

A Hybrid Approach to Find COVID-19 Related Lung Infection Utilizing 2-Bit Image Processing



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Abstract This study describes the deployment of an image processing approach for finding COVID-19 affected lungs. Medical scans are useful in diagnosing illnesses and determining if organs are working normally. Medical image processing is an ongoing research subject in where numerous ways are used to help diagnosis, as well as different image processing techniques that may be used. Picture processing was used in this work, which includes image pretreatment, histogram leveling, smothering, eroding, and dilation. The usage of 2-bit picture is selected since this characteristic is well-known and there are several resources accessible. The Open CV library, which includes a plethora of image processing functions, is likewise free to use. Our experiment has shown how COVID-19 affected lung disorders can easily be identified with the help of a 2-bit image segmentation technique. The plan comprises (1) using a deep robust acquisition access to portion proper regions of interest from bleak medical examination image sizes of 903 total, (2) using a propagative neural network to improve contrast, sharpness, and illuminance of image contents, and (3) from the beginning to the conclusion, a regression strategy plan was used to accomplish medical picture categorization by material design in deep neural networks.

Keywords Image processing · Bio-informatics · Neural network · Artificial intelligence · COVID-19

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1 Introduction

Nowadays, the coronavirus (COVID-19) has outspread out all over the Earth. The citizenry of all world are suffering from this pandemic. They are affected by fear, anxiety, depression, and loneliness. Not only fear but also economic crisis is a big challenge for them [1]. Most people are suffering from the disease because of the COVID-19 pandemic, and sometimes, it is very difficult to predict the symptoms of some diseases. But, the symptoms can be detected by using the image processing method that is vastly used in the modern era. To get much information from an image, this process is used, and it is a method to convert an image into digital form. Image processing can be used to predict many diseases like crop disease, plant disease, leap disease, skin disease, fungal disease, lung cancer, etc. The lungs are the organs that are mostly affected by the coronavirus(Sars-Cov-2). The tubule or cartilaginous tube is depicted by the snout. Into your lungs, it separates into little and small branches. Alveolar are tiny air sacs that may be seen at the tips of each branch. That is where O_2 enters and CO_2 departs your blood. Sometimes, it is difficult to detect but image processing can be used to detect these symptoms in the initial stage, and it is a very helpful and low-cost system. Your immune system fights back as the virus spreads direct your metabolic process. The lungs and airways expand and inflame. This might begin in one area of your lung and progress to the rest. COVID-19 causes are mild to severe symptoms in around 80% of individuals. You might be suffering from a dry cough or a sore throat. Pneumonia, a lung illness in which the alveoli become inflamed, affects certain people. As lungs are mostly affected by COVID-19, so our paper aims to predict lung disease which is influenced by this coronavirus. We have used 900 images. Our image dataset consisted of patients who were affected with COVID-19 and other lung diseases during the 2020–2021 time region.

2 Literature Review

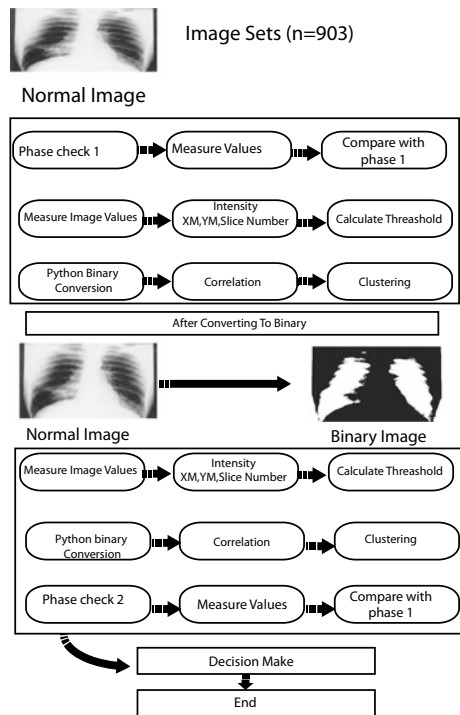
The goal of this study [2] is to provide a conciliate informing to large learning method in medical image model processing, starting with abstract underpinnings and working through applications. In this [3] experiment, they explored cutting-edge deep learning architecture and how to optimize it for medical picture segmentation and classification. This article explained how to use the Python3 and via the Open CV package to process medical pictures[4]. Many techniques had been discussed in this literature [5], among those there were ROI segmentation, K-means, and water-shed. The primary goal of this [6] the goal of this research was to create a comprehensive source for healthcare visual analytic methods that have benefited from high-performance computer platforms. With this in mind, publications from the Scopus and Web of Science electronic archives were searched. Sobel and Prewitt used algorithms in their project. [7] edge detection research using 180 nm technology. VLSI is used to construct the edge detection algorithms, and the architecture's digi-

tal IC design is discussed. The authors of this study suggested a flexible framework [8] for deep eruptive acquisition-based medical image processing and analysis. By incorporating [9] motorist memorability into PCNN, the network gains biological function. Furthermore, the use of nanosecond resistors could considerably reduce the size of PCNN.

3 Methodology

Image processing has had lots of algorithms and processing tools. Our experiment established the process of judgment based on image analysis. We have conducted our experiment by taking data from this source [10]. Our data was divided into four categories, for example, COVID-19 infected patients, bacterial infected patients, age-related lung failure patients, and some of them were idiopathic [11]. Figure 1 shows our whole experiment in a nutshell. We have used the 903 images where 70% of images were COVID-19 affected. 10% were bacterial infections, 5% were age-related lung failure, and 15% were idiopathic. We have used the Python programming language for our experimental analysis. First, we have analyzed without converting the images into segments of binary values. The findings of RGB pictures

Fig. 1 Experimental flowchart showing from the initial data collection where the total number of images was 903, checked phase one and measure the values, compare again with initial stages then again after measuring the XM, YM and slicing started, the below portion showing after the converting the normal image into binary. Lastly, the whole data was again checked, and decisions have been made and stop the process



are computed using brightness values. The formula is used to convert RGB pixels to brightness values and calculates and shows the mean, standard deviation, minimum, and maximum values for each column. Secondly, we have converted our normal images to binary and then again gathered the values. This time the values showed significant changes. The %area denoted that how much the Human Lung is affected. The more the area cover, the more infected the individual's lung is. We also used parameter-based neural network systems for validating our second result to make sure all our experiments were okay. Nevertheless, the correlation showed that there was enough evidence to show the COVID-19 patient's lung was much more vulnerable and affected than the normal age-related infected lung or lung infection caused by bacteria. The second iteration took more than three minutes in the programming environment, in this case, Jupiter notebook. The model training sum of squares error was 15.821, and average overall relative error was 0.428. The testing period consisted of 8.191 sums of squares error and 0.469 average overall relative error. The area percentage fluctuated from -0.453 to 1.375 . All the 903 images were considered. The last iteration showed fluctuation between 0.002 and 0.394 (Tables 1 and 2).

Table 1 Sample of data set view

Label	X	Y	XM	YM	%Area
COVID-19	469.795	241.408	469.795	241.408	27.741
COVID-19	523.168	543.949	523.168	543.949	52.743
COVID-19	460.219	336.42	460.219	336.42	44.572
Bacterial infection	1072.626	916.776	1072.626	916.776	41.874
COVID-19	421.712	571.308	421.712	571.308	40.221
COVID-19	195.925	183.731	195.925	183.731	43.638
Bacterial infection	401.952	364.924	401.952	364.924	51.856
COVID-19	1267.149	1712.241	1267.149	1712.241	43.404
Bacterial infection	569.687	532.223	569.687	532.223	49.648
COVID-19	2317.007	2214.071	2317.007	2214.071	53.804

Table 2 Layer optimization values

Layers		H(1:1)	H(1:2)	H(1:3)	H(1:4)	Area	Area_A
Input layer	(Bias)	1.036	0.388	0.708	-0.296		
	X	-0.164	-0.476	-0.018	-0.323		
	Y	0.013	1.042	-0.023	-0.082		
	XM	-0.460	-0.204	-0.677	0.389		
	YM	-0.089	0.650	0.320	-0.376		
Hidden layer 1	(Bias)					-0.453	1.375
	H(1:1)					0.044	-1.352

Table 3 Model description

Training set	Sum of squares error	15.821
	Average overall relative error	0.428
	Relative error for scale dependents	0.763
Testing set	Training time duration	0:00:00.02
	Sum of squares error	8.191
	Average overall relative error	0.469
	Relative error for scale dependents	0.681

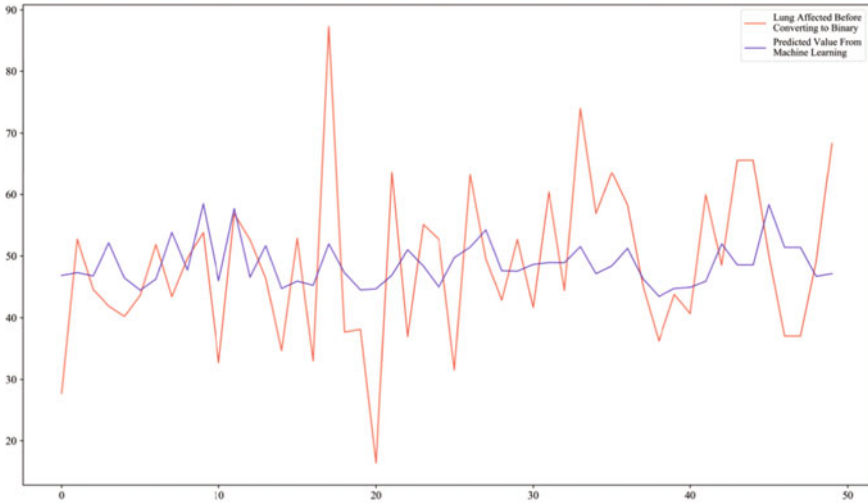
3.1 Image Processing Terms Description

Threshold is the image's threshold. To get a binary picture B with 1 in blank pixels and 0 in character dots, apply a 0.9 threshold to I . To conduct binary erosion on I , we utilized a 2 10 horizontal mask. This helps to propagate the character pixels along the rows, resulting in a significant disparity between the sums corresponding to blank rows and rows containing characters when we 1 add up the rows of the photo. To generate a list of m numbers, add the horizontally degraded image along rows. Many blank rows appear adjacent to one another, as one might expect. The image is broken into multiple images, each carrying one row of text, at the mid-point of each continuous stretch. The midpoints of contiguous stretches of blank columns are $m1$, $m2$, ..., mp . For $I = 1$ to $p = 1$, the pictures $I[m_i: m_i + 1, :]$ contain a row of text. To get column splits and further separate each text row image, we conducted steps 2–4 for the picture of each line using a vertical mask instead of a horizontal mask and column sums instead of row sums. Most of the characters are split; however, if the text contains characters like I or subscripts in, we may not have divided each character. As a result, if the image acquired after step 5 has more than one linked component, steps 2–5 are repeated (Table 3).

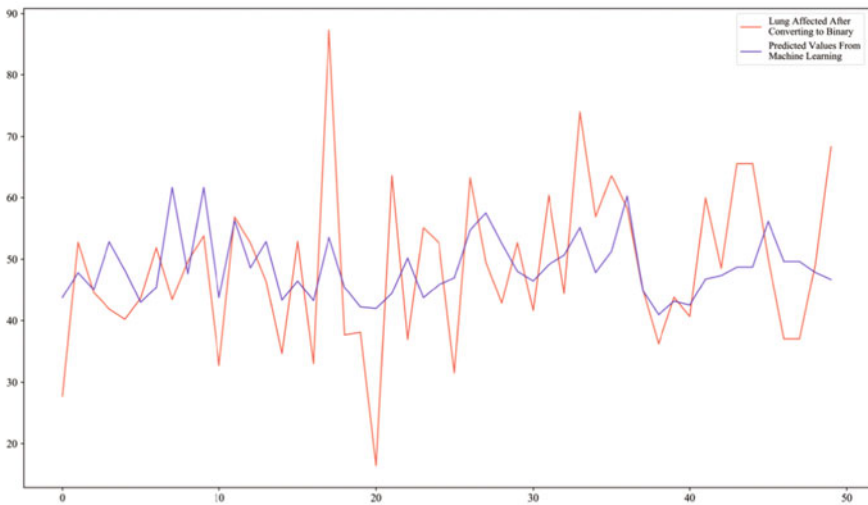
$$\text{ValueImage} = 0.299 \text{ Red} + 0.587 \text{ Green} + 0.114 \text{ Blue} \quad (1)$$

4 Experimental Results

Figures 2 and 3 showing the initial phase of conducting experiments in binary environments. The after results clearly showing the more enlarged area. The normal image could not give as many of the binary values. We were able to create a theoretically novel and possibly helpful metric for comparing 2-bit secondary structures by drawing inspiration from image processing and the dot plot representation for 2-bit secondary structure. We demonstrated our method using the 2-bit design issue and an application that uses the distance measure to discover informational rearrangement point mutations in a picture sequence. The process of restoring a picture from a



(a)



(b)

Fig. 2 a Before converting to binary, the lung affected number was constant. The machine learning prediction curve shows the constant rate. **b** After converting to binary, this time the affected lung images did not show any constant curve rather showed ups and downs that means there were infected lungs and detectable after processing

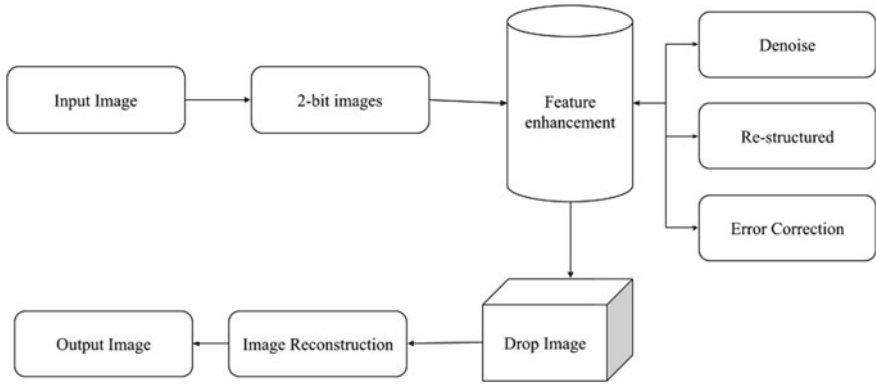
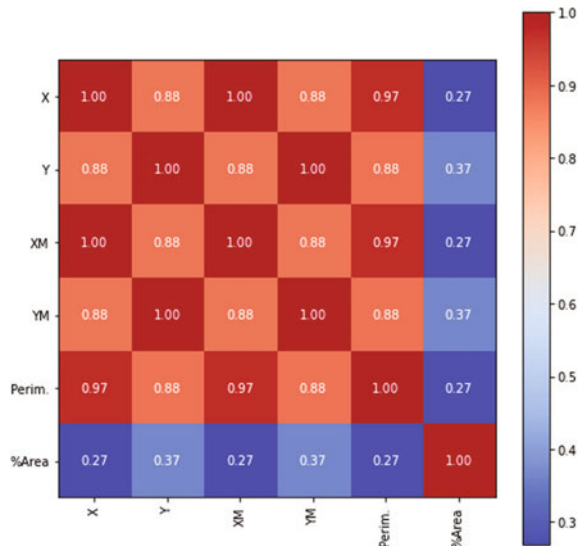


Fig. 3 Image restoration, 2-bit images once again collected after processing and features were again extracted in reverse form thus whole images can be seen. Denoise algorithm applied and again compare with the real images

Fig. 4 Correlation matrix showing the XM, YM, area and X, Y value intensity



damaged version-typically image restoration is the process of restoring a blurry and noisy image. Image restoration is a fundamental topic in image processing that may also be used to evaluate more general inverse problems. The restored image’s quality, the method’s computing efficiency, and the estimation of critical parameters like the point-spread function are all factors to consider are all critical concerns that must be addressed, Fig. 4 showing our image restoration procedure. To offer an understanding of the nature of the problem, basic picture restoration techniques are reviewed. These approaches also give efficient solutions for deblurring hazy pictures with a low computing complexity. A similarity matrix is a tool that displays the collinearity

Table 4 Acronym used

Acronym	Meaning
ROI	Region of interest
VLSI	Very large scale integration
PTL	Paced transfer learning
PCNN	Partially connected neural network
ITK	Indigenous traditional knowledge
VTK	Virtual tool kit
Binary	Values consisted of 0 and 1
OpenCV	OpenCV is a programming function library primarily
CATIA	Dassault Systèmes' multi-platform software package
X	Value of X co-ordinate
Y	Value of Y co-ordinate
XM	Intensity of X co-ordinate pixel
YM	Intensity of Y co-ordinate pixel

for several variables. The matrix illustrated in Fig. 5 shows the correlation among the different attributes like x , XM , y , YM , intensity, and percent area. It is a strong tool for summarizing a immense datasets as well as distinguishing and visualizing trends in the data (Table 4).

Algorithm 1 Input

- 1: Start
 - 2: initial labeled images, composed of 903 samples
 - 3: calculate the x, xm, y, ym
 - 4: train the segmentation of phase-1
 - 5: test the segmentation of phase-2
 - 6: make image centroid_initial with $k_i = R_{i+1}$
 - 7: for reoccurrence_i:
 - 8: initialize $k_i + 1 = R_{i+1} + 1$
 - 9: End
-

5 Conclusion

Images are a figurative way of expressing data. Images are made up of tiny components known as pixels. Each pixel has a incomparable function and treasure, and we wanted to deal with these values. In our example, it is a two-bit binary picture. A geometric picture refers to an image that is represented arithmetically by non-representational schema such as lines. Each photograph is saved in a specific file

format, which consisted of two parts: the header and the data. Imaging processing methods are a set of ways for manipulating images with the help of a computer. We were able to implement a deep robust learning approach for our analysis using a prerogative neural network that helps to improve the contrast, sharpness, and illuminance of the images. We also made it possible by using the regression strategic plan to perform scanned lungs images to classify. The goal of segmentation is to divide pictures into significant sections. The partitioning of pictures is handled via local segmentation. The main limitation of our analysis is that if we could analyze for more than a million data images, then there would be more chances of prediction of COVID-19 affected lung. In the future, 4-bit or 8-bit image analysis could be made possible.

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