

Ensure the Proper Wearing of Face Masks Using Machine Learning to Fight Covid-19 Virus

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Abstract

In this pandemic time, wearing face masks is mandatory to all because of the possibility that a person can get COVID-19 virus through their mouth, nose or eyes, which could possibly happen when a person has a direct or close contact to a person with that virus. But, despite the strict implementation, some people disregard the proper wearing of face masks and unaware the risks of possible virus transmission for such negligence. In this paper, it will demonstrate how a Convolutional Neural Network (CNN) can detect if a person is wearing a face mask or not and the additional parameter to support to detect if the face mask is properly worn by a person by considering the facial landmarks thru face recognition using Histogram of Oriented Gradients (HOG) feature descriptor with a linear SVM machine learning algorithm. Two (2) processes are involved in proper wearing of face masks detection. It needs to pass in Face Mask Detection to proceed to the next process which is the Face detection wherein the result of checking should return false to confirm the proper wearing of the face mask of a person.

Keywords: *Convolutional Neural Network (CNN), Histogram of Oriented Gradients (HOG) and SVM machine learning algorithm*



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INTRODUCTION

The world stops when covid-19 strikes. Many countries impose total lockdown to stop the threat of this deadly virus. People were restricted in going outside and issued an order to stay at home. But it seems that it's too late for some preventive action because even powerful countries like the United States, Japan and France were unable to control the virus thus they faced the deadly covid-19 which the numbers of infected is continuously rising each day until today. Protocol was implemented to attempt to control the spread of this virus. The vaccine is unavailable yet, the only thing the people can do is to follow the health protocol issued by the government. The Inter-Agency Task Force or IATF is the agency formed by the executive of the Philippine government to respond to emerging infectious diseases in the Philippines . The said agency imposed protocols such as wearing a face mask and face shield, social distancing and always sanitizing hands to ensure the safety of people against the COVID-19 virus. They always remind the public to follow and strictly observe the issued health protocols. But as we observed, people do not properly use the face mask which the right way to use is that it should cover both your nose, mouth and chin. Despite that there's a strict implementation in wearing face masks in public places but it's a bad response from the others when the authority is not around. They will only use the face mask if the authority advised them to use it and remove it once the authority leaves them. They wear face masks but not in the proper way and maybe they are unaware that the virus could enter the nose, eyes or mouth of a person. The paper objective is to present a method that can

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detect if a person is properly using the face mask in response to fight against the COVID-19 virus. It will be discussed additional evaluation to support the accuracy of detecting proper wearing of face masks.

LITERATURE REVIEW

Ejaz and Islam (2019) work to boost the accuracy of recognition for masked faces. They proposed multiple approaches for this like Multi-Task Cascaded Convolutional Neural Network (MTCNN) to deal with face detection problem, then Google FaceNet embedding model for countenance extraction and the classification task will be processed by the Support Vector Machine (SVM). The approach has been found with attractive outcomes and noteworthy performance on masked face recognition after conducting experiment. Joshi et al. (2020) proposed also a framework which will identify the faces and their corresponding facial landmarks present within the video frame using the MTCNN face detection model. The neoteric classifier will process the facial images and cues thru the utilization of the MobileNetV2 architecture as an object detector for identifying masked regions. The proposed framework was tested on a dataset of collection of videos that captures the movement of individuals in publicly spaces while complying with COVID-19 safety protocols. The methodology shows the effectiveness in detecting facial masks because of precise and accuracy of results. The tactic of considering facial landmarks like nose, mouth and eyes in face recognition is crucial in validating proper wearing of face masks. Histogram of Oriented Gradients (HOG) is essentially a feature detector that's often accustomed extract features from image data. It's widely employed in computer vision tasks for object detection like face recognition. Yuan et al. (2019) demonstrate an efficient expression identification method based on facial landmark feature points. Humans may be able to transfer information and show emotion through their visage, which is a powerful nonverbal means for them to do so. The geometric positions of different critical components of the face are the subject of their research. The facial area is first recognized via an image or video. The major features of the face will then be retrieved, and the location of the face will be corrected at the same time. The relative position of the face is used to put a group of critical points. The aforementioned procedure is an excellent technique to not only prevent the effects of changing the environment and thus the lightings, but also to increase the popularity of facial expressions. However, they used the HOG feature extraction approach of facial features in a different way in their research. The results suggest that the proposed method can extract crucial information and obtain greater recognition accuracy in their experiment.

RESEARCH METHODOLOGY

The researcher used developmental methods to come up with the desired algorithm. This research type was used to develop a system that will detect the proper wearing of face mask to fight the COVID-19 virus using Machine Learning (ML). The developmental approach was used since the study aims to establish processes that needs to generate system/ algorithms. The study creates approach that consists of two (2) principal processes: Detecting if a person is wearing a mask and if the person is properly wearing the mask. The researcher builds a CNN model using TensorFlow to detect if a person is using a face mask and apply Histogram of Oriented Gradients

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(HOG) feature descriptor with a linear SVM machine learning algorithm to detect if a person is properly wearing the face mask.

FINDINGS AND DISCUSSION

The Figure 1 shows the learning curves (training and validation accuracy and loss) of the model are the following for 30 epochs of training. It shows ~99% accuracy on our test set.

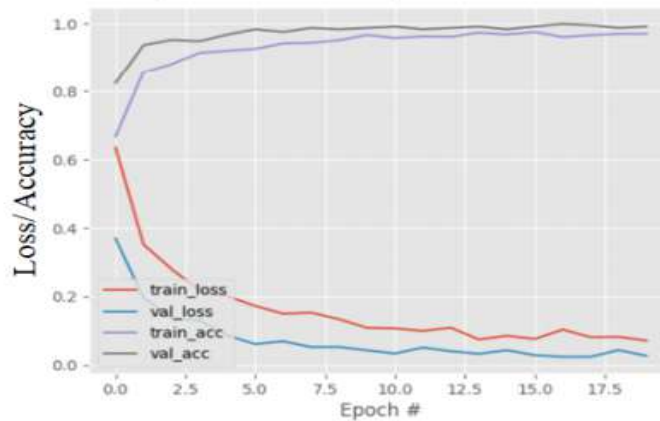


Figure 1. Learning Curves



In this image, the model we have was able to detect that the person is wearing a mask and displays the label for that. We notice in the image that the mask is not properly worn because it should cover the nose. In using the face mask, make sure it fully covers the mouth, nose, and chin. Additional parameter was inserted to address the issue. The image presents a person wearing a face mask (it was confirmed by the model) but he failed to properly wear the mask. Face detection based on facial landmarks like eyes, nose and mouth will be the option to confirm and support the accuracy of detection of properly wearing face masks. Below is the evaluation done on face

detection using the Histogram of Oriented Gradients (HOG) feature descriptor with a linear SVM machine learning algorithm.

In image A, it returns a result of “No face detected” since nose and mouth was covered by the face mask. Unlike in image B, since it's not fully covered the nose thus it returns a result of “Face detected”. This option will confirm the face mask detection that passed in the first process was properly worn if Process B returns a result of True or “No face detected”.

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CONCLUSION AND FURTHER RESEARCH

Health protocols that are implemented by the government like wearing face masks should be followed by its people in this pandemic time. Machine Learning (ML) algorithms can be considered in support for the implementation of the said health protocols. In this paper, the two (2) processes discussed such as Face Masks Detection and Face Recognition used Convolutional Neural Networks (CNN) and Histogram of Oriented Gradients (HOG) feature descriptor with a linear SVM machine learning algorithm which successfully support to meet the goal of the study. Based on the results obtained, the additional parameter is able to support to make it more accurate the detection of proper wearing of face masks. The additional method detects faces based on the facial landmarks like nose, eyes, and mouth. A result of false or no face detected from Process B will be used to confirm that the face mask was properly worn.

Recommendations

Based on the significant findings and conclusions of this research, the following recommendations are offered:

1. The researcher encourages the government (local and national) to support the application of the algorithm in detecting the proper used of face mask in fighting the spread of COVID-19 virus to human.
2. Future researchers may use other algorithms as reinforcement to improve the accuracy of the algorithm.

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