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Face Mask Detection for Automated Entry System Using CNN Algorithm

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A B S T R A C T

COVID 19 pandemic has caused a global health epidemic. The most powerful tool for safety is wearing a face mask in public places and everywhere else. The COVID 19 outbreak forced governments around the world to implement lock- down to deter virus transmission. According to survey reports, wearing a face mask at any public place reduces the risk of transmission of the notorious virus. In this paper, an intelligent IoT-enabled department uses a machine learning model to monitor body temperature and face mask detection. The proposed system can be used at any hotel, shopping mall, motel, entrance of apartments, schools, theaters, colleges, etc. In addition, this system will be unaffected by many generic factors. This proposed model can get users more protective against COVID by using the Internet of Things technology.

Keywords: CNN, Face mask detection system, machine learning, opencv, tensorflow, One-stage detector, Two-stage detector.

1. Introduction

The main purpose of the study was to create a model for getting a face mask for reduction. The corona virus spread to communities. There are a few precautionary measures that need to be taken to suppress viral infections to save lives. So is a face mask one of the perfect strategies to provide an adequate level of protection over time for epidemics like Covid-19. We should make a face mask a regular part of our day lives with other people in public places. Face masks serve as a protective barrier against viral attacks. Facial detection is a very serious problem in photographic processing streaming. We need to train the face detector to see the limits using deep learning or machine learning techniques. First we need to load the face mask detector in a variety of ways, train the detector to distinguish data sets. The latest step is to install the detector to make facial recognition and to distinguish the case for use as a mask with or without a mask. The face detection training database contains images of people with a mask and not having a mask. We will use the database to build a detector using techniques similar to image machine analysis and learning. The main purpose is to train the face detector model to identify the person wearing the face mask and not wear a face mask. We can supply the facial model with both real images and data sets that are created by using specific software. In a densely populated country, monitoring whether people wear a mask or not is not possible and that causes diseases to spread widely. So a face mask detector serves as a strategic remedy to prevent the spread of disease. This study focuses on the study activities related to the targeted system. Also in creation of a novel object acquisition method that combines single-stage and two-stage detectors to accurately detect an object in real time from video streaming and transfer learning. Create a novel object acquisition method that combines single-stage and two-stage detectors to accurately detect an object in real time from video streaming and transfer learning. Improved affine modification is developed to prevent facial areas from uncontrolled real-time images with differences in face size, shape and background. This step helps to improve the person who violates the face mask practices in public places / offices. The creation of an unbiased facemask database with a measure of inequality equals one. The proposed model requires less memory, which makes it easier to use on embedded devices used for surveillance purposes. Also in creation of a novel object acquisition method that combines single-stage and two-stage detectors to accurately detect an object in real time from video streaming and transfer learning.

2. Literature Survey

A Survey on Machine Learning and Internet Things for COVID [1] : Publishing year 2021, The survey results indicate that ML used with big data is critical for understanding the pandemic and providing solutions to curb it. Machine Learning neural networks and image processing when combined with IOT can solve real time problems. Machine Learning when combined with IOT can solve real time problems in very less amount of time. IOT compatible hardware is required; Realtime Datasets are needed for Neural Networks.

Neural Network-Based Face Detection [2] : Publishing year 2018, A retinally connected neural network examines small windows of an image, and decides whether each window contains a face. The system arbitrates between multiple networks to improve performance over a single network. The

algorithm can detect between 78.9% and 90.5% of faces in a set of 130 test images, with an acceptable number of false detections. The main limitation of the current system is that it only detects upright faces looking at the camera.

Using the R-CNN Mask Separating PV Panels from Background Images [3]: 2020 publication year. The COVID-19 epidemic is causing a global crisis in health care. One of the best ways to stay safe from infection is to wear a face mask so in this study we suggest a method that uses TensorFlow and OpenCV to get a face mask on people. The model achieved 94.33% accuracy, did the worst to predict people with a negatively applied mask at 87% and the best to predict well-covered people with 99% accuracy, The only limitation is that it can only process a full face before.

Facial Mask Detection to Avoid Coronavirus Infection [4]: Publishing year 2021. The face mask screening program has been successful in identifying people who wear face masks or who do not wear face masks in public places. The 2-stage detector model helps to distinguish real-world and artificial images into situations that are used as masked or unmasked people by identifying a boundary box set during training. A face mask can also take pictures from a video stream to identify targeted alternatives. Face mask detectors can be distributed to any location such as hospitals, bus stations, train stations, supermarkets, and other public service centers to prevent the spread of the novel coronavirus among the public.

Convolutional neural networks an overview and application [5]: Publishing year 2018. Achieving remarkable achievements in a wide range of fields, including medical research, and the growing interest in radiology. While in-depth learning has become the dominant approach in a variety of complex tasks such as image classification and object discovery, it is not a panacea. Familiarity with the key concepts and benefits of CNN and the limits of in-depth learning is essential for use in radiology research with the aim of improving the performance of radiologists and, ultimately, patient care.

3. Incorporated Packages

3.1 OpenCV

OpenCV is an open source library for computer vision, machine reading, and processing images and now plays a major role in real-time performance which is very important in programs.In this project, OpenCV acts as a source to control the camera capture and live capture of Live Input. We can capture video on camera using OpenCV and it will allow us to perform the operations you want on that media.

3.2 TensorFlow

TensorFlow is a system for managing all aspects of a machine learning system. In this project TensorFlow acts as a backend for the system where live video input will be stored and preprocessed and made ready for further computations

3.3 Keras

It is a part of Tensorflow but also has its individuality.In this project Keras which is a python library will be used for Convolutional Neural Network (CNN) as it has functions needed for the same. Keras is a highly powerful and dynamic framework. Keras neural networks are written in Python which makes things simpler.

4. Proposed System

The proposed system includes software and hardware to get working. Further is the detailed flow of the proposed model. Collection of dataset.

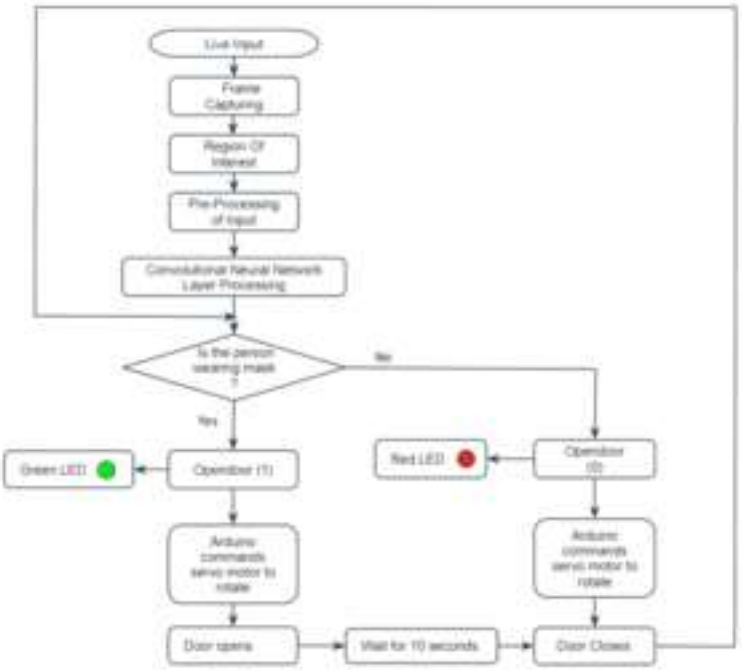

Fig .A. Workflow of Proposed System

The stages included in the workflow of this model are listed as follows:

1. Making a model and training.
2. Taking live input.
3. Capturing the exact frame from the live input.
4. Considering only the region of interest for further processes
5. Preprocessing is done in the region of interest.
6. The preprocessed image is fed to the neural network.
7. The input is classified into mask or no mask classes.
8. After subsequent classification, a function named Opendoor is responsible for the movement of servo motor which further is responsible for the locking and unlocking of door
9. Depending on the classification of input, an argument is passed to Opendoor.
10. Depending on that argument, Arduino commands the servo motor to rotate at a certain angle in order to lock or unlock the door.
11. If the door is unlocked , It waits for 10 seconds and then locks itself until an input frame is classified to be masked.
12. The green and red LED resembles alert i.e green means get in and red means the user is not wearing a mask

5. Result and Outcome Analysis

The result or final outcome of this face mask detector model is in the form of live video output in which a person wearing a mask is shown

Some real time images of the outcome of this model are shown below :

The face mask detection model is successful in detecting a person and shows the result as mask or no mask, regardless of the accessories worn by a person. Accessories include spectacles, hair bands, necklaces and earrings. The model also successfully detects different colors and patterns of masks as shown in the example below:

fig. a. wearing spectacles

fig. b. not wearing spectacles

The face mask detection model is successful to detect a single person and show results as a mask or no mask. Example of this is shown below:

fig.c. Single person in frame

The face mask detection model is successful in detecting more than one person at a time and showing the result as a mask or no mask to each of them simultaneously. Below is the output image of two people standing in the input frame and the result of their face detection is as follows:

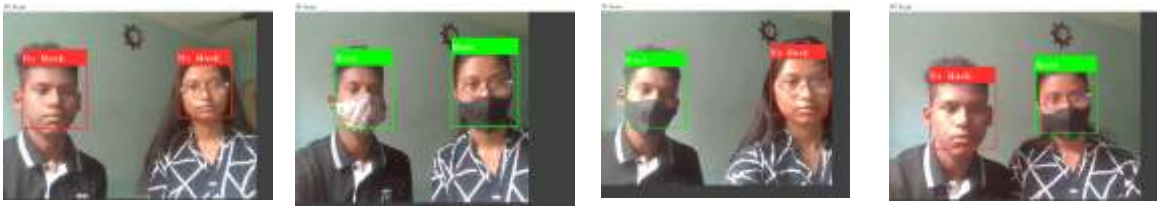

fig.d. Two people in frame

The face mask detection model is successful to detect a person and show the result as mask or no mask regardless of the gender of the person standing in the input frame. The image output example for this is shown below:

Fig.e. Male without mask

fig.f. Male with mask

fig.g. Female with mask

fig.h. Female without mask

4. Conclusion and Future Scope

The face mask detector system is successful in identifying the people wearing face masks or not wearing face masks in public areas. The 2 stage detector model helps to classify the real world and artificial images into cases like people wearing masks or people not wearing masks by identifying the boundary box set during training in a dataset. In this project, a deep learning based approach for detecting masks in public places to curtail the community spread of Coronavirus is presented. The proposed technique efficiently handles occlusions in dense situations by making use of an ensemble of single and two-stage detectors at the preprocessing level. The ensemble approach helps in achieving high accuracy and improves detection speed considerably. Furthermore, this application on pretrained models with extensive experimentation over an unbiased dataset resulted in a highly robust and low-cost

system. The identity detection of faces, violating the mask norms further, increases the utility of the system for public benefits. Finally, this work opens interesting future directions for researchers. Firstly, the proposed process can be integrated with any high-resolution video monitoring devices and not limited to mask detection only. Secondly, the model can be extended to detect facial landmarks with a face mask for biometric purposes.The face mask detector can be deployed in any places like hospitals, bus stations, railway stations, theaters, malls and other public serving facilities to avoid spread of the novel Coronavirus among the community.

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