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# Pneumonia Detection on X-rays Image using YOLOv8 Model

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**Abstract –** Pneumonia is an acute inflammatory disease of lung tissue. It is usually caused by microorganisms such as bacteria, fungi and viruses. The young children are particularly vulnerable to this illness. Report in 2019 shows that pneumonia kills almost 2,000 children under the age of five every day worldwide and affects over 800,000 children under the age of five annually. Analyzing the chest X-ray results of the patient's body is one method of diagnosing pneumonia. Therefore, this research was done to deploy a deep learning to identify the healthy and pneumonia affected lungs from chest X-ray images in order to aid in the diagnosing process. This research was done by using 2000- chest X-ray dataset—of which 1500 pneumonia lung data and 500 normal lung data. The computer vision model YOLOv8 is used in this study. The accuracy results from the training process were 56.15% in the pneumonia class and 92.03% in the normal class. Wether in the testing process yielded an average value of 0.482 (48, 2%) for the pneumonia class and 0.675 (67,5%) for the normal class. From these results, there are promising possibilities for developing a pneumonia detection system using YOLO in the future.

**Keywords -** Pneumonia, chest X-Rays image, YOLOv8

## 1. INTRODUCTION

Pneumonia or also known as pneumonia is an acute inflammatory disease of lung tissue and is usually caused by microorganisms such as bacteria, fungi and viruses [1]. This disease can attack anyone, but children under 2 years of age and elderly people over 65 years of age are very susceptible to pneumonia [2]. Based on UNICEF data through the Fighting For Breath report in 2019, more than 800,000 children under five every year in the world suffer from pneumonia, and around 2,000 children under five die every day from pneumonia [3]. Indonesia is indeed one of the countries that has made good progress in preventing and treating pneumonia. However, the mortality rate of children under 5 in Indonesia due to pneumonia in 2018 was 4/1,000 live births, whereas it still has not reached the global target in 2025, namely 3/1,000 live births. This data is quite worrying and it is estimated that the figure will increase due to the impact of Covid-19 on children [4], [5].
Although a patient's medical history and physical examination are typically used to make the diagnosis of pneumonia, it can occasionally be challenging to distinguish between

pneumonia and other illnesses since the symptoms can resemble those of the common cold or the flu [6]. Chest x-rays are performed to check for lung inflammation and are frequently used to detect pneumonia [7], [8]. White patches or stains on the lungs are the hallmarks of a chest X-ray that indicates pneumonia , [9], [10].

In a prior study, researchers employed deep learning technology and the Convolutiunal Neural Network (CNN). This approach was with 10,000 data points, containing 14 different patient disease categories. Test findings from this study showed improved accuracy values up to 13,5 % when compared to a number of reference techniques [6], [11]. An additional study that served as a source for this research examined the binary classification of 5847 chest x-ray image data, identifying between lungs that were infected with pneumonia and those that were not. The study yielded findings with sensitivity and specificity values more than 90%[7], [12].

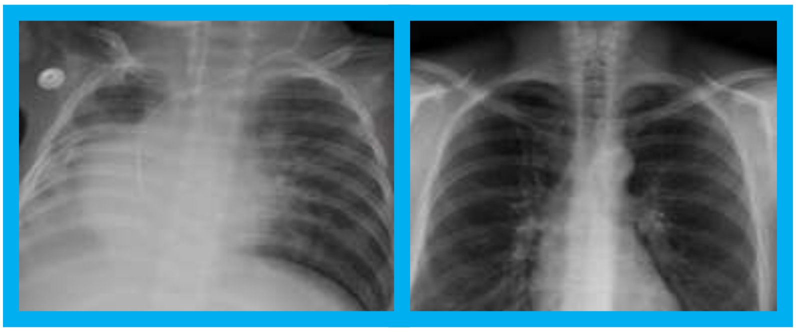
The author intends to develop a deep learning system to distinguish between healthy and pneumonia-affected lungs from X-ray images based on the previously given background. This research was conducted using 2000 datasets of Chest or Lung X-rays—1500 of which are normal lung data and 500 of which are pneumonia lung data. Author then applied the YOLOv8 computer vision model for training and testing purposes because of the nature of YOLO which is able to see the entire image during the test [13]. YOLO prediction results can be informed in a small object area, even in a global view of the image.

## 2. RESEARCH METHOD

### 2.1. Datasets Processing

The dataset that the author uses is an X-ray image of the lungs or chest that comes from the Kaggle website. The dataset consists of 2000 datasets in JPG image format. The following things need to be prepared so that the dataset can be used in the training and testing process:

(a)



(b)

(c)

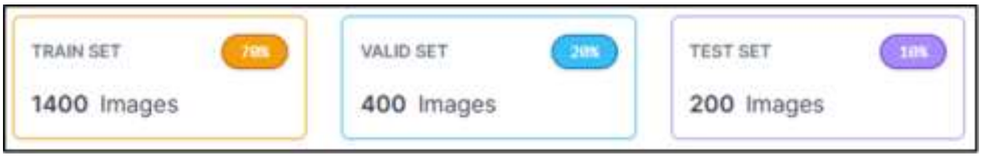


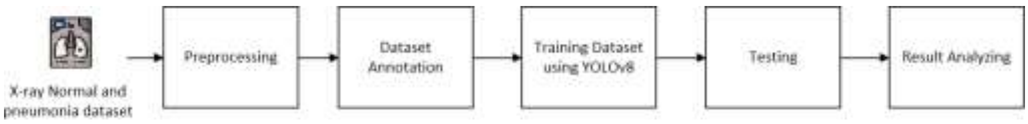

Figure 1. (a) Difference between Pneumonia Image and Normal Image, (b) Difference between Normal and Pneumonia Classes, (c) Datasets Allocation

a.) Dataset identification that aims to differentiate normal lung images from pneumonia lung images as shown in Fig. 1.a.
b.) The dataset are then labeled with two different classes in Roboflow website, namely the pneumonia class and the normal class. The normal class is marked in green and the pneumonia class is marked in orange as shown in Fig. 1.b.
c.) The dataset are then allocated into 3 categories, namely: Training Set of 1400 datasets, Validation Set of 400 datasets, Testing Set of 200 datasets as shown in Fig. 1.c.

2.2. Research Procedures

This section describes how the research process progresses from start to finish along with each stage carried out. To make it easier to understand the research process, the research is described in the form of a flowchart so that the objectives of the research can be achieved well and in a focused manner.The research flowchart can be seen at Fig. 2. (a) below.

(a)




(b)

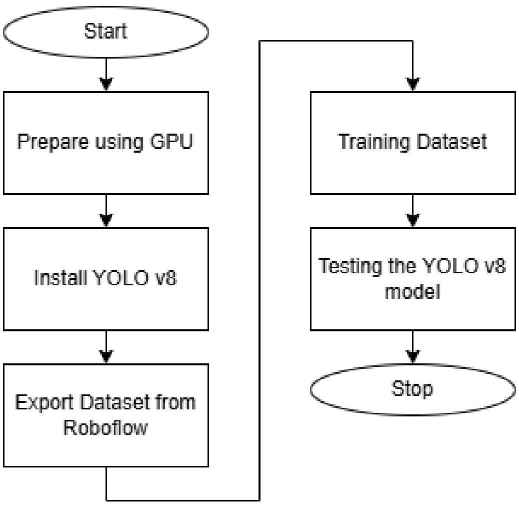



Figure 2. (a) Diagram Research Flow, (b) Training and Testing Flowchart

a.) Dataset x-rays of normal and pneumonia are collected from the Kaggle explained in the previous section. The dataset contains 1500 pneumonia and 500 normal chest X- rays.
b.) The next stage is the preprocessing stage, at this stage all the datasets will be resized to a size of 512 x 512 pixels.
c.) Dataset annotation to label images as the classes, if the image contains pneumonia, the annotation will be applied as pneumonia with a bounding box. Whereas, when the images are normal chest x-rays, the images given are annotated with normal.

d.) Training is the part of the dataset that we train to make predictions or carry out the function of an algorithm. You Only Look Once (YOLO) version eight is applied in this training process.

e.) Meanwhile, testing is the part of the dataset that we test to see its accuracy, or in other words, its performance.

f.) The final step was analyzing the results from training and testing results to obtain conclusions.

The training and testing process was carried out using the Google Collab website using the YOLOv8 model and the Python programming language. The author also uses the T4 GPU hardware accelerator provided by Google Collab. The training and testing flowchart can be seen at Fig. 2. (b).

a.) Prepare Using GPU in Google Collaboratory. Then, connect to the T4 GPU and make sure it is connected to the GPU.

b.) Install YOLOv8.
In this study, installing YOLO on Google Colab used the YOLOv8 model.

c.) Inference with Pre-trained COCO Model
This is done to ensure that the YOLOv8 model is running properly. The COCO dataset is used to train and evaluate deep learning models in object detection.

d.) Export Dataset from Roboflow
Export dataset from Roboflow that has been prepared previously.

e.) Training dataset using YOLOv8 model
The training dataset is used to make predictions and carry out the functions of the algorithm. This research uses the YOLOv8 model.

f.) Testing the YOLOv8 Model
Some datasets are tested to see their accuracy, or see their performance.

## 3. RESULTS AND DISCUSSION

The author uses the YOLOv8 model with epochs 65. The following are the training results in the form of a confusion matrix table in Fig. 3 below.

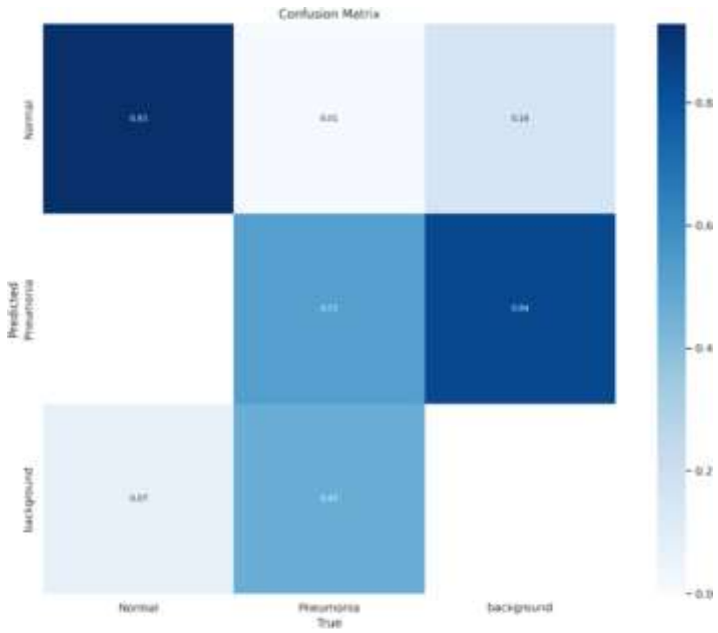



Figure 3. Confussion Matrix

From Fig. 3 These can be identified for each class, namely as follows:

a. Normal Class

1. True Positive (TP): Predicted “Normal” True “Normal” = 0,93
2. True Negative (TN): Predicted “Beside Normal” True “Beside Normal” = 0,53 +0,84 + 0,47 + 0 = 1,84
3. False Positive (FP): Predicted “Normal” True “Beside Normal” = 0,01 + 0,16 =0,17
4. False Negative (FN): Predicted “Beside Normal” True “Normal” = 0 + 0,07 =0,07

To find out the accuracy of the normal class, it can be found using the following formula:

$$Accuracy = \frac{number\ of\ true\ predicted\ (positive\ dan\ negative)}{number\ of\ all\ data}$$

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN}$$

$$Accuracy = \frac{0{,}93 + 1{,}84}{0{,}93 + 1{,}84 + 0{,}17 + 0{,}07} = \frac{2{,}77}{3{,}01}$$

$$Accuracy = 0{,}9203 = 92{,}03\%$$

b. Pneumonia Class

1. True Positive (TP): Predicted “Pneumonia” True “Pneumonia” = 0,53
2. True Negative (TN): Predicted “Beside Pneumonia” True “Beside Pneumonia” = 0,93 + 0,16 + 0,07 + 0 = 1,16
3. False Positive (FP): Predicted “Pneumonia” True “Beside Pneumonia” = 0 + 0,84 = 0,84
4. False Negative (FN): Predicted “Beside Pneumonia” True “Pneumonia” = 0,01 +0,47 = 0,48

To find out the accuracy of the pneumonia class, it can be found using the following formula:

$$Accuracy = \frac{number\ of\ true\ predicted\ (positive\ dan\ negative)}{number\ of\ all\ data}$$

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN}$$

$$Accuracy = \frac{0{,}53 + 1{,}16}{0{,}53 + 1{,}16 + 0{,}84 + 0{,}48} = \frac{1{,}69}{3{,}01}$$

$$Accuracy = 0{,}5615 = 56{,}15\%$$

Testing process was carried out to determine its performance, the testing results are shown in Fig. 4 below:

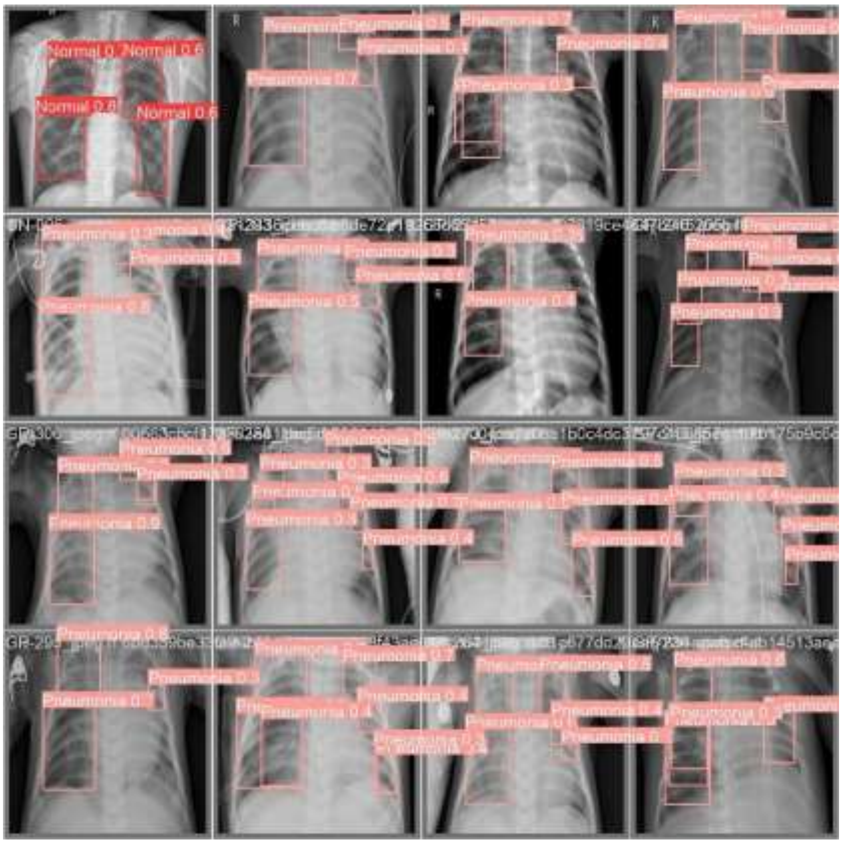


Figure 4. Testing Results

Based on the Fig. 4 above, it can be seen that the normal class has an average Accuracy value of 0.675 and the pneumonia class has an average Accuracy numerical value of 0.482. These two results were then compared with the research that was the reference for this research as shown in the following table.

| No. | Ref. No. | Technique | Accuracy Results |
|---|---|---|---|
| 1 | [6] | CheXNet (121-layerconvolutional neural network trained on ChestX-ray14) | 76,80% |
| 2 | [7] | CNN + ANN | 90,78% |
| 3 | Proposed Method | YOLO v8 | 67,5% for normal class dan 48,2% for pneumonia class |

Based on the comparison of these results, it can be seen that the results using YOLO v8 still have values that are far below the average compared to the reference research used. This can be caused by the still manual process of annotating the dataset used in the training and testing process [14]. Even though the YOLO method has a lower average accuracy than other methods, this method can produce the prediction results in a small object area, even in a global view of the image [13], because of its nature which is able to see the entire image during the test.

## 4. CONCLUSION

Based on the results and discussions of the studies that have been carried out, this study shows that the training process using the YOLOv8 model resulted in the normal class having quite good accuracy, namely 92.03%, in the pneumonia class, the accuracy was not good enough, namely 56.15%. In the results of the testing process, it is also known that the normal class shows performance that is not good enough, namely having an average figure of 0.675 (67.5%) and likewise the pneumonia class shows performance that is not good enough, namely having an average figure of 0.482 (48.2%). These two results are possible because of the still manual process of annotating the dataset used in the training and testing process. In order to improve the accuracy of the YOLO system used, it is intended that an automated results validation mechanism will be applied in the future research.

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