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Health Care System To Identify Covid-19 From Chest X-ray Report Using Image Processing and CNN

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Abstract—Covid-19 may be a huge serious deadly virus that has been declared as a pandemic by the world health organization (WHO). The complete world is functioning with all its may to finish Covid-19 pandemic, that puts countries in serious health and economic issues, as presently as potential. The foremost necessary of these is to properly determine those that get the Covid-19. The COVID-19 virus has spreading to numerous components of countries in 2019, as well as Indonesia. This international pandemic becomes a deadly eruption since there's no Vaccination to treat or forestall transmission of the virus. Fast take a look at is chosen as a vital technique to find Covid-19 in Indonesia as a result of the worth is fairly low-cost compared to the SWAB take a look at. The rise in Covid-19 patients tends to steer to restricted capability for the Covid-19 take a look at on the market at the hospital so the most recent technology to find and overcome this pandemic issue is required. Thus, this analysis aims to look at the entire of a hundred X-Ray chest pictures of the Covid-19 patients and a hundred X-ray traditional chest pictures.

Keywords—Covid 19 Identify, Chest X-ray Report,Image Processing, CNN

I. INTRODUCTION

The first case of COVID-19 was detected within the City Wuhan province of China back in Dec 2019 and began spreading all across the planet since then. the world Health Organization or WHO has declared it a pandemic in 11th March 2020. nowadays on Oct the 12th we've 7.18 million cases and 110,135 individuals have succumbed to the deadly virus world wide Coronavirus is a very dangerous infectious virus seen in animals and humans. The new coronavirus illness, a member of the coronavirus family, that bust go in late Dec is caused by the SAR-CoV-2 virus.This communicable disease,known as Covid19 within the literature, attacks the system directly, thus symptoms of fever, cough, and shortness of breath cause frequently determined. In advanced cases, it causes inflammation o f t he a ir s acs i n t he l ungs s uch a s k nown as respiratory disease Rapid test, as another to identify Covid-19, is presently thought of problematic to hold out since the diagnostic system isn't out there in all places. Given the restrictions of Covid-19 testing, alternative various diagnostic measures ar desperately required. Therefore, the automated detection instrument, like the appliance of X-ray scans, is required to investigate the patient's lungs and to observe whether somebody has been infected by the virus or not. the appliance of X-Ray scans is applied as another diagnostic mechanism since nearly all hospitals have associate X-ray machine. Hence, Covid-19 virus detection is conducted while not use special kit.

This study aims to look at the patterns rising from the X-ray chest pictures of the patients who are infected by the Covid-19 virus. The observation is enforced using deep learning. The deep learning algorithmic program that's selected to be applied within the present analysis is Convolution Neural Networks (CNN). aside from applying the CNN basic model, the VGG16 transfer learning model is additionally wont to compare and reveal that model has the most effective performance. Also, a pre-trained model is employed during this analysis because the dataset. After that, the pre-trained model is re-implemented on the new dataset, one in all that is VGG16 [8]. the appliance of image processing is additionally applied to enhance the image quality using contrast restricted graph effort (CLAHE). the mix of CNN and CLAHE is enforced to acknowledge objects within the kind of medical pictures and image improvement, particularly the detection of the Covid-19 virus on X-ray chest pictures. within the present analysis, the programing language along side implement CLAHE and CNN is Python in beside with the OpenCV library.

II. LITERATURE REVIEW

Computer science in Artificial Intelligence (AI) is one kind of technological advancement shown by machines. not like the natural intelligence displayed by humans, the term "artificial intelligence" is usually wont to define machines that mimic the "cognitive" functions associated with the human mind, like as "learning" and "problem-solving". In distinction to ways machine learning strategies that need hand extraction options from the input, AI performs a deep learning technique by finding out the features derived from bound information.

The Convolutional Neural Networks (CNN) algorithmic rule is associate “artificial intelligence” with a deep learning technique that's quite superior to different models. that's to mention, CNN is probably going to be the dominant technique within the process tasks of computer vision [9]. the target of this analysis is to explore the feasibility of CLAHE and CNN's basic performance with some primary preparation situations and transfer learning trials. The dataset used is two hundred X-ray chest pictures. To be specific, the dataset used consists of a hundred traditional X-ray pictures and a hundred Covid-19 X-ray Reports.

Pneumonia is one amongst the lung’s deadly diseases. The respiratory illness identification involves a group of chest radiographs taken by a medical specialist. However, a diagnosing that's aided by humans has its limitations like the provision of specialists, fees, and alternative problems [10]. within the current X-ray chest image of the Covid-19 patients, the researchers add the non-Covid respiratory illness dataset so the amount of datasets used is obtained with most accuracy. In different words, during this analysis, the dataset used contains traditional X-ray chest Report and Covid-19 X-rays chest Report.

After the researchers choose the correct technique to observe Covid-19 through X-ray chest Reports, the researchers begin enhancing the image quality by implementing contrast restricted graph equalisation (CLAHE). The method involves Graphs equalisation procedure to process X-ray datasets and analyzes the performance levels of CNN that are combined with CLAHE.

Neural Network (NN) may be a basic algorithmic rule system that's usually used at the present. Neural Network (NN) mechanism is galvanized by the training method of the humans’ brain. The perceptron is one among 1st} systems of NN that was first planned by Rosenblatt [11]. Convolutional Neural Network (CNN) may be a developmental variation of Neural Network (NN) advised by weasel and David Hubel once observant the visual area of cats in 1968 [12]. The space|cortical area|cortical region} usually possesses alittle area shaped from a cell that's sensitive to the purpose specified in the field of vision. that's to mention, the cell inside the cortex is activated solely during a specific form and orientation.

The basic structures of CNN are basically just like the structures of NN generally. They contains some similar aspects, like input, hidden, and output layers. Meanwhile, each layer on CNN usually contains many elements like activation, convolution, and pooling. The condition of every layer is about relating to the abstraction grid structure during which alittle space on the previous layer specifies any worth within the feature.

Image improvement may be a issue that must be taken under consideration to carry out high-quality segmentation, particularly in X-ray Reports. The enlarged contrast and sharpness of the image ar possible to enhance the accuracy of consequent modes for more diagnosing of autonomic disease systems [13]. during this research, there's associate analysis of varied preprocessing techniques for vertebral bone segmentation. The 3 strategies used are distinction restricted adjustive Graphs `Equalization (CLAHE), Graphs equalisation (HE), and Gamma Correction (GC).

The objectives of the current analysis are} to check and measure the accuracy of the techniques used to improve image quality. In different words, 3 pre-processing strategies are compared, namely HE, GC, and CLAHE. The ends up in this analysis discover that gc shows the simplest sensitivity although CLAHE displays the most effective accuracy. due to the proper detection accuracy, either positive or negative, CLAHE is considered the foremost appropriate performance metric to use. Thus, the foremost suitable algorithmic rule for image improvement is CLAHE.

III. METHOD

An adaptational bar chart feat (AHE) may be a procedure wont to enhance the image contrast by increasing the native distinction of the image. The native distinction is acquired by forming a symmetrical grid on the image supposed region size. the problem of excessive distinction improvement in AHE are often resolved by 0using CLAHE that assigns a limit worth to the histogram. This worth is termed the clip boundary that represents the most height of a bar chart [14].

Convolutional Neural Network (CNN) may be a development of Multilayer Perceptron (MLP) designed to method twodimensional information. CNN is concerned within the Deep Neural Network since it's a high network depth. it's additionally wide applied to method the image information. within the case of image classification, MLP isn't appropriate to use due to its incapability to store the abstraction info of the image data. Besides, it also considers every picture element to be AN independent feature leading to poor outcomes.

CNN was established below the name of NeoCognitron projected by Kunihiko Fukushima, a research worker from the NHK Broadcasting Science analysis Laboratories, Kinuta, Setagaya, Tokyo, Japan [15]. The conception was then finalized by Yann LeChun, a research worker from AT&T Bell Laboratories in Holmdel, New Jersey, USA. The CNN model with the name LeNet was with success applied by LeChun in his research on numbers and handwriting recognition [16].

The X-ray detection of Covid-19 patients on their chests using distinction contrast adjustive bar chart feat (CLAHE) and Convolutional Neural Networks(CNN) allotted through many stages as illustrated in Fig. 1.

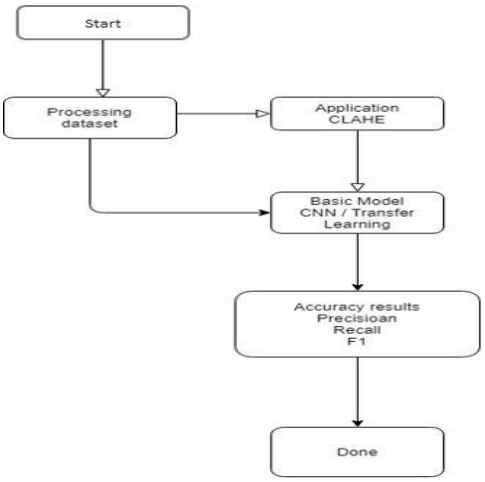


Fig. 1. Flowchart of research

A. Processing Dataset

Regarding the method of information collection, the datasets used were 200 Report of chest X-Ray consisting of 100 images of Covid-19 chest X-ray and 100 images of normal chest X- ray. The collected datasets of Covid-19 chest X-ray were obtained through GitHub [17] whereas the datasets of normal chest X-ray were obtained through Kaggle [18].

B. Application of CLAHE

The CLAHE implementation served to enhance the standard of images that had been classified. It additionally functioned to enhance the image contrast to get important outcome.

C. Scenario Analysis

The method of information analysis was conducted through two situations. the primary scenario was allotted by comparison the detection between Reguler dataset and also the dataset that had been improved by CLAHE. The second scenario was implemented by comparing the CNN basic model with VGG16 transfer learning. within the process of scenario analysis, the researchers examined the amount of accuracy, precision, recall, and F1. within the process of Covid-19 detection analysis using CNN' basic model, the researchers implemented the procedures as seen in Fig. 2. Meanwhile, in the process of Covid-19 detection analysis using VGG16 learning transfer, the researchers used created procedures as illustrated in Fig. 3.

Fig. 2. CNN basic architecture

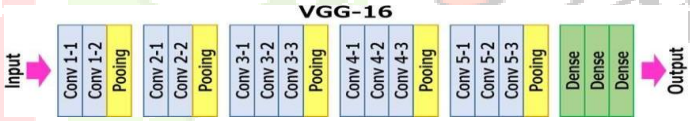


Fig. 3. Architect VGG16

I. RESULTS AND DISCUSSION

This section presents the experimental method and results that are applied Calculate the planned method. Fig. 4. portrays the research steps that are carried out within the present research.

Fig. 4. Research steps

A. Process Dataset

The researchers acquire the most information from 2 sources, specifically Github and Kaggle. when collection the data, the researchers classify the dataset manually into 100 Covid-19 X-ray Report and 100 normal X-ray images as seen in Fig. 5. Then the dataset is processed and analyzed using Google Colab so the researchers will set the shape path of data.

Fig. 5. Covid-19 and normal X-ray image

At this stage, the researchers use CLAHE that's combined with the Python language programming. Fig. 6. shows a picture before the method of research whereas Fig. 7. presents the results once the image being processed with CLAHE. relating to the image shown in Fig. 6. it may be complete that there's a major modification in image contrast and clarity that automatically improves the image quality in Fig. 7. The key factors in CLAHE are clip limit (CL) and therefore the number of tiles (NT) [19]. The clip limit may be a system regulation noise amplification so the height of the clip doesn't exceed the required limit. Meanwhile, the amount of tiles is that the non- overlapping number of squares or areas at constant size.

Fig. 6. Before CLAHE

B. Application of CLAHE

Fig. 7. After CLAHE

C. Scenario Analysis

This stage contains two situations to be compared. the primary scenario is that the comparison between the essential dataset and therefore the CLAHE-enhanced dataset. The second scenario is the comparison between CNN' basic model ANd VGG16 transfer learning. The CLAHE implementation has shown an up performance on the accuracy and validation as shown in Fig. 8. indicates portrays 98%curacy and 97% validation. Moreover, Fig. 9 indicates 99% curacy and 97% validation. that's to say, the results show an improvement on the regular dataset increased by CLAHE that is examined using CNN' basic model

```
model.evaluate_generator(train_generator)

[0.0191231369972229, 0.981249988079071]

model.evaluate_generator(validation_generator)

[0.057231537997722626, 0.9750000238418579]
```

Fig. 8. Using a regular dataset

```
[13] model.evaluate_generator(train_generator)

     [0.0018916826229542494, 0.9937499761581421]

[14] model.evaluate_generator(validation_generator)

     [0.09678425639867783, 1.0]
```

Fig. 9. Using CLAHE

In the initial scenario, the researchers propose the graph of loss and precision models that are shown in Fig. 10. to Fig.13 is that the visual kind of Fig. 8. And Fig. 9. The models will be wont to verify the accuracy of every epoch. The results of applying the accuracy model on the standard information set using CLAHE can even be seen within the Confusion matrix in Fig. 14. By using the

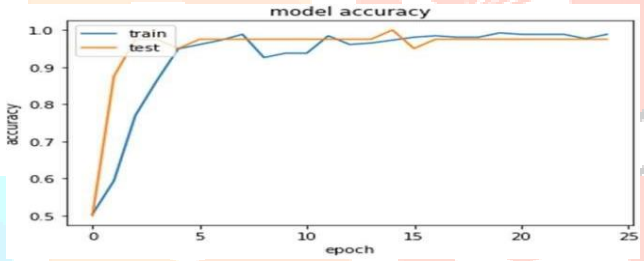


Fig. 10. Dataset Model Accuracy

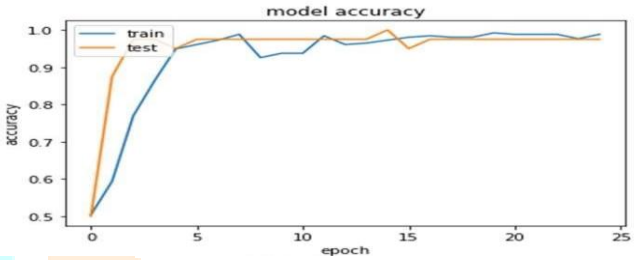
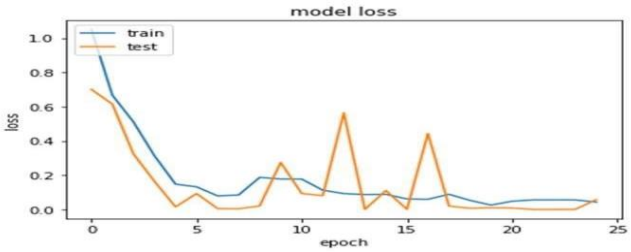


Fig. 11. CLAHE Dataset Accuracy Model



Confusion Matrix, it can be determined that of the 40 data used for the validation process, there are 20 true positives, 19 true negatives, 0 false positives, and 1 false negative.

Fig. 12. The usual dataset loss model

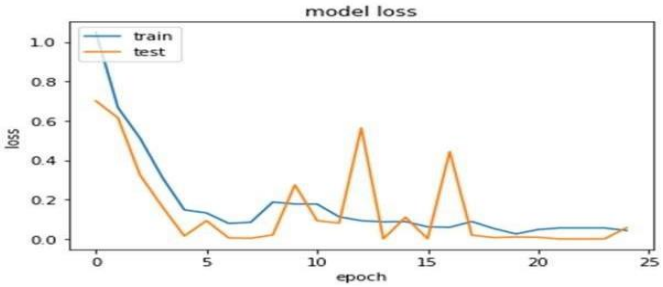


Fig. 13. CLAHE Model Loss dataset

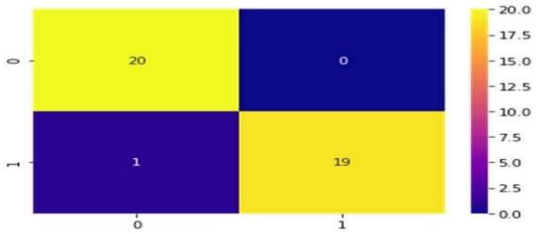


Fig. 14. Confusion matrix

The continued step is that the comparison of the primary scenario's results that's applied using precision, recall, and F1 analysis. The results of applying the conventional dataset and also the dataset that has been improved by CLAHE have an equivalent percentage as shown in Fig. 15. The dataset used only contains forty images. Therefore, even if there are variations within the accuracy and validation models, it still has no important result on the results of precision, recall, and F1.

```
Precision: 1.000000
Recall: 0.950000
F1 score: 0.974359
```

Fig. 15. Precision, recall, F1

The second situation could be a comparison of the VGG16 learning transfer using an equivalent data. the method of research reveals lower than optimum leads to the second experiment as seen in Fig. 16. The VGG16 transfer learning model application with a similar dataset that's measured using the CNN basic generator model shows the accuracy rate of 44% and 50 %. On the contrary, the information loss displays a better accuracy that is 69%. These results show that there's a mistake in combining the generator model applied to VGG19. The researchers gift the accuracy graph made in Fig. 17. and the graph of the loss model in Fig. 18.

```
[ ]  model.evaluate_generator(train_generator)
     [0.6931498646736145, 0.4437499940395355]
[ ]  model.evaluate_generator(validation_generator)
     [0.6931484341621399, 0.5]
```

Fig. 16. Train accuracy and validation of VGG16

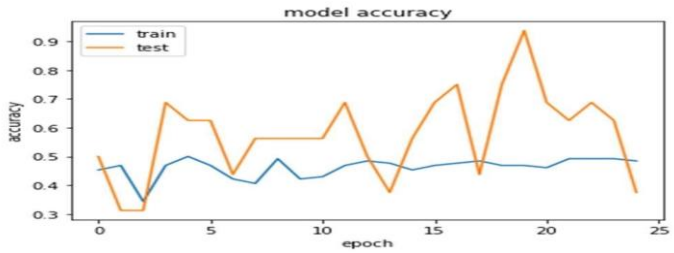


Fig. 17. VGG16 Accuracy Model

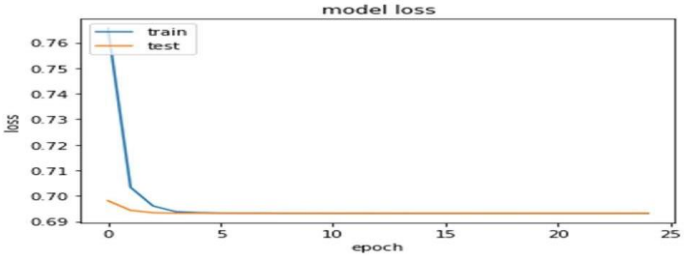


Fig. 18. VGG16 Loss Model

CONCLUSION

Numerous experiments are conducted leading to many conclusions. within the initial comparison scenario, it is all over that the application of CLAHE is taken into account ready to have an effect on the accuracy of the generate evaluating model as shown in Fig. 9. However, since this research examines alittle dataset consisting of forty images, the detection of Covid- 19 willnot affect the precision, recall, and F1. In comparison, in the second scenario, between CNN basic model and transfer of learning, it can be seen that the VGG16 transfer of learning isn't applicable to be applied with an identical evaluating model that analyzed using basic CNN. this can be because of a mistake within the detection method so the accuracy of the transfer learning application is taken into account low. Besides having the ability to extend accuracy, this research also can show the improvement of CLAHE accuracy by dynamical the worth of epochs in the training process. In developing additional research, it's advised that future researchers use additional datasets, specifically X-ray respiratory disease to collect several variations. Thus, the system is probably going to tell apart the variations among the Covid-19 virus, pneumonia, and traditional chests of the patients. Also, adding the respiratory disease dataset will improve the performance on the accuracy, precision, recall, and F1 so the distinguishable variations is seen clearly..

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