# Masked Face Identification Using The Convolutional Neural Network Method

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**ABSTRACT**

In times of a pandemic like this, masks are part of the main needs in daily activities when outside the home. Because masks can help us avoid the Covid-19 virus, it often happens among people when doing activities outside the home that they forget to wear masks, therefore the level of public awareness of the importance of wearing masks is decreasing. This study aims to create a system that can classify people who wear masks and do not wear masks as an evaluation material for the level of public awareness of the importance of wearing masks. The total data used in this study were 600 data samples which were divided into two, namely 300 data samples wearing masks and 300 data samples not wearing masks. The CNN architecture in this study is the same as the CNN architecture in general, the difference is the depth level of the convolution layer and pooling which consists of 5 convolution layers, 5 max pooling, and finally, 2 layers dense In the training process, it gets the highest accuracy rate of 98%, while in the validation process it gets the highest level of accuracy at 95%. Therefore, the results of these two processes show that the application of deep earning by utilizing the convolutional neural network can classify objects that wear masks and do not wear masks properly. The results of testing the research dataset are quite maximal by using 40 new dataset testing data to test the convolutional neural network that has been created by the researchers to get an overall accuracy result of 97.5%.

**KEYWORDS**
CNN
Clasification
Masked Face Mask



## 1. Introduction

The Covid-19 virus has been claimed by the world health agency, namely WHO (World Health Organization) as a pandemic around the world including in Indonesia, the impact is so greatly felt by the Indonesian people as the rate of increasing positive cases of Covid-19 and also deaths that occur. Several aspects are also affected, both in terms of economic, social, and health [1]. The government took swift steps to impose the New Normal stage, as a form of government in handling cases of the spread of the Covid-19 virus in Indonesia by enacting this policy so that the wheels of the economy can run as it should. During a pandemic like this, of course, you are afraid of contracting the Covid-19 virus when carrying out activities outside the home such as going to work, shopping, school, and college. One of the tools that can protect against the Covid-19 virus is masks, the use of masks during a pandemic is not new anymore but wearing a mask is the main need when doing activities outside the home in accordance with the government's policy of wearing masks to stop the spread of the Covid-19 virus. However, people often ignore this because there is still a lack of education for the public to always wear masks, which makes the level of public awareness decrease a little The Covid-19 virus has been claimed by the world health agency, namely WHO (World Health Organization) as a pandemic around the world including in Indonesia, the impact is so greatly felt by the Indonesian people as the rate of increasing positive cases of Covid-19 and also deaths that occur. Several aspects are also affected, both in terms of economic, social, and health [2].

Here are some similar studies on the classification of masked faces with the convolutional neural network method, including research conducted by [1] designing an automated system to be able to detect masked faces and not by utilizing the help of deep learning and combining face detector methods accompanied by a tracking program with a graphic user interface. The results obtained in the tests that have been carried out get an accuracy value of 99% on the testing data. While in other studies conducted by [3] building a neural network with the help of the Convolutional Neural Network algorithm utilizing

1000 datasets used for training the Deep Learning system to be created and also conducting tests with the aim of seeing the accuracy of the classification value of images of masked faces and not. The accuracy obtained from the highest test data reached 96%.

Along with the use of deep learning in classifying an object with the help of convolutional neural network research conducted by [4] designed a mask detection system with an android-based convolutional neural network method. The results obtained in his research got an accuracy value of 90% indicating that the system created can classify objects wearing masks and not wearing masks. Another study also utilizing artificial intelligence for mask detection systems in vehicle drivers was carried out by [5] applying the MobileNetV2 architecture to get an accuracy value of 100% for objects where the driver wears a mask, while for objects that do not wear a mask, they get an accuracy value of 97.76%.

The convolutional neural network is an architecture commonly used to classify an object according to a book [6] entitled MATLAB Deep Learning, Neural Network, and Artificial Intelligence which explains that this Convolutional Neural Network is a deep neural network specialist to recognize an image. With this technique, Convolutional Neural Network can find out how important it is to increase the layers used at the image processing stage. The CNN architecture in this study is the same as the CNN architecture in general, the difference is the depth level of the convolution layer and layer pooling which consists of 5 convolution layers, 5 layers max pooling, and finally 2 layers dense.

## 2. Method

For this study object using images of objects wearing masks and not wearing masks, were collected in a dataset used to measure the success or failure of the system that has been created. The object is the students of SMA 1 Pringgarata, the amount of data needed is 40 data including 20 data on wearing masks, 20 data on not wearing masks, and also using data from data providers are free, namely, kaggle.com which can be accessed at the following link https://bit.ly/DatasetPenelitianKu Where the data used was as many as 300 wearing masks and 300 not wearing masks, bringing the total data to 640 wearing masks and not wearing masks. Researchers hope that this research will be used as evaluation material to discipline students and students to always use masks. As for the software used to facilitate this research, it includes windows 11 home, python 3.7.12, google collaboratory, hardware library 2.7.0, pandas library, 1.1.5, NumPy library 1.19.5, and finally TensorFlow library 2.7.0. The flow chart of the research process, it will be explained in Fig.1 which describes the stages carried out in this study.

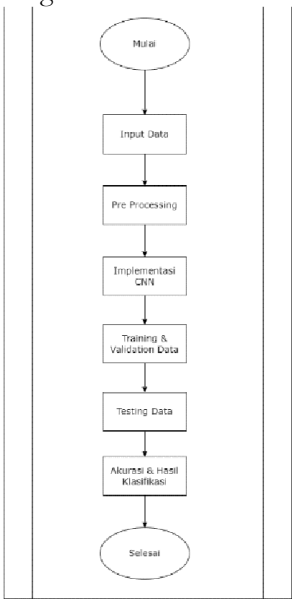


**Fig 1.** Masked Face classification flowchart

The CNN model built into this study needs to ascertain the number of convolution layers, pooling layers, kernels, filters, and activations. In this study, it applied a filter of (32) filters with kernel size (3.3) with the initial input of image size (150,150) pixels and activation using relu on the first layer convolution. At the first Max Pooling apply a one-step shift by size (2, 2). Furthermore, on the second layer consolidation apply as many as (64) filters with kernel size (3, 3) with activation using relu and on Max

Pooling the second layer also applies one step shift with size (2, 2). On the third and fourth layer convulations each apply as many (128) filters with kernel size (3, 3) and activation using relu, in Max Pooling the third and fourth layers also apply one step shift with size (2, 2). In the fifth layer consolidation apply (256) filters with kernel size (3, 3) and activation using relu and Max Pooling (2, 2) which applies one filter shift step. The next step goes into the first dense layer that has (512) neurons. Thus, it will produce an output with a size (512). Furthermore, Fig.2 this output will be entered on the second dense layer which has 1 neuron so that it will produce an output with a size (1). The output of this last layer is what is used as the final result of the model for the classification of mask use, why using output 1 aims to see if there is an error in classifying one class object whether it is a class wearing a mask or not wearing a mask.

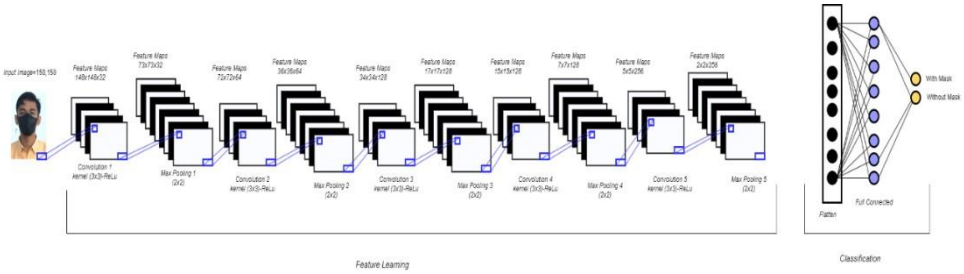


**Fig 2.** CNN Architecture Model

## 3. Results and Discussion

### 3.1. Dataset

The data used in this study is direct data from the place of the object of study, namely data on students of SMAN 1 Pringgarata who wear masks and do not wear masks, totaling 40 data samples that are used later for the prediction process using the convolutional neural network method. As for the training and validation data in this classification system, it will later use data from Kaggle.com totaling 600 data which is divided into data on wearing masks and not wearing masks. In the preprocessing stage, the dataset is divided into two parts of the total data of which 480 data for training and 120 data for validation, the last 40 new data as test data that are not included in the training process are used for the process of predicting the performance results of this system In Fig.3 this is an example of a sample of object data wearing masks and not wearing masks sourced from students of SMAN 1 Pringgarata which is used as test dataions.


**Fig 3**. Sample Test Data

At this preprocessing stage, image augmentation is needed which aims to provide an understanding of the system to be able to learn the pattern of the inputted image. In the studies conducted [7] In his research, he explained that the use of image augmentation is very necessary because this way the machine can study the pattern of the image that is processed by exposing the neural network with various variations so that the features to be carried out can recognized by the system. With this image augmentation, it can help the CNN model be able to recognize image variations that are not in the dataset, besides that this image augmentation can reduce the risk of overfitting which means that the performance of the system we make the training set process will be better than the testing set.

### 3.2. Training and Validation

This training process will process as many as 480 images and 120 images for validation data in *jpg and *png formats. From the total data, it will be classified into two classes, namely wearing masks and not wearing masks. The classification method is that if the output of the image is 0, the image belongs to the

class category of wearing a mask while the output of Fig.1 is included in the class category of not wearing a mask. Fig. 4 below is a graph of the results of the training process.

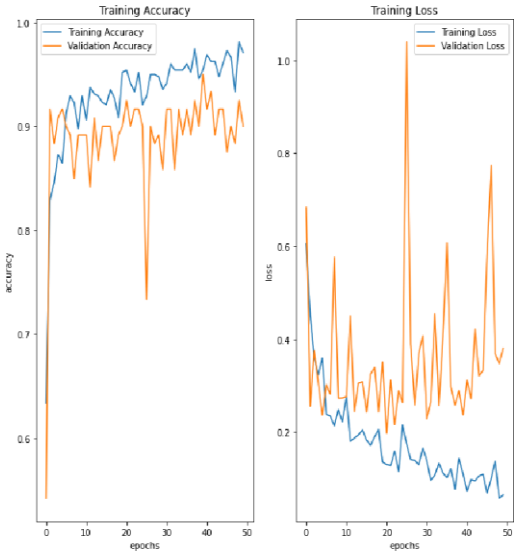


**Fig 4.** Graphic of CNN Training and Validation Model Results

In this training process, it sets 50 iteration processes to read the pattern of the dataset being processed using inputs measuring 150 x 150 pixels. Based on the results of training (training) this model the accuracy obtained the highest result of 98% while for validation accuracy the highest value reaches 95%.

### 3.3. Data Testing

At this stage of the testing process, the dataset that we use is a dataset sourced from the research site, namely SMAN 1 PRINGGARATA as the object. The test data used in this study as described above totals 40 new datasets divided into 20 datasets wearing masks and 20 datasets not wearing masks. The following is a breakdown of the testing process based on Table 1 below.

**Table 1.** Data Testing Result

| Metrics | Prediction | |
|---|---|---|
| | With Mask | Without Mask |
| **Class** | **0** | **1** |
| **0** | 20 | 0 |
| **1** | 0 | 19 |
| **Sum True Classification** | 20 | 19 |
| **Sum False Classification** | 0 | 1 |

Based on table 1 above is the predicted result of the new dataset from the convolutional neural network model that has been created. It can be seen from the table above that the prediction process of the new dataset runs quite well and provides maximum results as well. The prediction of the new dataset with objects wearing masks from figure one to the tenth image of the classification results are all correct while with objects not wearing masks the classification results are nineteen images correctly not wearing masks and 1 other image object is wrong in classifying not wearing masks. Next, enter the stage of calculating the accuracy of the entire matrix following the explanation.

$$Overall\ Accuracy = \frac{Sum\ All\ Poin}{Sum\ Number\ of\ Testing\ Enties}$$

$$Overall\ Accuracy = \frac{39}{40} = 0{,}975 = 97{,}5\ \%$$

With the overall accuracy results above by predicting a new dataset of 40 data with inputs measuring 150 x 150 pixels, the accuracy was 97.5%. This accuracy is found from the total number of correct predictions divided by the amount of data predicted as a whole, with this accuracy hail the convolutional neural network model that has been made by researchers is quite good and maximal in classifying objects that wear masks and do not wear masks in the scope of students of SMAN 1 PRINGGARATA.

## 4. Conclusion

Based on the results of the analysis carried out above, several conclusions can be drawn, namely, by utilizing the convolutional neural network model, researchers can create a system that can classify an object of facial imagery wearing a mask and not a mask. The accuracy level obtained from the highest training results reached 98% and validation (validation) reached the highest value of 95%, while the data testing process (testing) got an accuracy value of 97.5%. With the accuracy results obtained, it shows that in the application of deep learning with a convolutional neural network model, classifying an object is very good and maximum.

## Declarations

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**Additional information.** No additional information is available for this paper

## References

[1] M. Baay, M. N. Baay, A. N. Irfansyah, and M. Attamimi, "Sistem Otomatis Pendeteksi Wajah Bermasker Menggunakan Deep Learning," *J. Tek. ITS*, vol. 10, no. 1, pp. A64–A70, Aug. 2021, doi: 10.12962/j23373539.v10i1.59790.

[2] S. Universitas, Y. Dharma, D. Christin, A. Putri, H. Yuliani, and R. Dwiastuti, "PENDAMPINGAN KEPADA SISWA SEKOLAH MENENGAH DI YOGYAKARTA DALAM PENERAPAN 5M SEBAGAI PERSIAPAN PEMBELAJARAN LURING," *Abdimas Altruis J. Pengabdi. Kpd. Masy.*, vol. 5, no. 1, pp. 47–51, Apr. 2022, doi: 10.24071/AA.V5I1.3830.

[3] A. Rahim, K. Kusrini, and E. T. Luthfi, "Convolutional Neural Network untuk Kalasifikasi Penggunaan Masker," *Inspir. J. Teknol. Inf. dan Komun.*, vol. 10, no. 2, p. 109, Dec. 2020, doi: 10.35585/INSPIR.V10I2.2569.

[4] S. K. Dirjen, P. Riset, D. Pengembangan, R. Dikti, N. Purnama, and P. K. Negara, "Deteksi Masker Pencegahan Covid19 Menggunakan Convolutional Neural Network Berbasis Android," *J. RESTI (Rekayasa Sist. dan Teknol. Informasi)*, vol. 5, no. 3, pp. 576–583, Jun. 2021, doi: 10.29207/RESTI.V5I3.3103.

[5] A. Wikarta, M. Khoirul, E. #2, A. Sigit, and P. #3, "Sistem Pendeteksi Masker pada Pengemudi Kendaraan Menggunakan Kecerdasan Artifisial," *JEPIN (Jurnal Edukasi dan Penelit. Inform.*, vol. 7, no. 2, pp. 250–254, Aug. 2021, doi: 10.26418/JP.V7I2.46877.

[6] "Deep Learning in MATLAB - MATLAB & Simulink." https://www.mathworks.com/help/deeplearning/ug/deep-learning-in-matlab.html (accessed Dec. 27, 2022).

[7] A. Wicaksono, A. Wicaksono, M. H. Purnomo, and E. M. Yuniarno, "Deteksi Pejalan Kaki pada Zebra Cross untuk Peringatan Dini Pengendara Mobil Menggunakan Mask R-CNN," *J. Tek. ITS*, vol. 10, no. 2, pp. A497–A503, Dec. 2021, doi: 10.12962/j23373539.v10i2.80219.