Prediction of COVID-19 Using Chest X-Ray Image and Euclidean Algorithm

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ABSTRACT

As we all know that Corona Virus is rise of COVID-19 pandemic communicable disease. it absolutely was first identified in Wuhan in December 2019. It expanded its circle everywhere the globe and eventually spreading its route to India. The full world is fighting against the spread of this deadly disease, cases in India also gradually increasing day by day since May after lockdown. This paper proposes a way to contribute to utilizing the machine learning and deep learning models with the aim for understanding its everyday exponential behavior together with the prediction of future reach ability of the COVID-2019 across the nations by utilizing the real-time information from the Johns Hopkins. This paper studies the COVID-19 dataset and explore the information by data visualization with different libraries that are available in Python. The paper also discusses this situation in India while tackling the Covid-19 pandemic and also the ongoing development in AI and ML has significantly improved treatment, medication, screening tests, prediction, forecasting, contact tracing, and drug/vaccine development process for the Covid19 pandemic and reduce the human intervention in practice.

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Keyword : -Covid-19, Pandemic, Artificial Intelligence, Machine Learning.

1. INTRODUCTION

The whole world is facing a health crisis, that's unique in its kind, of the COVID-19 pandemic. because the corona virus continues spreading, researchers are concerned by providing or help provide solutions to save lots of lives and to prevent the pandemic outbreak. Among others, computer science (AI) has been adapted to deal with the challenges caused by pandemic. during this paper, we design a deep learning system to extract features and detect COVID-19 from chest X-ray images. Three powerful networks, namely ResNet50, InceptionV3, and VGG16, are fine-tuned on an enhanced dataset, which was constructed by collecting COVID-19 and normal chest X-ray images from different public databases.

We applied data augmentation techniques to artificially generate an oversized number of chest X-ray images: Random Rotation with an angle between −10 and 10 degrees, random noise, and horizontal flips. Experimental results are encouraging: the proposed models reached an accuracy of 97.20% for Resnet50, 98.10% for InceptionV3, and 98.30% for VGG16 in classifying chest X-ray images as Normal or COVID-19. The results show that transfer learning is proven to be effective, showing strong performance and easy-to-deploy COVID-19 detection methods. We applied data augmentation techniques to artificially generate an oversized number of chest X-ray images: Random Rotation with an angle between −10 and 10 degrees, random noise, and horizontal flips. Experimental results are encouraging : the proposed models reached an accuracy of 97.20% for Resnet50, 98.10% for InceptionV3, and 98.30% for VGG16 in classifying chest X-ray images as Normal or COVID-19. The results show that transfer learning is proven to be effective, showing strong performance and easy-to-deploy COVID-19 detection methods.

With more than 100 million confirmed cases as of February 2021, the pandemic is still accelerating globally. The disease is transmitted by inhalation or contact with infected droplets with an incubation period ranging from 2 to 14 days [1], making it highly infectious and difficult to contain and mitigate. With the rapid transmission of COVID-19, the demand for medical supplies goes beyond hospitals' capacity in many countries. Various diagnostic and predictive models are employed to release the pressure on healthcare workers. For instance, a deep learning model that detects abnormalities and extract key features of the altered lung parenchyma using chest CT images is proposed [2]. On the other hand, Rich Caruana et al. exploit intelligible models that use generalized additive models with pairwise interactions to predict the probability

of readmission [3]. To maintain both interpretability and complexity, Deep COVIDNet is present to achieve predictive surveillance that identifies the most influential features for the prediction of the growth of the pandemic[4] through the combination of two modules. The embedding module takes various heterogeneous feature groups as input and outputs an equidimensional embedding corresponding to each feature group. The DeepFM [5] module computes second and higherorder interactions between them. Models that achieves high accuracy provide fewer interpretations due to the trade-off between accuracy and interpretability [6]. To be adopted in healthcare systems that require both interpretability and robustness[7], the Multi-tree XGBoost algorithm is employed to identify the most significant indicators in COVID-19 diagnosis [8]. This method exploits the recursive tree-based decision system of the model to achieve high interpretability. On the other hand, a more complex convolutional neural network (CNN) model can discriminates COVID-19 from Non-COVID-19 using chest CT image [9]. It achieves interpretability through gradient-weighted class activation mapping to produce a heat map that visually verifies where the CNN model is focusing.

COVID-19 attacks the lung and damages the tissues of an infected person. At the early-stage, some people may not find any symptoms where most of the people had fever and cough as the core symptoms. Other secondary symptoms could be body aches, sore throat, and a headache could be all possible. At present, COVID-19 disease is increasing daily due to the lack of quick detection methods. All over the world, a huge number of people died of this disease in 2020. The respiratory tract and lungs are the media where the virus can spread easily. As a result, inflammation occurs, and air sacs can be filled with fluid and discharge. The process is responsible for creating an obstacle in oxygen intake. Quick and accurate detection of the virus is a major challenge for doctors and health professionals around the world in order to reduce the death rate caused by this virus. Due to the global climate changes, people have already been suffering from many other diseases, and the impact created by the COVID-19 is immeasurable. Currently, the virus has spread to almost every country in the world. Recently, all over the world, America, South-East Asia, and Europe have the uppermost number of confirmed COVID19 cases. On 7 January 2021, more than 85,929,428 confirmed cases of the virus and 1,876,100 deaths were reported by World Health Organization (WHO) due to the disease. At present, further research on an effective screening process is required for diagnosing the virus cases and segregating the affected people. Health professionals and scientists of many countries in the world are attempting to improve their treatment plan and capacity of test through implementing multifunctional testing to stop spreading the virus and for protecting themselves from the deadly virus.

In this situation, the testing and detection of the disease play a vital role in saving human lives. Presently, DNA amplification-based polymerase chain reaction (PCR) is used for identification of COVID-19 with the help of genetic material. However, the efficiency and accuracy of PCR results can be affected by the quantity of viral ribonucleic acid (RNA) that increases the chances of false ineffective results. The traditional lab-based manual testing techniques for detecting the disease are time taking and resource-limited. In contrast, the medical images generated by the magnetic resonances and X-ray solve the problem and help in the diagnostic assistance work with high accuracy. The chest computed tomography (CT) scan or X-ray images show the desired outcomes while detecting the disease in the patients. In rural areas or areas with lacking capacity, expertise, and medical staff, it is essential to conduct quantitative COVID-19 tests for the welfare of the citizens. Applying artificial intelligence and machine learning techniques is an effective way to detect a disease and minimize the workload of the medical personnel in this critical situation.

The rapid spread of COVID-19 as a result to the new SARS-COV-2 virus is the biggest problem facing humanity today, and about one half million patients die from Covid-19 this year (2020) in the world. Therefore, it has become imperative in order to detect positive cases as quickly as possible to prevent the further spread of this epidemic. AI-based X-ray screening is considered as a promising approach in order to test COVID-19 in asymptomatic patients. In addition, detection of Covid-19 in chest X-ray images is a challenging task depending on the presence of the experienced radiologists. Having a radiologist does not solve the problem to some extent, since the appearance is not specific and often ambiguous, which leads to significant differences between the radiologist during diagnosis.

For example, an expert radiologist diagnoses the pathology correctly while a less experienced radiologist diagnoses it with abnormalities. By developing CheXNet algorithm which is more efficient than expert X-ray specialist, the diagnostic problem will be solved and the most important is that the algorithm can be relied upon for diagnosis in institutions which lose out to

diagnostic imaging specialist. CheXNet algorithm consists of a (121) layer convolutional neural network (CNN) which is trained on 14 ChestX-ray.

2. LITERATURE SURVEY

In paper Apostolopoulos ID, Mpesiana TA (2020)[1] Covid-19: automatic detection from x-ray images utilizing transfer learning with convolutional neural networks. He developed an automatic model for COVID-19 detection by using Chest X-ay images. Under this model they did two types of classification i.e. Binary classification

Gazzah S, Bencharef O (2020)[2] A Survey on how computer vision can response to urgent have to contribute in COVID-19 pandemics proposed a model named "CoroNet," which may be a CNN model for COVID-19 diagnosis using radiography images of chest. The suggested method relies on the "Xception Architecture" which could be a pre-trained model with the dataset of ImageNet then it's trained on a dataset that was gathered from various publically accessible databases for research purpose.

Axell-House DB, Lavingia R, Rafferty M, Clark E, Amirian ES, Chiao EY (2020)[3] The estimation of diagnostic accuracy of tests for COVID-19: A scoping review They used 3 different binary classifications algorithms by using 5-fold cross validation with 4 classes as follows (COVID-19, bacterial pneumonia, normal and, virus infection

Chest X-ray classification using Deep learning for automated COVID-19 screening[4] The classification on chest X-Ray s images and designed a classification model which focused on accurate diagnosis of COVID-19. Their dataset contained the chest Xrays images that were divided into 4 classes are as follows tuberculosis (TB), pneumonia, COVID-19 and normal. They used VGG16 model which achieved the precision was 95.9 percent.

Eurosurveillance Editorial Team (2020)[5] Note from the editors: World Health Organization declares novel coronavirus (2019-nCoV) sixth public health emergency of international concern.they explain Eurosurveillance 25(5): 200131e China CDC assesses the transmissibility of this virus to be sufficient for sustained community transmission without unprecedented control measures. Further cases and deaths in China are expected within the coming days and weeks. Further cases or clusters also are expected among travellers from China, mainly Hubei province. Therefore, health authorities within the EU/EEA Member States should remain vigilant and strengthen their capacity to reply to such a good.

3. DECENTRALIZED CERTIFICATE SYSTEM

As the number of corona virus patients are increasing day by day then we need a fast and an efficient method to diagnose a patient and where Artificial Intelligence is the best solution for diagnosis. The Artificial Intelligence is useful because we can give a set of images together and it will give us more accurate.System determine prediction of Corona Virus test using Chest X-Ray.

Working:

Interpretable Machine Learning system is based on multi feature technology. The system's application will be programmed on the public data. In the system, four steps are involved. Image pre-processing, Feature Extraction ,Feature Selection Algorithm ,Pattern Classification

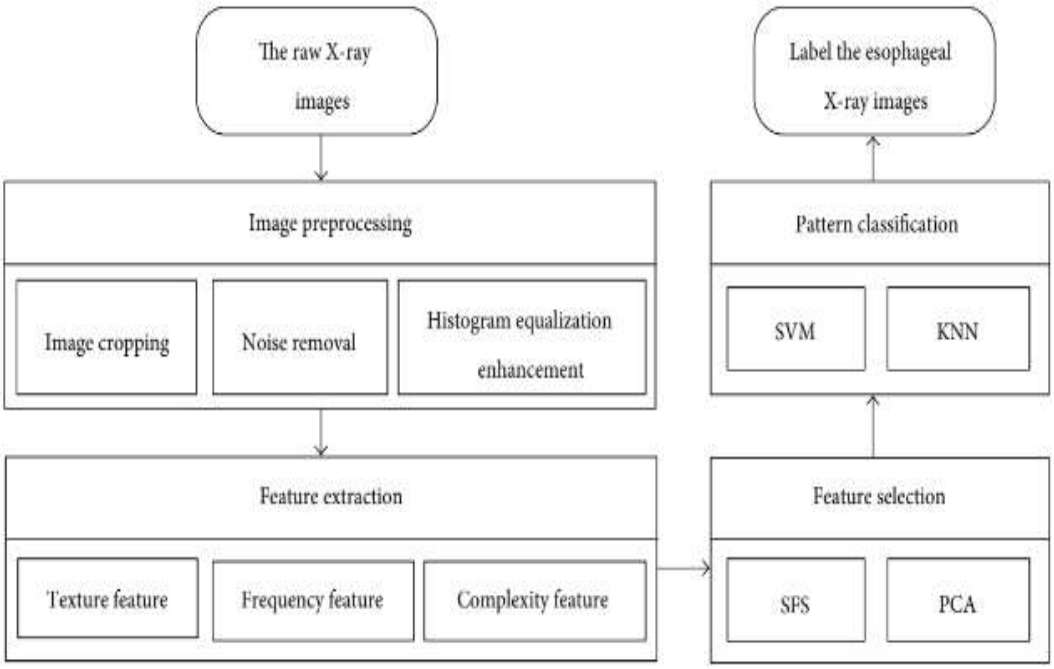


Fig 1.System Diagram

Following is the working process of the system that is developed in this study:

1) When an X-Ray image is come in system First step of system is Image preprocessing. in this process format images before they are used by model training and inference. This includes, but is not limited to, resizing, orienting, and color corrections.

2) In image process cropping, noise removal and histogram equalization enhancement steps are done.

3) After that feature extraction process is come. in texture feature , frequency feature, complexity feature processes is happen. in texture feature extraction spatial variation of the brightness intensity of the pixels. Texture is the main term used to define objects or concepts of a given image.

4) In Feature extraction is a part of the dimensionality reduction process, in which, an initial set of the raw data is divided and reduced to more manageable group.

5) In Feature selection SFS and PCA technique are used. SFS based on used of self ration image and PCA allows the identification of standards in data and their expression in such a way that their similarities and differences are emphasized.

6) After that image is go through pattern selection process in this process SVM and KNN technique are used where in SVM trains on a set of label data. The main advantage of SVM is that it can be used for both classification and regression problems. SVM draws a decision boundary which is a hyper plane between any two classes in order to separate them or classify

them. SVM also used in Object Detection and image classification.

7) Where KNN classifies unknown data points by finding the most common class among the k closest examples.

8) After all these process the final output declared that the given X Ray image is Corona Positive or negative patient.

Here main aim of this system is to improve treatment methods and health management as well as recognition and diagnosis. It will improve the speed and accuracy of diagnosis, develop fresh, effective therapeutic approaches that will help patient to discover corona virus.

3.1 Algorithms

Proposed Algorithm for COVID-19 Detection

Input: COVID-19 Chest X-ray image dataset (D) with resize image (M)
Extraction: Extract Feature Matrix (f).

CNN Feature Vector (Fc).
Step 1: Initialize Fc ≥ Mi .i = 1
Step 2: Extract each image feature D(i,1,570).
Step 3: Fc (i,1) = M(x,1) + Fc (i,1).
Step 4: Fc = overall CNN features.
Histogram Oriented Gradient (HOG).
Step 1: Initialize. H0 = Low pass output,H1 = Band pass output.
Step 2: HOG (i,1) = H0 (i,1) + H1 (i,1).
Step 3: HOG = overall Histogram Oriented Gradient
Fusion of features in Vector (V).
Training feature (V) = [Fc , HOG].
test_image = imread(img).
Extract test feature (T) = repeat step 1, 2 from test_image.
result (i) = classify (training feature, T).
Output: result (i) = COVID19 Positive or Normal.

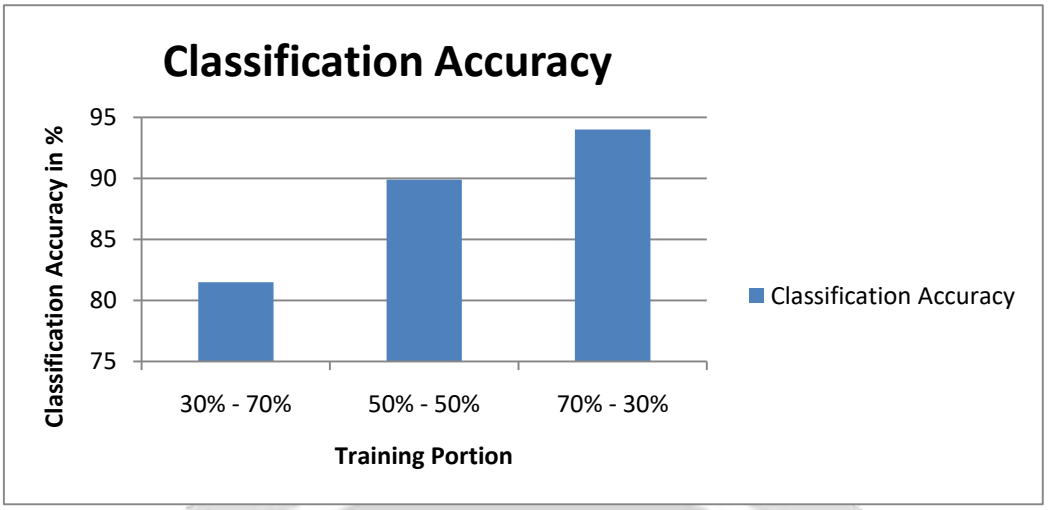
4 RESULT AND DISCUSSIONS

A machine learning technique, are used in prediction of disease from images. A total of 100 images belonging to 2 categories were used in this study. Classification processes with proposed method was carried out for different training-test rates of images in Table below 94% classification rate was achieved for the 70%-30% training-test partition. According to the results, it was seen that texture features.

A B

Training Portion	Classification Accuracy
30% - 70%	81.5
50% - 50%	89.9
70% - 30%	94

Fig : Experimental result in graph



Snapshot of Result

Here are some images of Result

1. Input of Images

In this image we will give X-Ray image as a Input image so this X-Ray image is taken from Diagnosis centre

Fig 1: Input of Image

2 Grey Scale of X-Ray Image:

When we will give input to the system the image is goes under next process that is grey scale of image .in this process the X-Ray image is converted into grey scale pixel.

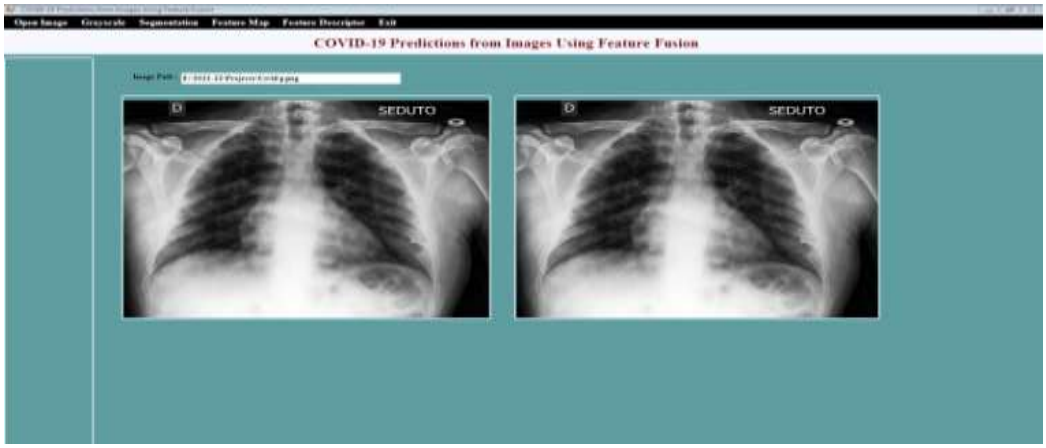


Fig 2: Grey Scale of X-Ray Image

3.Feature Description:

This process is nothing but all feature description of pixel which is given by above step that is grey scale. in this process it gives vectors description of each point.

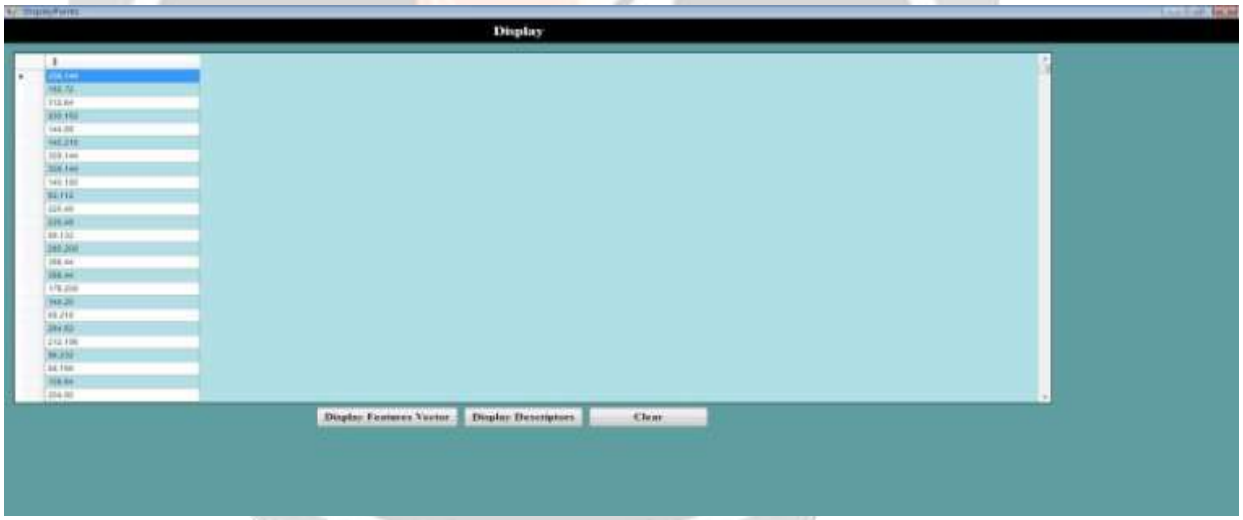


Fig 3: Feature Description

4.image after Feature:

This process gives an image after performing feature Description**.**

Fig 4: image after Feature

5. Image of Segmentation:

This is a process in this a image gives a result after feature extraction which gives a comparison of input image and corona positive patient image. this show final result of system.

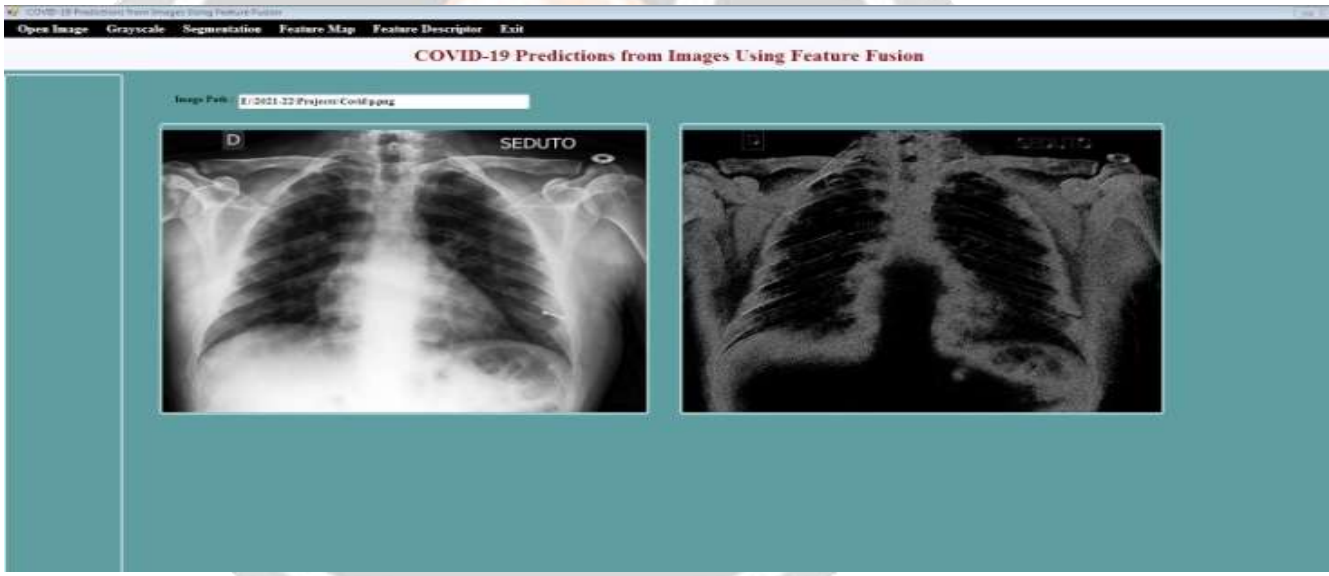


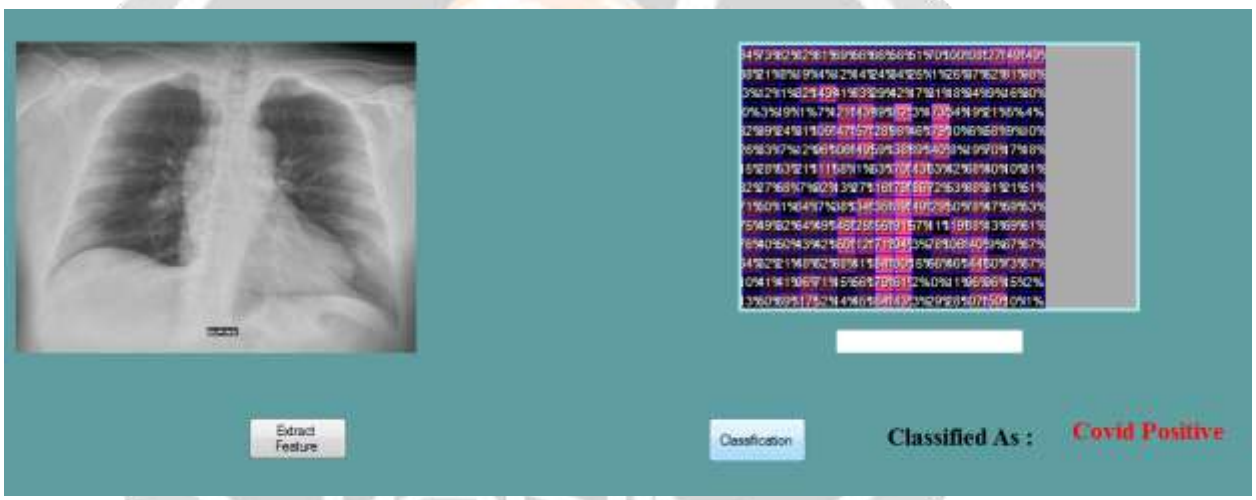
Fig 5: Image of segmentation

6 Image of Classification:

After segmentation image is classified by comparing it with train image. so it will give Final result of image.

7.Result Image

This image is Corona Positive Patient.



4. CONCLUSIONS

This is very helpful in a very pandemic, especially the available health resources don't match the burden of disease also because the need for preventive measures to be taken. Research in deep learning always strives to make better representations of reality and to form models capable of learning these representations from non-labeled data on an oversized scale without one. Information concerning previous publications may be included. In this paper multiple feature extraction are been used which is useful for early corona patient detection. this will increase accuracy of result hence easy to understand which take less time for test result.

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