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Automatic Detection of COVID-19 from X-Ray Images Using CNN

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ABSTRACT:The outbreak of COVID-19 introduced a tremendous pressure on the medical field all across the globe. During this period, many successful and unsuccessful tests has been introduced to detect this pathogen. One of the promising methods is to detect it from x rays of patients. It has already been proven efficient. This project aims to automate this process by introducing AI (Artificial Intelligence) by using CNN (Convolutional Neural Network) to analyse these images and predict the presence of COVID-19. Also, an improved algorithm is used to train the model which is fast and efficient. The code is python based and which is transferrable to a standalone computing board like the Raspberry pi.

KEYWORDS:COVID-19, CNN, ANN, Image processing, Artificial Intelligence, Raspberry pi.

I. INTRODUCTION

The virus called the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) had been discovered in late 2019. The virus which originated in China became a cause of a disease known as Corona Virus Disease 2019 or COVID-19. The World Health Organization (WHO) declared the disease as a pandemic in March 2020. According to the reports issued and updated by global healthcare authorities and state governments, the pandemic affected millions of people globally. The most serious illness caused by COVID-19 is related to the lungs such as pneumonia. The symptoms of the sickness can vary and consist of dyspnea, high fever, runny nose, and cough. These instances can maximum usually be recognized the usage of chest X-ray imaging analysis for the abnormalities X radiation or X-ray is an electromagnetic shape of penetrating radiation. These radiations are surpassed thru the favoured human body parts to create images of internal info of the frame component.

The X-ray picture is a representation of the inner body parts in black and white shades. X-ray is one of the oldest and usually used medical prognosis tests. Chest X-ray is used to diagnose the chest-related sicknesses like pneumonia and other lung diseases, because it gives the photograph of the thoracic cavity, including the chest and backbone bones along with the soft organs along with the lungs, blood vessels, and airways. The X-ray imaging technique provides several advantages as an alternative analysis method for COVID-19 over other testing approaches. Those advantages include its low price, the widespread availability of X-ray facilities, non-invasiveness, less time consumption, and tool affordability. Hence, X-ray imaging can be considered a better candidate for the mass, clean, and brief prognosis system for an epidemic like COVID-19 thinking about the present-day international healthcare crisis

Paper is organized as follows. Section II describes automatic text detection using morphological operations, connected component analysis and set of selection or rejection criteria. The flow diagram represents the step of the algorithm. After detection of text, how text region is filled using an inpainting technique that is given in Section III. Section IV presents experimental results showing results of images tested. Finally, Section V presents conclusion.

II. RELATED WORK

Image pre-processing basically aims to enhance the quality of images included in the dataset; which accordingly enhances the display of particular pathologists and enhances the outcomes of FE and segmentation approaches. The use of image processing approaches entails the management of digital photos by adopting several stages.

Pre-processing step improves the quality and size of the obtained dataset. Several procedures can be conducted to achieve the following goals: reducing the noise in the initial images, enhancing the quality through raising the contrast, and removing the high/low frequencies. This entails rifting the insufficient dataset into a

substantial one. Several transformation scans be applied to the dataset, including scaling, cropping, flipping, filtering, and rotation. Hence, each image can be transformed into a new one, by including required information to promote the following steps.

Gray scaling can also be applied to initial datasets because they are usually generated by different types of machines. Hence, a histogram matching procedure can be performed on all samples by considering one sample as a reference to unify the histogram distribution of all samples. The lack of data or unreliable data can influence the effectiveness of ML and DL due to a shortage of sufficient features. The over-fitting problem happens when a network learns a task with very high variance such as to perfectly model the training data. These models of variation usually entail noise, changes in contrast, rotations, and translations. In biased input, data augmentation can be utilized to enhance the counts of infrequent samples.

The work in this paper is divided in three stages. 1) Neural Network Training 2) Model Creation 3) Image recognition. The input images are taken up for training using the convolutional neural network training. Then after that the model neural network is created. This model can now accept

III. METHODOLOGY

In the experiments of this project, a primary dataset containing 178 X-ray images has been used as a base dataset. Of 178 images, 136 X-ray images belonged to confirmed COVID-19 patients and other 42 images belonged to normal or people with other diseases like pneumonia. The dataset used is available on GitHub. The basic dataset consists of two classes of COVID-19 with 136 samples and others with 42 samples. Thus, the dataset was imbalanced and needed pre-processing to achieve promising results. As a first attempt, CNN was trained on the given original dataset and around 54% accuracy was achieved, which was not worthy of the current application domain

- (i) Primary chest X-ray image dataset of COVID-19 patients collected from GitHub. The dataset has been collected by the University of Montreal's Ethics Committee no. CERSES-20-058-D from different hospitals and clinics
- (ii) (ii) For dataset balancing, a collection of chest X-ray images were collected from Kaggle.
- (iii) Independent validation dataset containing a collection of 100 COVID-19 X-ray images for the real-world testing of the proposed CNN was collected from IEEE Data Port.

The experiments have been conducted using Core i7 7th generation machine with 8 GB RAM, Microsoft Windows 10 platform using Python language with Anaconda 3 software and Jupyter Notebook.

IV. EXPERIMENTAL RESULTS

The figures (a), (b), (c) shows the x-ray images of a normal, pneumonia affected and covid affected patients respectively. It is the grayscale version of it. It is converted to grayscale in order to improve the processing of the image by the neural algorithm



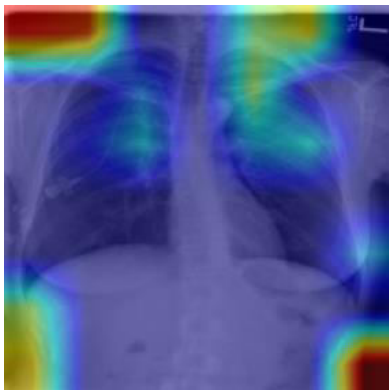
(a)



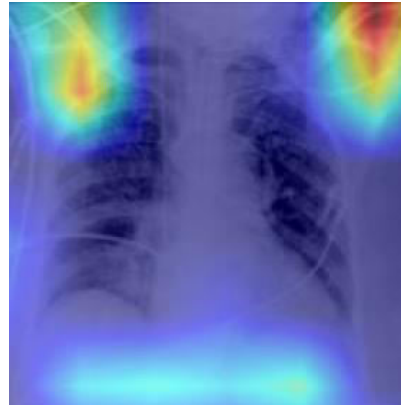
(b)



(c)



(d)



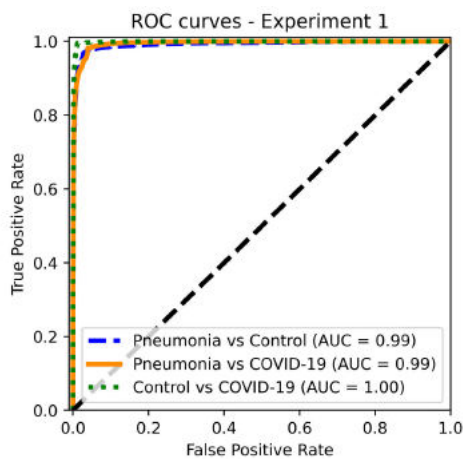
(e)



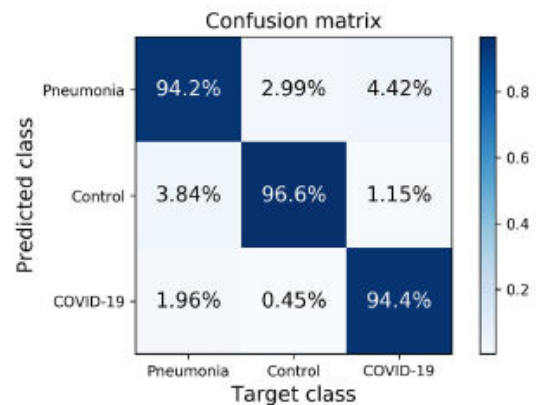
(f)

Figures (d), (e), (f) shows the segmentation result of the images showing a normal person, pneumonia infection and a covid detected person.

Figure (g) shows the ROC curve for the experiment. Figure (h) shows the confusion matrix and the efficiency of prediction using the cnn algorithm.



(g)



(h)

V. CONCLUSION

This study has been conducted to demonstrate the effective and accurate diagnosis of COVID-19 using CNN which was trained on chest X-ray image datasets. The model training was performed incrementally with different datasets to attain the maximum accuracy and performance.

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