratory kit for testing or do not have CT. This is often important because no appropriate treatment option has been discovered, so an accurate diagnosis is crucial. AI tools have generated accurate and consistent outcomes in applications that use visual-based or different kinds of information [4]. Due to the imbalanced data, the ultimate conclusion was made using the obtained confusion matrices instead of the accuracy results. Since no effective treatment option has been discovered, this can be significant, so an accurate diagnosis is crucial.

1.2 proposed System

The ConvNet combines the feature extraction and classification phases in a single network. A conventional ConvNet comprises three layers: Convolution, pooling, and complete connection. Feature extraction is done in the convolutional layer using masks, splitting images into predetermined dimensions of segments, and then extracting features from an image using filters. Then, by applying an activation function to the values obtained by the masks, a feature map is created, representing features on the 2D map [5]. The activation function nonlinearly initiates the most knowledgeable neurons, lowering the neural network's computational cost. Numerous activation features are available in CNN, with the rectified linear unit (ReLU) being the most frequently used [6]. It does not activate all neurons simultaneously, resulting in faster convergence when the weights find the optimal values to generate the trained response during training. To reduce the dimensions of the images, a pooling process is performed on the generated feature map. Finally, the feature map is vectorized and sent to the fully connected layer. The fully connected layer is where the neural network's convergence and classification of input patterns take place, and its fundamentals are based on error backpropagation to update the weights within this layer.

2. METHODOLOGY

2.1 Convolutional Neural Network (CNN/ConvNet)

Convolutional neural networks (CNN/ConvNet) are deep neural networks frequently used in deep learning to interpret visual data. Matrix multiplications come to mind when we think of neural networks. However, that is not the case with ConvNet. It employs a technique called Convolution.

Bottom line, ConvNet's job is to compress the images into a more accessible format while still maintaining essential elements for a solid prediction.

Convolutional neural networks are made up of several layers of artificial neurons. Artificial neurons are mathematical functions that calculate the weighted sum of multiple inputs and output an activation value, a rough replica of their biological counterparts. When you feed an image into a ConvNet, each layer generates several activations functions, which are then passed on to the next layer.

3. IMPLEMENTATION

Here we use Machine Learning algorithms to predict the presence of covid 19 in a patient. The algorithms used are convolutional neural networks. The process flow of this project is represented in Fig 1. Initially, the data is collected and studied. Secondly, the raw data is structured and divided into training and test data. Now the data is provided to the algorithms and allowed to train the data. First, it is checked whether the data is valid or not. If data is valid, then the algorithms get trained separately. The algorithm is trained accordingly for different parameters of input. Then next, it comes to the test data, where the data is provided to predict the presence of covid 19 based on the parameters provided. This data is compared with data used for the training algorithm, and then the errors are calculated. The less the error is, the good the efficiency and accuracy of the prediction. So, the covid 19 is predicted based on the trained or historical data.

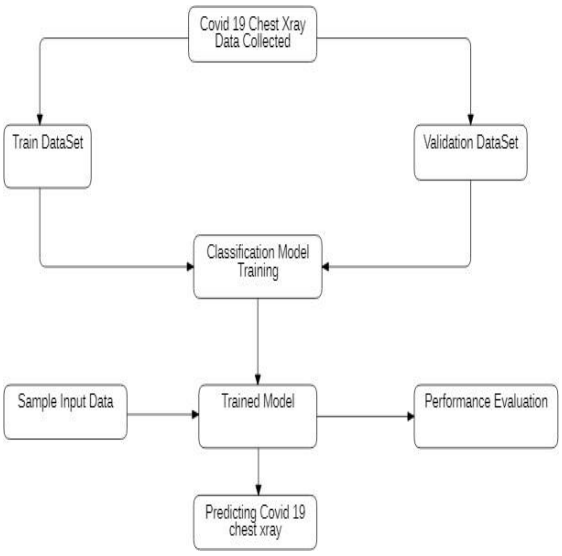

Fig- 1: Data Flow Model of the whole process

4. RESULT

After the data is collected from different sources, then the collection is to be studied, and statistical analysis is to be done. The output is represented in Fig. 2.

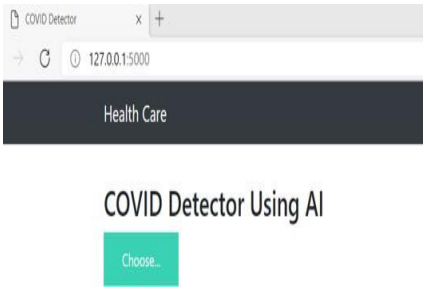

Fig-2: The output screen

Fig. 3 is the representation of the patient affected by covid 19. This analysis makes us and the algorithm understand the data collected efficiently, and the predictions will be accurate.

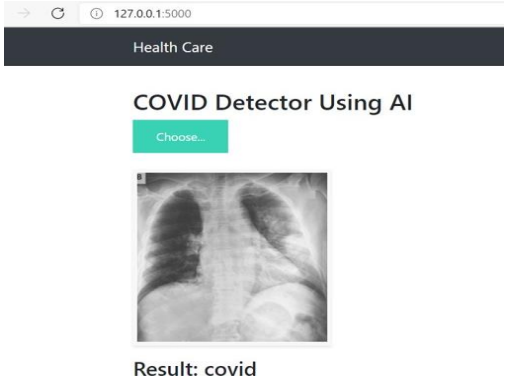

Fig-3: Detection of Covid-19 by making use of x-ray

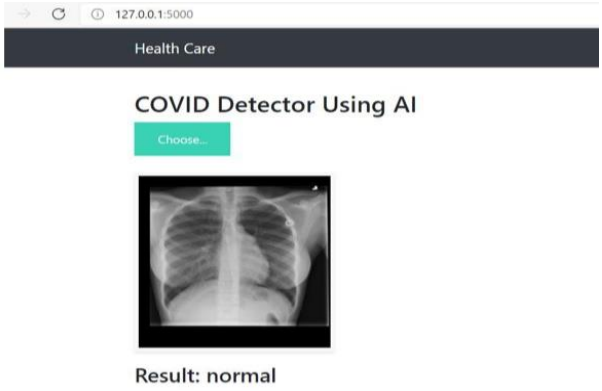

Fig-4: X-ray of an ordinary person

4. CONCLUSIONS

COVID-19 mass testing and early detection are critical in preventing the spread of this recent global pandemic. Time, cost, and accuracy are the few most critical factors in any disease detection process, particularly COVID-19. This paper proposes a CNN-based model for detecting COVID-19 cases from patients' chest X-rays to address these issues. A set of 330 chest X-ray images equally divided into two classes: 'COVID-19' and 'Normal,' are used to train the model. Similarly, an equally divided image set of 82 chest X-rays is used for model validation. This model has a precision and accuracy of 97.56 and 95.34 percent, respectively.

Moreover, this model is compared to the other two CNN models with several convolutional layers. The comparative studies show a better F1-score and overall performance of the proposed model (Model 1) than the other two. This model can be improved further with the availability of the larger dataset. So, CNN has excellent prospects in detecting COVID-19 with minimal 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 to work in clinical diagnosis.

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