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Face Recognition Application For Classification Image of Using Mask Using Convolutional Neural Network Model and Transfer Learning in Indonesia

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Abstract:- Since 2019, there has been a new virus that has changed the world order. This outbreak was named the Covid-19 pandemic and was caused by a virus called the corona virus or *severe acute respiratory syndrome coronavirus* 2 (SARS-CoV-2). The virus has been detected in Indonesia since early March 2020, and until now it has not been well resolved, even though a vaccine has been found (Kemenkes RI, 2020). In fact, recently the Omicron variant caused by SARS-CoV-2 B.1.1.529 was reported to have begun to be detected in Indonesia after positive cases of the corona virus began to subside (Ministry of Health of the Republic of Indonesia, 2021). Wearing a mask is one of the most effective ways to prevent the spread of the corona virus. Based on data from the Covid-19 Handling Task Force (2021) on the behavior of wearing masks in 2021, there are 76-90% of Indonesians who comply. The percentage of people who comply with wearing masks seen from the data is quite high, unfortunately the data was taken only by monitoring about 4 million Indonesians. In fact, the number of Indonesian people far exceeds that number. In addition, monitoring that cannot be carried out at any time makes this effort less effective. The above problems encourage the creation of innovative products that can help provide effective solutions, namely the *Face Recognition application* which can detect whether a person is wearing a mask or not in certain places. This application is one of the *Deep Learning* methods , namely *Convolutional Neural Network* (CNN) and *Transfer Learning* . The results of this study are CNN's modeling to classify mask users and the interface design of the application.

Keywords:- *COVID-19; Convolutional Neural Networks; Masks; Transfer Learning.*

I. INTRODUCTION

Since 2019, there has been a new virus that has changed the world order. This outbreak was named the Covid-19 pandemic and was caused by a virus called the corona virus or *severe acute respiratory syndrome coronavirus* 2 (SARS-CoV-2). The virus has been detected in Indonesia since early March 2020, and until now it has not been well resolved, even though a vaccine has been found (Kemenkes RI, 2020). In fact, recently the Omicron variant caused by SARS-CoV-2 B.1.1.529 was reported to have begun to be detected in Indonesia after positive cases of the corona virus began to subside [1].

Covid-19 is a virus that can spread very quickly and has become an epidemic in most countries in the world, so the World Health Organization (WHO) has designated it as a global pandemic. The Indonesian government itself is trying to deal with the Covid-19 pandemic by maximizing health protocols named 3T and 3M. The 3T health protocol, namely *testing, tracking,* and *treatment , is* targeted for government activities , while the 3M health protocol, namely wearing masks, washing hands, and maintaining distance is a health protocol targeted for community activities[2]. WHO also provides several recommendations to prevent transmission of the corona virus, one of which is to use a mask [3][4].

Wearing a mask is one of the most effective ways to prevent the spread of the corona virus. Based on data from the Covid-19 Handling Task Force (2021)[4] on the behavior of wearing masks in 2021, there are 76-90% of Indonesians who comply. The percentage of people who comply with wearing masks seen from the data is quite high, unfortunately the data was taken only by monitoring about 4 million Indonesians. In fact, the number of Indonesian people far exceeds that

number[5][6]. In addition, monitoring that cannot be carried out at any time makes this effort less effective.

The above problems encourage the creation of innovative products that can help provide effective solutions, namely the *Face Recognition application* which can detect whether a person is wearing a mask or not in certain places. This application is one of the *Deep Learning methods* , namely *Convolutional Neural Network* (CNN) and *Transfer Learning* . CNN is a classification method that belongs to the *Deep Learning group* using a convolution *layer* to convolute input with *filters* [7].This CNN algorithm is capable of extracting abstract features from an image, this technique is used to perform a large number of object classification processes [8].

II. MATERIALS AND METHODS

The material used in this research is a dataset from www.kaggle.com using 300 mask and non-mask images. The data is open which can be used as training data and testing data to test the system modeling created.The method used to process the data is using the Convolutional Neural Network method. *Convolution neural network (CNN)* is one type of neural network that can be used for image classification. *Convolution neural network* works with several stages where the input and output of each stage consists of several feature maps. Each stage consists of three main layers, namely convolution, activation function layer, and pooling layer [9]

CNN is a classification method that belongs to the Deep Learning group using a convolution layer to convolute input with filters [10].This CNN algorithm is capable of extracting abstract features from an image, this technique is used to perform a large number of object classification processes [11].

In order to improve and make the CNN method more efficient, the method is combined with the *Transfer Learning technique* . *Transfer Learning* technique is a technique that utilizes a model that has been previously *trained* which is used to classify new datasets, so there is no need to do data *training* from the beginning [12] With a combination of the CNN algorithm and *Transfer Learning technique* , the face detection application can have good accuracy.

III. RESULT

The system that has been designed is then implemented in the form of a Mask-Tec application with supporting features. The following are the main features of the Mask-Tec application:

A. Home View

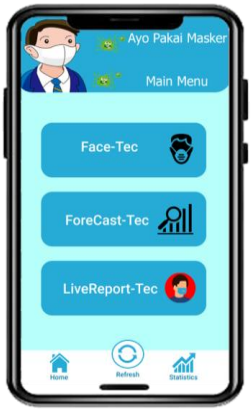

Fig 1. Home View

The application home page contains what features are available in the Mask-Tec application.

B. Face-Tec

Fig 2. Face-Tec Feature

The Face-Tec feature is a feature that can classify images associated with the camera in *Real-Time.* The captured image on the camera will be stored in *cloud -based storage* and a classification process is carried out from the data. Successfully classified data will be displayed on the LiveReport-Tec feature.

C. ForeCast-Tec

Fig 3. ForeCast-Tec Feature

ForeCast-Tec is a feature that can forecast the potential for the spread of Covid-19 in certain places based on a comparison between people who wear masks and people who don't.

D. LiveReport-Tec

Fig 4. LiveReport-Tec Feature

LiveReport-Tec is a report feature of the number of people who wear masks and those who do not wear masks captured on camera. This Live Report takes place daily and moves in *Real-Time.* The Mask-Tec application can assist the government in controlling the use of masks in the community. By installing it in an area that is prone to crowds and is often passed by a lot of people.

Based on this, there are several recommendations that can be used in the implementation of this Mask-Tec application.

- *Deploy Mask -Tec in the place with the lowest compliance percentage*

Based on data from the Covid19.go.id website[6], there are public places that have a low percentage of compliance with the use of masks, which include restaurants/shops (68.65%), public sports venues (77.50%), tourist attractions (85.30%) and roads. general (85.53%) . By installing a camera that is connected to the application at that place, it can potentially reduce public disobedience in the use of masks because real-time monitoring can be carried out .

- *Deploy Mask-Tec in the province with the lowest percentage of compliance*

From the data obtained, there are several provinces with the lowest level of compliance in using masks. With the help of this application, the government can monitor provinces with low levels of compliance with masks so they can control the spread of Covid-19 in the area.

The Mask-Tec application is a solution to overcome the problem of community non-compliance in using masks. With technology that can move in *real-time,* it can make it easier for the government to control people's behavior. This application has the potential to help reduce the spread of Covid-19 in the community by controlling the use of masks. However, this application requires support from the government in its implementation so that it can be implemented in real terms.

IV. DISCUSSION

The Mask-Tec application is an application designed to detect the use of masks using a camera, the image from the camera will be captured and classified to classify people who use masks and those who do not. This application uses CNN and *Transfer Learning methods.*

To get valid results from the reliability of the application in capturing images, a training system is needed that can recognize the image of mask users and non-mask users. In the system training process, the CNN algorithm is used which can be described in the following *Flowchart* :

The training data that will be used is a dataset originating from the www.kaggle.com site which contains training data on images of people wearing masks and people not wearing masks. The *training data process is* carried out using *Google Colab* . The data was extracted to calculate how many datasets from mask users and datasets from non-mask users with the following *source code* :

```
import os, re, glob, cv2, numpy as np

dirs = os.listdir('drive/MyDrive/dataset/')
label = 0
im_arr = []
lb_arr = []
X = []
y = []
for i in dirs: #loop all directory
    count = 0
    for pic in glob.glob('drive/MyDrive/dataset/'+i+'/*'):
        im = cv2.imread(pic)
        im = cv2.resize(im,(70,70))
        im = np.array(im)
        count = count + 1
        X.append(im)
        y.append(label)
        if(count <= 10):
            im_arr.append({str(i):im})
    print("Jumlah "+str(i)+" : "+str(count))
    label = label + 1
    lb_arr.append(i)
X = np.array(X)
y = np.array(y);
```

```
Jumlah masker : 300
Jumlah non-masker : 300
```

Fig 5. Source Code

The *Source Code* outputs that the data set between the mask image and the non-mask image is 300 images each. Then the feature extraction process is carried out by giving the values of the x and y dimensions for each image to be processed so that the results are as follows:

```
import matplotlib.pyplot as plt

fig, axs = plt.subplots(3,7,figsize=(20,10))
cnt =0
row= 0
col =0

for i in im_arr:
  for key, value in i.items():
    if (cnt==7):
      row = row+1
      col=0
      cnt=0
    axs[row,col].imshow(value)
    axs[row,col].set_title(key)
    cnt=cnt+1
    col=col+1

plt.show()
```

Fig 6. The Result of Extraction Process

After the image is successfully extracted, the CNN architecture is built to perform *Data Processing* by building an architecture based on the CNN layer

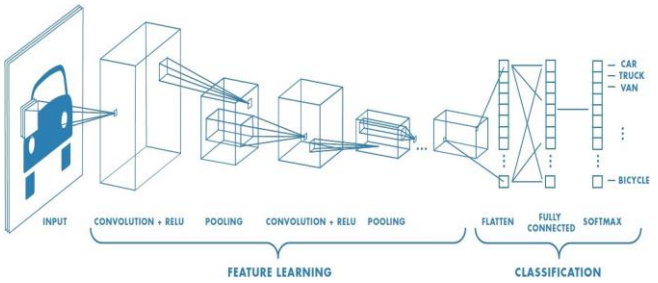

Fig 7. CNN Layer

Based on the layer image from CNN, it is translated in the form of lines of code to be implemented so that the results of the architecture are as follows:

```
from keras.models import Sequential
from keras.layers import Conv2D, MaxPooling2D, Dropout, Flatten, Dense
model = Sequential() #model = sequential
model.add(Conv2D(32, kernel_size=(3, 3),activation='relu',input_shape=(70,70,3))) #layer convolutional 2D
model.add(MaxPooling2D(pool_size=(2,2))) #max pooling with stride (2,2)
model.add(Conv2D(32, (3, 3), activation='relu')) #layer convolutional 2D
model.add(MaxPooling2D(pool_size=(2,2))) #max pooling with stride (2,2)
model.add(Dropout(0.25)) #delete neuron randomly while training and remain 75%
model.add(Flatten()) #make layer flatten
model.add(Dense(128, activation='relu')) #fully connected layer
model.add(Dropout(0.5)) #delete neuron randomly and remain 50%
model.add(Dense(2, activation='softmax')) #softmax works
```

Fig 8. The Code of CNN Architecture

Then, 100 datasets were trained to train the system in classifying the image of mask users and non-mask users. From the training results obtained, the resulting accuracy rate was 89.90%. After the system is trained with 100 data, the system is tested with data. Based on the test results, the *Confusion Matrix obtained* from the test is as follows:

```
from sklearn.metrics import classification_report
print (classification_report(y_test_n, y_prediction_n, target_names=["masker","non-masker"]))
```

	precision	recall	f1-score	support
masker	0.96	0.85	0.90	104
non-masker	0.85	0.96	0.90	94
accuracy			0.90	198
macro avg	0.90	0.90	0.90	198
weighted avg	0.91	0.90	0.90	198

```
cm=confusion_matrix(y_test_n,y_prediction_n)
sn.heatmap(cm, annot=True, xticklabels=["Masker","Non-Masker"], yticklabels=["Masker","Non-Masker"])
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fa81b2f1050>
```

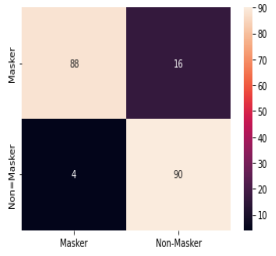

Fig 9. Confusion Matrix

After conducting *Data Training* and *Data Testing* , a comparison between the levels of accuracy is obtained which is depicted in the following graph:

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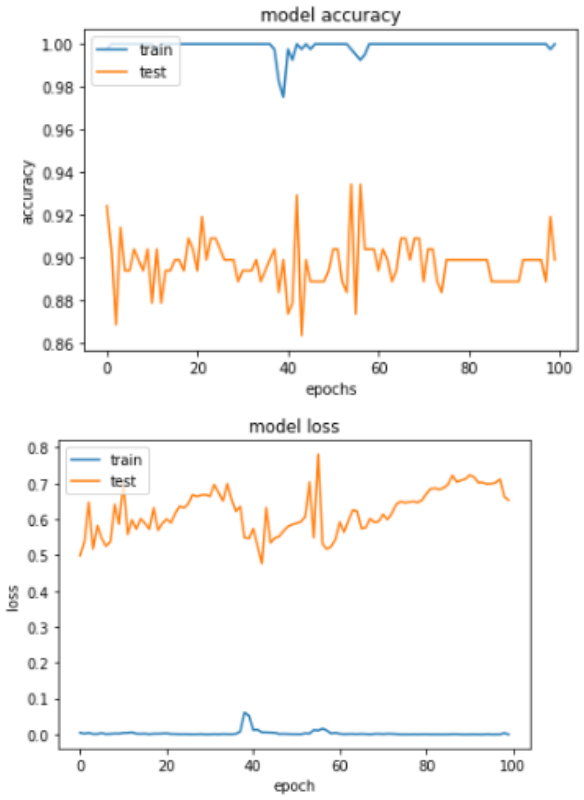

Fig 10. Comparison of Accuracy Levels

The results of this modeling will be used into applications using *Transfer Learning* where the existing model is reused to analyze other datasets.

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