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# USING THE YOU ONLY LOOK ONCE (YOLO) METHOD FOR DETECTING PHYSICAL DISTANCING AND MASKED FACES

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**Abstract**

The flow of news regarding the development of Covid-19 has dominated various information channels in Indonesia in the last 2 years, either through print media or digital media. Various types of news related to Covid-19 continue to circulate, including hoax news. One of the hoax news that is widely circulating is news about the Covid-19 vaccine. The rise of information containing hoax news and untrue rumors about the Covid-19 vaccine in society can worsen the pandemic situation. Currently there is no intelligent system capable of classifying hoaxes regarding the Covid-19 vaccine. To maximize prevention of the spread of hoax news about the Covid-19 vaccine and overcome the problems faced, the author designed a classification system for hoax news about the Covid-19 vaccine using a machine learning approach. The system built can classify news using a combination of the Name Entity Recognition (NER) and Backpropagation algorithms. The datasets used are: 600 Covid-19 vaccine news data obtained from the sites https://turnbackhoax.id/ and https://www.kompas.com/ with the keyword "covid vaccine". The dataset is divided into two, training data and test data. The training data is preprocessed and then used in model design. Test data is used to evaluate the results of model design. This process produces a machine learning model with a good accuracy level of 97.62%.

***Keywords: Physical Distancing, Mask Detection, You Only Look Once (YOLO).***

## INTRODUCTION

The COVID-19 pandemic in Indonesia has been going on for almost 2 years. This is certainly not a short time in efforts to deal with the COVID-19 pandemic. The government has made various efforts to reduce the level of spread of the COVID-19 virus, starting from Large-Scale Social Restrictions (PSBB), Large-Scale Social Restrictions Transitional PSBB, Implementation of Micro Community Activity Restrictions (PPKM), to implementation of Community Activity Restrictions (PPKM) level 3 and 4 [1]. The efforts made have not significantly helped reduce the spread of the COVID-19 virus in Indonesia. One of the reasons why the spread of COVID 19 in Indonesia has not yet ended is the lack of public compliance in implementing health protocols, especially regarding the use of masks [2], apart from the emergence of the Omicron variant which is susceptible to attacking the young population and has mild symptoms compared to the symptoms of the previous Delta variant as well. will be the focus of the government in handling the spread of this variant [3].

The government, through the COVID-19 Task Force, has taken various steps to increase public awareness in complying with health protocols through educating the public regarding the importance of health protocols, socializing the 3M, 5M protocols and so on. Health protocols such as maintaining distance and using masks are two things that are highly emphasized, but it is very unfortunate that people often ignore them, both in cities and in villages. Lhokseumawe is one of the areas that often falls into the red zone, this is due to the lack of awareness and non-compliance of the people of Lhokseumawe City in implementing health protocols. Lhokseumawe State Polytechnic (PNL) is one of the educational institutions in the city of Lhokseumawe. The PNL leadership also implements strict health protocols for the PNL academic community, however, from the results of observations, it is still found that the PNL academic community still does not implement health protocols in activities within the PNL environment.

The following are several things that cause the implementation of health protocols to not be optimal, including:

1. Public awareness is still lacking in maintaining health protocols.
2. There is no device that can detect health protocol violators.

Based on these problems, a solution can be taken that can be applied at the Lhokseumawe State Polytechnic, namely by building a system that is able to detect violators of Physical Distancing and wearing masks using vision technology with the YOLO method. The following are the features offered as a solution to the problems described:

1. Detect violators who do not practice physical distancing.
2. Provide a warning alarm if there are Physical Distancing violators.

The You Only Look One (YOLO) method is used to recognize objects in the form of people and faces, then the system will calculate the distance between the two objects, apart from that the system will also check the use of a mask on the person's face. Thus, it is hoped that the implementation of the Physical Distancing and Masked Face detection system using the YOLO method can increase public awareness, especially at the Lhokseumawe State Polytechnic, to comply with health protocols so that it can help the government in making efforts to reduce the spread of COVID 19. You Only Look Once (YOLO) is a method that allows a computer to detect an object in real-time. The detection system used is to use a repurpose classifier or localizer. A model is applied to an image at several locations and scales. The area with the image that is given the highest score will be considered as a detection [4]. According to the creator of the YOLO algorithm [5], YOLO is a new approach to object detection systems, targeted at real-time processing. YOLO frames object detection as a single regression problem, from image pixels directly to spatially separated bounding boxes and bound class probabilities. YOLO performs object detection and recognition with a convolution neural network, which predicts bounding boxes and class probabilities directly in one evaluation [6].

Classification in general is the process of identifying labels from the data to be tested, whereas in You Only Look Once (YOLO), classification uses localization, that is, there is an additional location for objects in the form of bounding boxes (bx, by, bh, bw) [7] . YOLO uses the entire set of the entire image to predict all bounding boxes in all object classes for an image simultaneously. The YOLO algorithm will consider all parts of the image globally and all objects in the image. YOLO divides the input image into an S × S grid. If the center of an object is in a grid, the grid cells are responsible for detecting the object [8].

The following is how You Only Look Once (YOLO) [9] [10] works:

1. Before training a neural network, the first step is that the image will generally be reshaped to size
   416x416, which is intended to speed up learning so that learning can be done in groups.
   Divide the image into cells ax a. On YOLO 3 and
2. 4 generally divide into 13 x 13 cells.

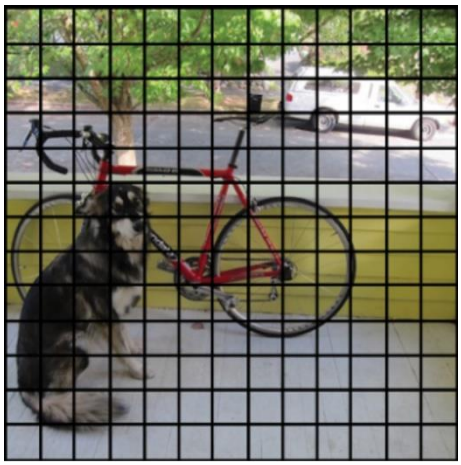


Figure 1 Splitting image cells [9]

3. YOLO then predicts the corresponding bounding boxes and class probabilities for the objects (if any are found, of course).

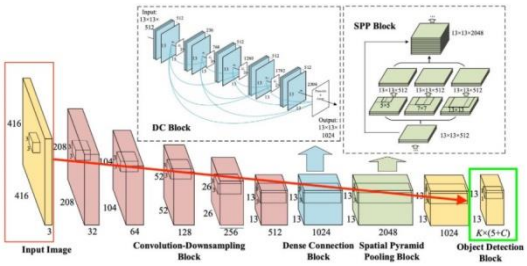



Figure 2 Basic architecture of YOLO[9]

4. The detection blocks that have been found are then labeled with the following values:

| | |
|---|---|
| y = | pc |
| | bx |
| | by |
| | bh |
| | bw |
| | c1 |
| | c2 |
| | c3 |

Information :
- pc: Number of objects in the column
- bx, by : grid row
- bh, bw: anchor / point where the object is located
- c1,c2,c3 : Criteria/class detected

**METHOD**

A. Data Requirements

Data collection on the Physical Distancing and Masked Face Detection System Using the You Only Look Once (YOLO) Method was carried out secondary and primary. Secondary data collection was aimed at detecting distance and masked faces, while primary data collection was carried out to record student faces.

The data used for the Mask Detector is data obtained via the website www.kaggle.com with the keyword "face mask". The dataset used is 450 data. The mask dataset can be seen in Figure 4.

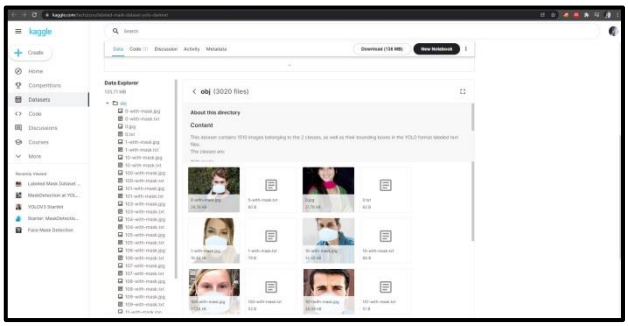


Figure 4 Masked Face Dataset

The data used for Face Recognition is facial photo data from IT 4B class informatics engineering students, as shown in Figure 5. The entire dataset prepared will be divided into two with a percentage of 80% for training data and 20% for testing data.

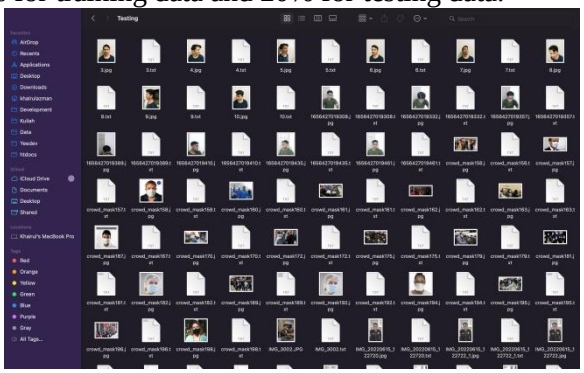


Figure 5 Dataset of student faces

B. Pre-processing

Pre-processing is the process of changing raw data into a form that is easier for the system to understand. In this system the pre-processing process is divided into two, namely the data labeling and data resizing stages.

Labeling is the process of labeling each dataset that has been prepared. Data labeling is done using the labelImg application. Data is labeled according to the class to be created.

Figure 6 Dataset Labeling

In figure 3.4 is the data label used for the training process using Darknet YOLO. 1 in the data indicates the class sequence number 0.572954 0.6352330.630117 0.612573 is the location of the four image label points.

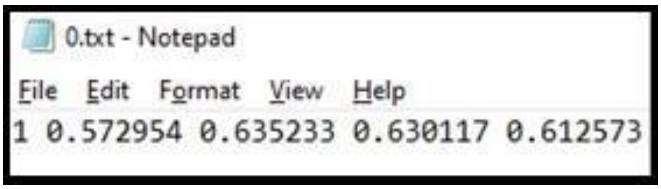



Figure 7 Mask data labels

C. Model Design

Figure 6 shows the flowchart of the model creation process for the You Only Look Once method.

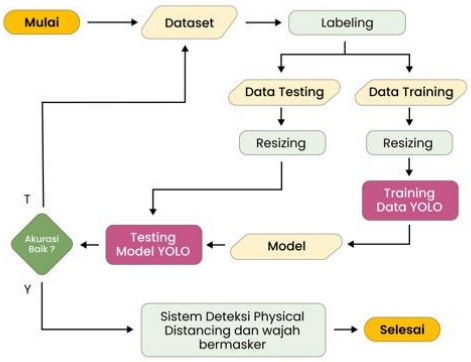



Figure 8 Model creation flowchart

The model creation process is carried out on Google Colab, so that the dataset that has been collected is uploaded to Google Drive. The You Only Look Once method will carry out resizing and carry out a training process. The output from training produces a model. The resulting model will be evaluated using the testing data that has been prepared. If the model accuracy is good then the model will be used in the system, if not then the dataset used will be checked again. The data training process is carried out using the darknet. With the following configuration:

- Width : 416
- Height : 416
- Max Batches: Number of Classes * 2000
- Steps : (80% of max batches), (90% of max batches)
- Filter : (Number of classes + 5) * 3

The final result of the training is a model in weight format which will be saved on Google Drive. A model that produces good accuracy is ready to be used in the system.

D. System planning

1) Diagram Context

The Physical Distancing and Masked Face Detection System has three entities, namely Study Program Staff, Students, and Head of Study Program. Study program staff have a role in inputting student data and deleting violation data. The system provides information regarding student data and violator data to study program staff. Student entities can view the history of violations by inputting NIM while KA. The study program can see reports of violators that have been detected by

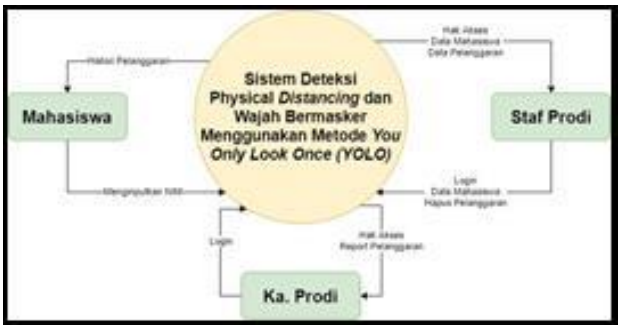



Figure 9 Context Diagram

2) Data Flow Diagram Level 1

Figure 10 is the Data Flow contained in the Physical Distancing and Masked Face Detection System Using the You Only Look Once (YOLO) Method. There are six processes carried out by the system, namely, Physical Distancing Detection, Mask Detection, Face Recognition for mask violators, Login (for Study Program Staff and Head of Study Program) Managing Violation data, managing Student data, and Reporting Violation data.

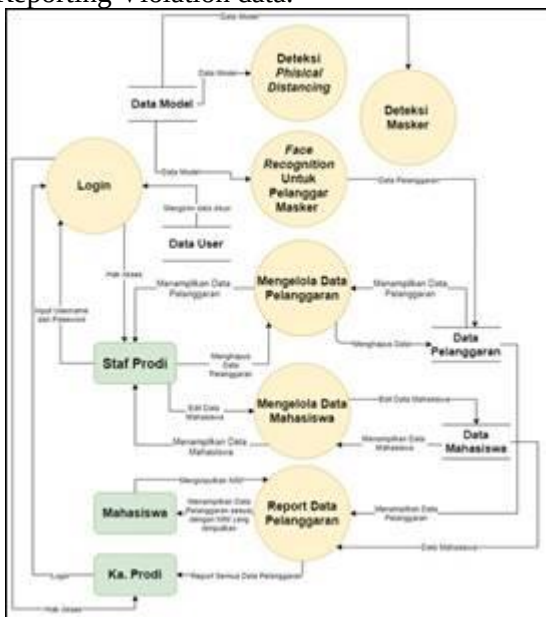



Figure 10 Data Flow Diagram Level 1

Data Flow Diagram Level 2 Physical Distancing Detection Figure 11 is a level 2 DFD for the Physical Distancing detection process. In the process, there is one entity, namely the Study Program Staff, which will display the detection monitor. This detection process uses data originating from the model table, which will produce a video of the detection process for physical distancing violators.

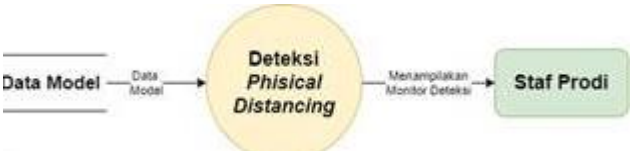



Figure 11 DFD Lv 2 Physical Distancing Detection

4) Data Flow Diagram Level 2 Mask Detection and Face Recognition

Figure 12 is a level 2 DFD for the Mask detection process. In the process, there is one entity, namely the Study Program Staff, which will display the detection monitor. This detection process uses data from the model table, which will produce a video of the mask detection process and if a student does not wear a mask, the student's face will be recognized, then evidence of the violation will be stored.


Figure 12 DFD Lv 2 Mask Detection and face recognition

5) Data Flow Diagram Level 2 Violation Report

Figure 13 is a level 2 DFD for the violation data reporting process. In this process there are two entities, namely students and teachers. Study Program. Each student can view their report by inputting their NIM, and ka. The study program can see all reports of violations committed by students.


Figure 13 DFD Lv 2 Violation Report

E. Database Design

The Physical Distancing and Masked Face Detection System Using the You Only Look Once (YOLO) Method has 6 main entities, namely Violations, Students, Departments, Study Programs, Classes and Admin. Each entity has a relationship with other entities, either many to one, one to many, many to many, or one to one. The following is an image of the Entity Relationship Diagram.

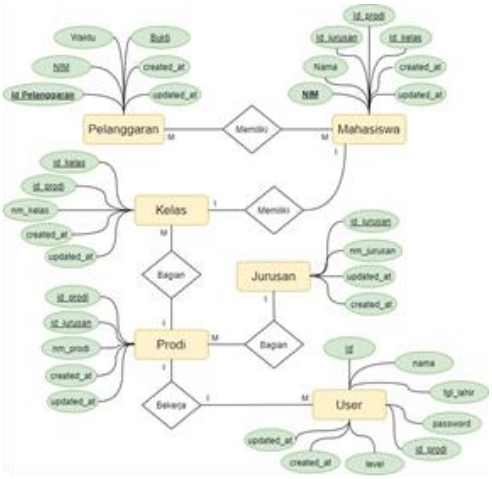



Figure 14 Entity Relationship Diagram

## RESULTS AND DISCUSSION

1) Model Testing

In developing the deep learning model, white box testing was carried out to see the ability of the resulting model to detect masks and recognize the faces of students who were not wearing masks. Figure 15 shows a graph of the model training results.

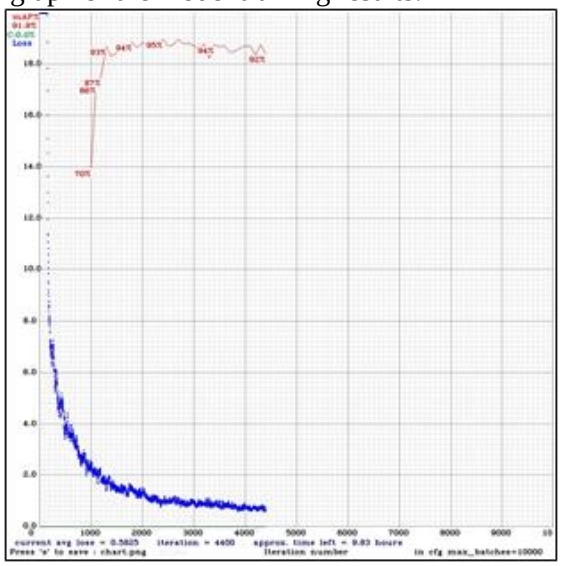


Figure 15 Graphic of Model Training

The graph in Figure 15 shows that loss decreases with additional iterations. The highest Mean Average Precision (mAP) was in the 2400th iteration, namely 95%, this shows that the model can learn very well.

2) Human Object Detection and Physical Distancing Testing

The human object detection test aims to find out whether the system can recognize human objects. The detected human object will be marked with a green bounding box, then the system will detect the distance between two human objects, if the distance is close then a red bounding box will be displayed.

Figure 16 Testing. Physical Distancing

Figure 16 shows physical distancing detection. The human object that is detected is then checked against the two closest objects. If the object is detected close together, a red bounding box will be displayed, whereas if the distance is normal, it will only be detected as a human object with a green bounding box.

3) Mask Detection and Face Recognition Testing

The aim of testing the use of masks is to see the accuracy of mask detection on students. If a mask is detected it will be marked with a mask bounding box (can be seen in Figure 17)


Figure 17 Mask Testing 3

Testing continues with facial recognition testing. Face recognition testing aims to see the accuracy of the detected faces, whether the system can recognize student faces according to the training dataset. Students who are detected will have their facial data saved and can see the details of student violations.

Figure 18 shows the face of a student with NIM 1857301058. The picture shows that the system has successfully detected students with the same NIM.


Figure 18 Face Recognition Test 3

Figure 19 shows the face of a student with NIM 1857301032. The picture shows that the system has successfully detected students with the same NIM.

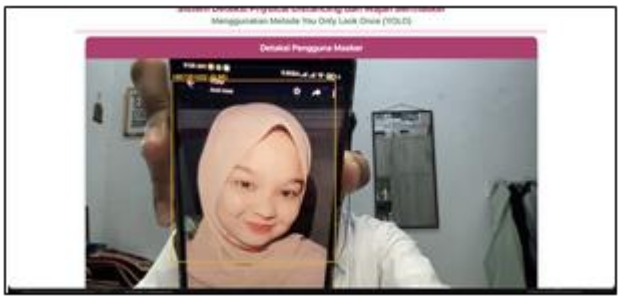



Figure 19 Face Recognition Test 4

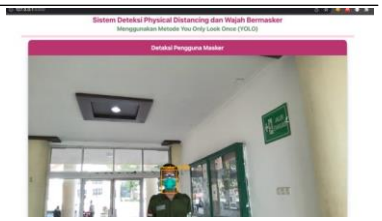
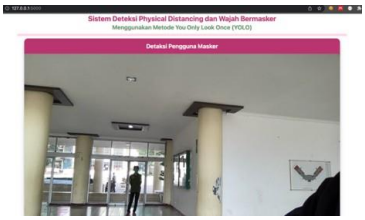
Figure 20 shows the test in low light conditions. The student in the picture is a student with NIM 1857301068 but the student detected was a student with NIM 1857301038. This shows that camera quality and light capacity influence detection accuracy.


Figure 20 Low Light Test

4) Distance Testing

Distance testing is carried out to see the accuracy of detection regarding the distance of the object to the camera. In the test, simulations were carried out at distances of 1 meter, 2 meters, 3 meters and 4 meters. The following is a detection distance testing table.

Table 1 Table of detection distance tests

| No | Jarak | Foto |
|---|---|---|
| 1 | 1 Meter |  |
| 2 | 2 Meter |  |
| 3 | 3 Meter |  |
| 4 | 4 Meter |  |

Based on the tests in table 1, it shows that the maximum distance the system can detect mask users is 4 meters.

## CLOSING

After designing and testing the Physical Distancing violation detection system and masked faces, the following conclusions were obtained:

1. The You Only Look Once method can be used for physical distancing detection, mask detection and face recognition.
2. The model creation process is carried out by labeling each dataset, then the dataset is used for the training process on Google Colab. The model produced in this research produces a mean average precision of 81.22%.
3. Physical Distancing detection is carried out by detecting two human objects and then calculating the distance between the two objects. If the two human objects are less than 30 cm apart, it will be detected as a violation. Violations are marked with a red bounding box and the violation data will be saved to the database as proof of the violation, whereas if it is normal then a green bounding box will be displayed.
4. Mask detection is carried out by studying images at a maximum distance of 4 meters from the camera, using the model that has been obtained, the system will detect faces wearing masks, if not wearing masks then the system will recognize the face of the student concerned and the violation data will be saved to the database as proof of violation.

**Suggestions and Acknowledgments (if any)**

The suggestions that can be given for further research are:

1. Using more datasets can increase accuracy.
2. Use a better camera so you can detect objects more accurately.
3. Integrating the Physical Distancing system and masked faces with CCTV, so that it can detect violators in various places.

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