

Face Mask Detection using Machine Learning

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Abstract. The whole world today, is facing the COVID-19 pandemic. This situation make people must adapt to the new normal, for example: work from home, online communication, keep clean to reduce transmission of COVID-19. Moreover, research has found that wearing a mask is one way to reduce the risk of viral transmission. It makes many public places have a measure about their customer must keep a distance between people and wearing the face mask correctly. But public service providers are not feasible to thoroughly check whether all a customer wear the mask or not. So, in this project, we propose face mask detection via webcam cameras using image recognition which is one of the high-accuracy and efficient face mask detector. This proposed system consists of three methods to detect face mask: 1) Image preprocessing 2) Face detection and crop 3) Classification of face mask. This system can detection a face mask, not wearing a face mask and incorrect face mask. This system will help public service providers ensure that all people in this place wear face mask correctly, promote people to use a face masks and it ensure that these public places have a safe environment.

Keywords: COVID-19, Face mask detection, Image recognition, Machine learning, Safety environment.

1 Introduction

Nowadays, COVID-19 has affected the world badly. The number of deaths of people infected with COVID-19 increases every day. This situation make people must adapt to the new normal and have a measure to prevent the infection of Corona virus. There are many measures which are needed to control the spread of COVID-19 such as keep clean, wash your hand often, social distancing and the most important is wearing the face mask. Due to a lot of research and studies proved that wearing a face mask reduces the problem of viral transmission, many public places such as shopping mall and park have a customer service measure only if their customer wear mask correctly. However, public service provider cannot always check whether a person wear a face mask or not Therefore, this project we will use technologies that can capture the face of person and show the result as a text. One of them is Machine Learning and Artificial Intelligence consist of various technologies will provide effective solutions to complex problems in these areas. This face mask detection platform can identify the person with face mask, using webcam cameras and analytics quickly. So, it will help public service providers ensure that all people in this place wear a face mask

correctly, maintaining the safety among people and ensure that these public places have a safe environment.

2 Objective

2.1 To prevent the spread of Coronavirus by using effective technology to detect the face mask.

2.2 To help precautions and safety measures of society about COVID-19 outbreaks.

2.3 To ensure these public places have a safe environment from COVID-19.

3 Scope

To prevent the spread of Coronavirus, this project has made to develop a real-time face mask detection through webcam. This system using Machine Learning and Artificial Intelligence with image processing. This project can detect face mask into three classes. First, without a mask class is people wearing a face mask correctly. Second, an incorrect mask class is people wearing a mask, but the mask does not cover a mouth or a nose. Another one is a correct mask is people wearing a face mask properly. The result will be show at the screen as a text and percentage of confidence degree. If people are not wearing a face mask, the system will show some messages like “No Mask” with red signal. If the people are wearing a face mask not properly, the system will show some message “Incorrect Mask” with blue signal. Otherwise, it will show “Mask” message with green signal.

4 Datasets

In this project, we have a dataset 5,961 images and separate the datasets into three classes: without mask, incorrectly mask and correct mask.



Fig. 1. This figure is sample dataset of class without mask that the person does not wears a mask (1,918 images).



Fig. 2. This figure is sample dataset of class correct mask that the person wears a mask properly (1,994 images).



Fig. 3. This figure is sample dataset of class incorrectly mask that the person wears a mask but it not properly (1,918 images).

5 System Architecture

Initially this system will detect person's face through webcam. Then, separate the images from the frames and face mask detection model will be load. The system will be performed for detection by images preprocessing, including determine this people in images wear face mask or not. The results will be converted into image frames.

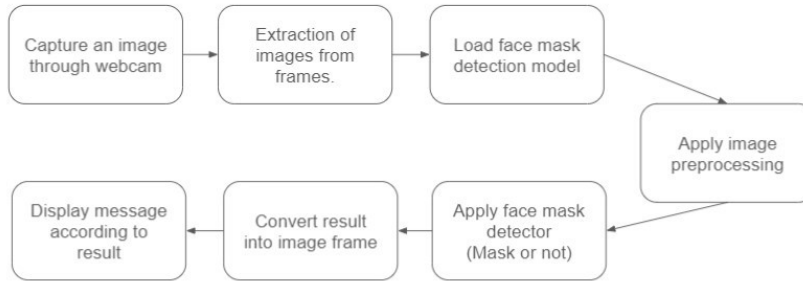


Fig. 4. System Architecture

Moreover, this project has also used Machine Learning tools and the model to learn and recognize a face mask images for each class. The Machine Learning tools that we use is as follows:

5.1 TensorFlow

TensorFlow is an end-to-end open-source platform Machine Learning. It can build and train Machine Learning models easily by using high-level APIs, Furthermore, it can train and deploy models in the cloud, in the browser, or on device no matter what language you use and share to public faster. For this project, we train and deploys model in the Sublime Text 3 that can sophisticated text editor which is widely used among developers. It includes many features and packages that make it easy for working with python language.

5.2 Keras

Keras is an API and deep learning framework which is easy to use. It used for developing and evaluating different deep learning models that have an efficient and effective numerical computation library. And it allows you to define as well as train neural network models in just a few lines of code. For this project, we use MobileNetV2 models that is a convolutional neural network architecture. Overall, the architecture of MobileNetV2 contains the fully convolution layer that have effective feature extractor for object detection and segmentation.

5.3 Scikit-Learn

Scikit-learn is probably the most useful library for machine learning in Python that provides unsupervised and supervised learning algorithms. The library contains a lot of efficient tools for machine learning and statistical modeling including classification, regression, and clustering. In this project, we use Scikit-learn to convert multiple class labels of face mask detection into binary labels (LabelBinarizer). Splitting data into training and testing (train_test_split) and build a text report to showing the classification (classification_report).

5.4 OpenCV (Open-Source Computer Vision Library)

OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products. It easy for businesses to utilize and modify the code.

Table 1. Parameters and information of training model

No.	Parameters	Information
1	Split Dataset	Training 80% and Testing 20%
2	Target Size	224 x 224 pixel
3	Function Activation	Softmax
4	Learning rate	0.0001
5	Batch Size	32
6	Epochs	10

6 Result

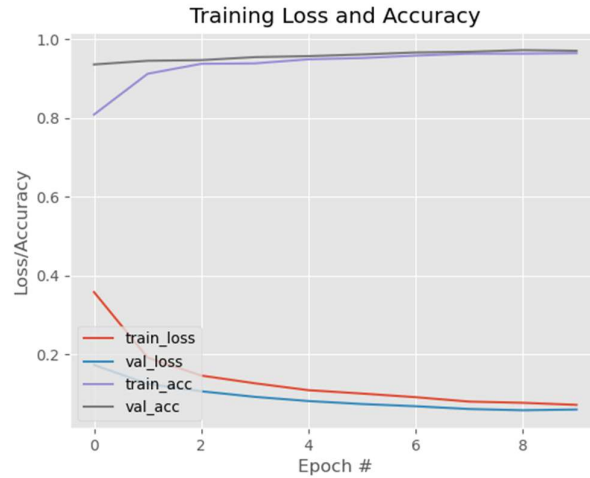


Fig. 5. Training Accuracy and Training Loss

The accuracy in this project by using MobileNet V2 model is about 0.958 when the number of complete passes through the training dataset or Epochs equals 10.



Fig. 6. The result will be show at the screen as a rectangle frame that detect a face, text, and percentage of confidence degree.

7 Conclusion

In this situation of Covid-19 pandemic, we all need to cooperate in keeping clean, social distance and the most important is wearing a mask. To reduce the spread of Coronavirus until able return to normal routine. The system Face mask detection will help to screening people in public whether they wear face mask or not. It makes

public service providers have more convenience and easy to screen people who do not wear a face mask or wear a face mask incorrectly. Moreover, it makes more people who come to use the service at the public places are wear a face mask. So, it can maintain the safety among people and ensure that these public places have a safe environment.

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