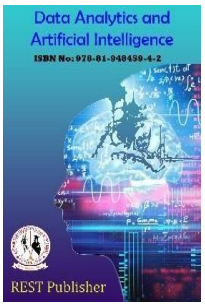
Data Analytics and Artificial Intelligence

Vol: 4(2), 2024

REST Publisher; ISBN: 978-81-948459-4-2

Website: http://restpublisher.com/book-series/daai/

DOI: https://doi.org/10.46632/daai/4/2/2



Prediction of COVID-19 From Chest X-Ray Images

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Abstract: *Currently, Corona virus disease (COVID-19), one of the most infectious diseases in the 21st century, diagnosed using Reversetranscription(RT-PCR testing), CT scans and/or Chest X-Ray (CXR) images. CT (Computed Tomography) scanners and RT-PCR testing are not available in many of the medical centers and hence in many cases CXR images become the most time/cost effective tool for assisting clinicians in making decisions. The COVID-19 outbreak has spread swiftly ascribed to contiguous imparting and generate a destructive result on international health. Until now, COVID-19 has pretentious the sphere with above 16.89 million contamination and near to 663,476 demise. Public health have been worn out in all nation because of the finite amount of Emergency Units. The person affected with corona virus in serious conditions are admitted into ICUs.The lung radiographs such as chest X-ray and computed tomography (CT) are satisfactory for the recognition of COVID-19 caused by high susceptible that is already traversed as a worth identification network for pneumonia disease. CT scan is more precise than chest X-ray to determine pneumonia but still chest X-ray is due to economic, speedy, and a small amount of radiation systems. Deep learning is acceptable in the medical field for the evaluation of complicated medical images. Deep learning neural networks have a great possible for building COVID-19 triage systems and determine COVID-19 cases, mainly sufferer with low severity. Regrettably, present databases do not allow building such systems as they are extremely heterogeneous and biased towards severe cases. This paper presents recurrent neural network (RNN) to diagnose COVID-19 from chest X-rays.*

Keywords: *Deep learning, Recurrent Neural Network Algorithm.*

1. Introduction

In the last months, the world has been observing how COVID-19 pandemic is increasingly affecting a large group of people rapidly everywhere around the world. The trends are not clearyet but some research authenticate that this problem may continue until2024. Besides, universality studies administered in several countries reveal that a small proportion of the population have developed antibodies after exposure to the virus, e.g., 5% in Spain. This means that frequently a large number of patients will need to be assessed in small time intervals by few numbers of clinicians andwith very few resources.

- Three Tests
- Diagnosis of Covid-19
- Automated image analysis
- Article Contribution

2. ALGORITHM

This project utilizes a prediction method using Deep Learning is evolved to recognize the covid affected and non covid patients using the patients chest x-ray. Initially the user must get into the website for using the prediction method,user must upload a chest x-ray image. Secondly, the uploaded image will get analysed by the server and it will display the respective result. If a patient is affected by covid, it will produce the result as positive. In the same way if he/she is not affected by covid, it will produce the result as negative.This prediction is essential with the assistance of a algorithm of deep learning like Recurrent Neural Network. Recurrent Neural Network Algorithm: Recurrent Neural Network (RNN) are a type of Neural Network where the output from previous step are fed as input to the current step. In traditional neural networks, all the inputs and outputs are liberated of each other, but in cases like when it isrequired to predict the succeeding word of a sentence, the preceding words are required and hence there is a need to remember the earlier words. Thus, RNN came into existence,which deciphered this issue with the assistance ofa Hidden Layer. The important character of RNN is Hidden state, that can recollect some information about a section. RNN have a “memory” that recall all information aboutwhat has been calculated. It uses the identical parameters for each input as it performs the same task on all the inputs or hidden layers to produce the output.This diminishes the complexity of parameters, unlike other neural networks.

Formula for calculating current state:

$$h_t = f(h_{t-1}, x_t)$$

where:
ht -> current state
ht-1 -> previous state
xt -> input state

Formula for applying Activation function(tanh):

$$h_t = \tanh (W_{hh}h_{t-1} + W_{xh}x_t)$$

where:
whh -> weight at recurrent neuron
wxh -> weight at input neuron

Formula for calculating output:

$$y_t = W_{hy}h_t$$

where:
Yt -> output
Why -> weight at output layer

3. EXISTING SYSTEM

Radiograph image utilization for initial COVID-19 screening may play a pivotal role in areas with inadequate access to a viral/antibody testing. In several studies, CT scans were used for analyzing and detecting features of COVID-19.Due to higher resolution of features of ground glass opacities and lung consolidation compared to chest X-ray images.

4. PROPOSED SYSTEM

A custom RNN architecture is designed to construct the deep learning model to carry out automated feature extraction and classification. Our proposed framework leverages a data augmentation of radiograph images for the COVID-19 data, by adaptively employing deep learning methods to generate synthetic COVID-19 infected chest X-ray images to train a robust model. The training data consisting of actual and synthetic chest X-ray images are fed into our customized Recurrent Neural Network (RNN) model. We propose a twodimensional (2-D), custom RNN model for classifying X-ray images to predict COVID-19 cases as depicted.

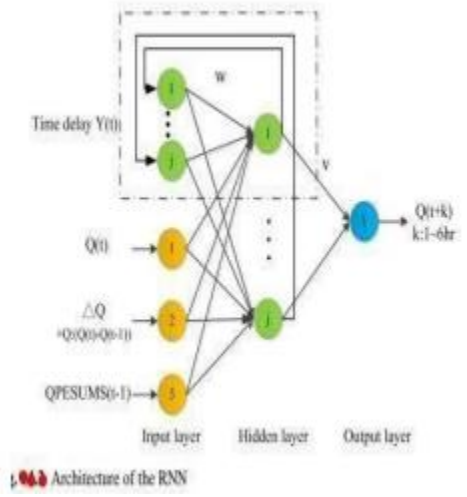
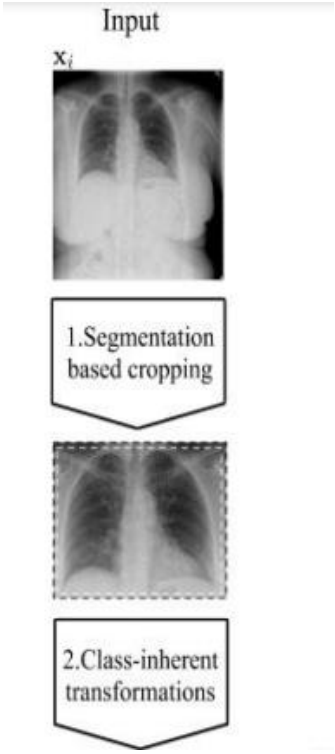


FIGURE 1. Proposed System Architecture



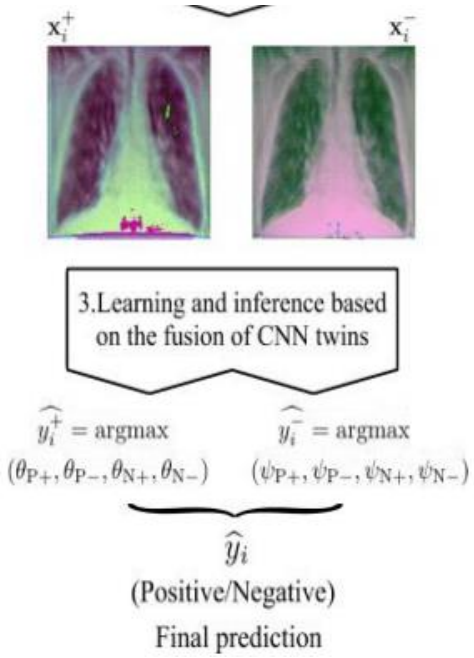


FIGURE 2. Flowchart for Proposed System

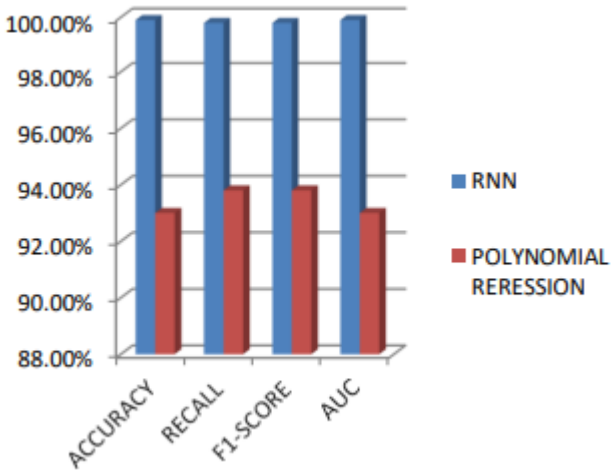


FIGURE 3. Comparison Chart

The above chart depicts the difference between existing system accuracy and proposed system accuracy.In proposed system we have used the RNN Algorithm which shows the best accuracy rate when compared to the existing system.The existing system shows the accuracy of 93% whereas the proposed system shows the accuracy of 99.9%. So,when compared to the existing system algorithm(Polynomial Regression Algorithm)our proposed system algorithm(RNN)shows the best result.

$$\begin{aligned}
\text{recall(positive class)} &= \textit{sensitivity} = \frac{\text{TP}}{\text{actual positives}} \\
\text{recall(negative class)} &= \textit{specificity} = \frac{\text{TN}}{\text{actual negatives}} \\
\text{precision(positive class)} &= \frac{\text{TP}}{\text{predicted positives}} \\
\text{precision(negative class)} &= \frac{\text{TN}}{\text{predicted negatives}} \\
\textit{accuracy} &= \frac{\text{TP+TN}}{\text{total predictions}}
\end{aligned}$$

View Source

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\begin{align*} \operatorname{recall}(\text{positive class}) &= \mathit
{sensitivity}=\frac{\text{TP}}{\text{actual positives}}\\
\operatorname{recall}(\text{negative class}) &= \mathit {specificity} =
\frac{\text{TN}}{\text{actual negatives}}\\ \operatorname{precision}
(\text{positive class}) &= \frac{\text{TP}}{\text{predicted
positives}}\\ \operatorname{precision}(\text{negative class}) &=
\frac{\text{TN}}{\text{predicted negatives}}\\ \mathit {accuracy} &=
\frac{\text{ TP+TN}}{\text{total predictions}} \end{align*}
```

$$\text{F1} = 2 \cdot \frac{\text{precision} \cdot \text{recall}}{\text{precision} + \text{recall}}$$

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\begin{equation*} \operatorname{F1}= 2 \cdot \frac{\text{precision }
\cdot \text{ recall}}{\text{precision + recall}} \end{equation*}
```

Accuracy: The condition or quality of being true, correct, or exact; freedom from error or defect; precision or exactness; accurateness. Our Project Accuracy Rate is 99.9%

F1-Score: The F1-Score is a measure of a model's accuracy on a dataset. The F-Score is a way of combining the precision and recall of the model, and it is defined as the harmonic mean of the model's precision and recall. Our Project F1-Score is 99.8%

Precision: Precision evaluates the fraction of correctly classified instances or samples among the ones classified as positive.

Recall: Recall also called Sensitivity, Probability of Detection, True Positive Rate. The correlation of correct positive predictions to the total positive examples. Our Project Recall Rate is 99.8%

5. MODULE DESCRIPTION

Image Preprocessing: This module is where the image is preprocessed where the image is augmented to optimum size, shape, orientation so as the machine can easily parse it. Feature

Extraction: This module is where the necessary features are extracted from the image that may include features such as color, hue, saturation etc.

Recurrent Neural Network: This module is where the image is classified into whether the patient has covid or pneumonia symptoms and then accordingly direct.

6. EXPERIMENTAL OUTPUT

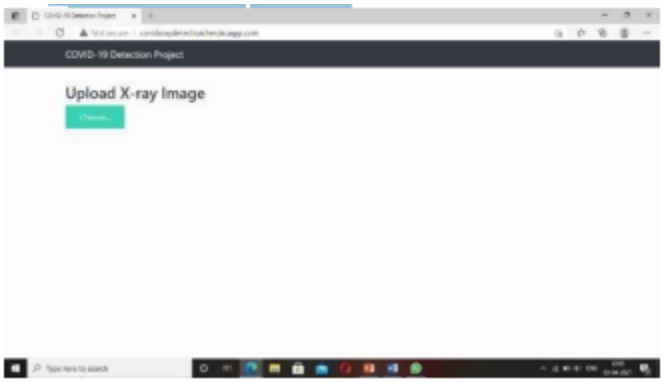

FIGURE 4. Patient X-Ray Image

FIGURE 5. Patient X-Ray Image

FIGURE 6. Result of Our Prediction

FIGURE 7. Prediction Result Page

7. CONCLUSION

Throughout the SARS-CoV-2 widespread, the use of deep learning techniques for the pinpointing of COVID-19 has enhance a pivotal point to getthe batter ofthe constraint of Emergency room. In this analysis, we intitiate a mixture of deep transfer learning and RNN for sort the X- ray samples into groups of COVID-19 and usual. The well-known RNN network accustomed categorize contrasting division using these properties. The VGG19- RNN is contemplate as the finest matrix with 99.9% accuracy, 99.9% AUC, 99.8% recall, and 99.8% F1- score to discover COVID-19 sufferer. Optimistically, it would diminish the assignment for the doctor to test COVID19 victim. There are several hindrances of our proposed system. Firstly, the COVID-19 test are less that require to be increased to authenticate our proposed system. Next,this observation only effort with a rear view of chest X- ray, hence it is not able to successfully codify other vission such as acute, unfit, etc. Third, the concert of our inquiry is not contrast with radioscopy that would be our forthcoming analysis.

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