International Journal of Multidisciplinary Research and Growth Evaluation.

COVID-19 prevention: Real-Time implementation of AI-based face mask detection

Sourav Dutta [1*], Subrojit Roy [2], Puneet Kumar [3]
[1-2] Student, Department of Computer Science and Engineering, Lovely Professional University, Phagwara, Punjab, India
[3] Faculty, School of Computer Science & Engineering, Lovely Professional University, Punjab, India

* Corresponding Author: **Sourav Dutta**

Article Info

ISSN (online): 2582-7138
Volume: 03
Issue: 02
March-April 2022
Received: 17-03-2022;
Accepted: 02-04-2022
Page No: 449-453

Abstract
The year 2020 has shown humanity an incredible variety of occasions among them COVID19 pandemic is the most dangerous change. It surprised the world since the beginning of the year and also affected the happiness and life of the masses. COVID19 has called for serious measures to be taken to prevent the spread of the disease. Cleanliness is an essential instruction for medication use in the emergency room, individuals give their best and public welfare; Face coverings are one of the personal defence equipment. People cover their faces when they leave their house, also authorities strictly ensure that individuals wear a face mask when they are gathering in an open point. To verify that individuals are complying with these necessity welfare rules, a procedure must be created. A face coverage indicator frame can be made to consider this. Face Covering identification means knowing whether an individual has a mask or not. The first step to detect the presence of a mask on the face is facial recognition, which makes the system is divided into two parts: face recognition and mask detection on those faces. Face recognition is one of the uses of item recognition and can be used in many areas such as security, biometrics, law enforcement and many more. Many identity frameworks are created around the world and running. By all means, this science needs to be improved; superior, more precise identifiers, because the world can't handle the cost of expanding corona cases further.

Keywords: COVID-19, Real-Time implementation, face mask detection

Introduction

Face Recognition is a way that fits stored models of every human face in a set of humans to pick out someone primarily based totally on certain features of that person's face. Face recognition is a natural approach to spotting and authenticating humans. Face recognition is a vital part of humans' ordinary touch and lives. The protection and authentication of an individual are important in each enterprise or institution. As a result, there is an extraordinary deal of interest in computerized face recognition using computer systems or gadgets for identification verification across the clock or even remotely in the modern world. Face recognition has emerged as one of the maximum difficult and fascinating issues in pattern recognition and image processing. With the useful resource of this type of technology, one can without problems stumble on someone's face via way of means of the usage of a dataset of identical matching appearance. The maximum effective method for detecting someone's face is to apply Python and a Convolutional Neural Network in deep learning. This approach is beneficial in quite a few fields, consisting of the military, defence, schools, colleges, and universities, airlines, banks, online internet apps, gaming, and so on. Face masks at the moment are broadly used as a part of preferred virus- prevention measures, mainly for the duration of the Covid-19 virus outbreak. Many people or businesses must have the ability to differentiate whether or not human beings are wearing a face mask in a given region or time. This data's necessities must be very real-time and computerized. The tough difficulty which may be stated in face detection is inherent variety in faces inclusive of shape, texture, colour, were given a beard moustache and/or glasses and even mask. From the experiments, it's far clear that the proposed CNN and Python set of rules may be very efficient and correct in figuring out the facial popularity and detection of people.

Related Work: Several analysts and researchers have worked on face technology detection throughout the last few decades. Viola-Jones proposed a breakthrough in real-time face detection with one of his notable face detectors. However, it ran into a few issues, such as face angles and brightness, which made it difficult to intercept. In 2006, Ramanan introduced a random forest tree model technique for recognising masked faces, which predicts face positions and structures. Yang created a face detection model with a facial feature aggregation approach in 2015. The facial detection models learn directly from the data provided by the user in the categorization based on convolutional neural networks, and then various machine learning methods are applied to it. In order to overcome facial occlusion concerns, Opitz-Waltner devised a grid loss in 2016. The COVID-19 epidemic highlighted the need for masked face detection, which tries to reduce viral propagation by recognising whether or not a person is wearing a mask. Jiang-Fan-Yan has announced Retina Mask, a one-step general purpose detector that seeks to extract robust functionality while taking contextual information into account. Loey-Manogaran created a hybrid model for identifying medical face masks that combines traditional machine learning methods with deep neural networks, and it is implemented using ResNet-50 and the Single Stage Detector YOLOv2, which improves detection performance. Militante-Dionisio suggested a model in which the input photos are segmented and end outcomes are predicted using VGG16 models. Face recognition and face mask detection methods like the ones above are aimed at recognising face masks or clean faces, however they neglect differing fine-grained mask wearing situations. On a real dataset, the proposed model aims to tackle all of the concerns raised in earlier studies with high average precision, demonstrating that it has the capacity to construct the distinct feature map.

Methodology

Phase 1: Training the Dataset

Dataset Visualisation: Only a few datasets are available for face mask identification, and the majority of them are either intentionally generated or full of noise with incorrect labels. Hence, we developed a useful dataset for training the model, which gave positive results in the end. The dataset, which included photos from a variety of data sources such as MAFA, RMFD, Celeb A, and other photographs retrieved from the internet, was cleaned by personal examination. Finally, a dataset of 4000 photos with the labels "with mask" and "without mask" was constructed, and the distribution is shown in Figure 1.

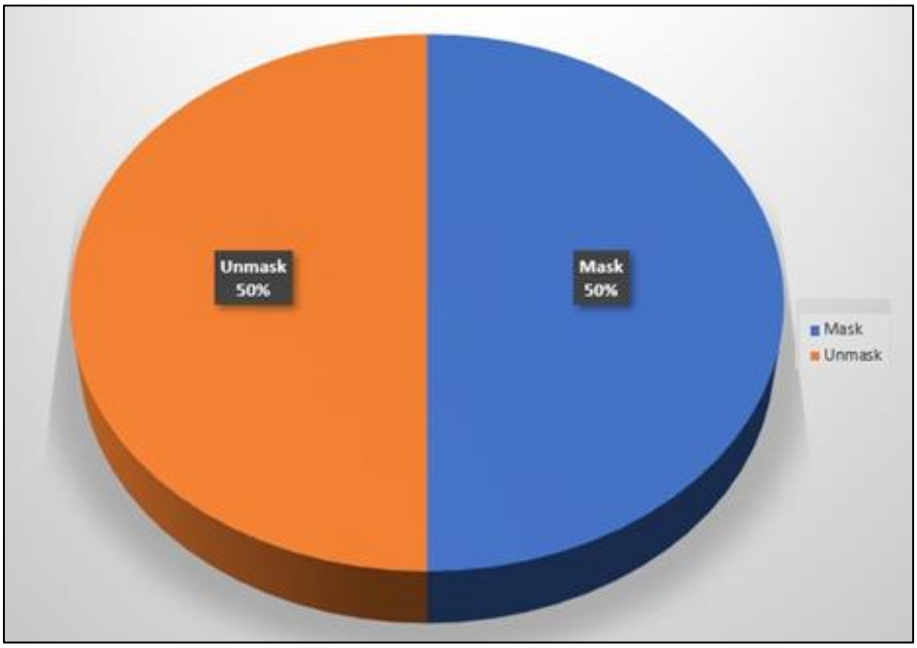

Fig 1: Dataset Visulation

Fig 2: With Mask and Without Mask Images

Pre-processing of images: Pre-processing the picture is a critical step before the actual training for greater model accuracy. Before using face detection and matching algorithms, the input picture must be pre-processed. Noise reduction, eye and mask identification, and hole filling procedures are all part of the pre-processing process. Noise reduction and hole filling assist to eliminate erroneous face/face detection. The facial picture is cropped and re-localized after pre-processing. To increase the quality of the pre-processed image, histogram normalisation is used. We employed Convolutional Neural Networks in this article, hence the dataset pictures were downsized to 224*224-pixel resolution, as shown in Figure 2. Following resizing, the photos were pixelized (that is, transformed into an array) using Open CV library methods. With Tensor Flow and Keras library functions, the pictures are labelled as 'with mask' or 'without mask' after they have been pixelized. For training, a master array comprising all pixelized pictures with labels was created.

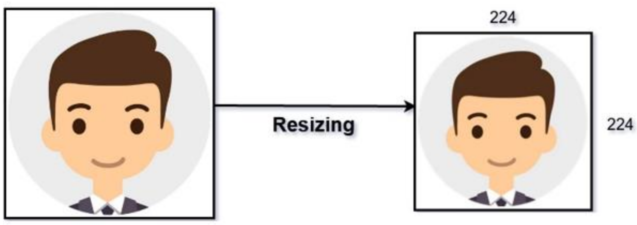

Fig 3

Training of the Model: The Convolutional Neural Network, i.e., MobileNetV2 is used in the last phase of training the model, as illustrated in Figure 3. As seen in Figure 3, both models were given the identical parameters for training. The dataset has been separated into two parts: 80 percent for training and 20% for validation. Both models employ accuracy metrics to validate the data, as it evaluates the model after each epoch. In this study, we utilised photographs with a batch size of 32 and input sizes of 224*224 as width and height, respectively for the CNN model. After testing, the parameters for the ADAM optimizer were adjusted based on the accuracy, which was found to be optimum at 20 epochs and a learning rate of 1e-4. As a result, Image Data Generator is used to expand the dataset by rotating, rescaling, zooming, and flipping the photos. Because picture resolutions are lowered when features are extracted, the dropout rate for both models is set at 50 to avoid over fitting.

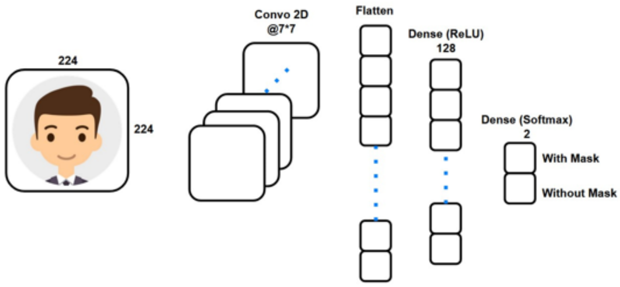

Fig 4

Phase 2: Detection

1. **Loading of Trained Model:** After some training, a model extension file containing the learned model classifier will be generated. This training will aid in the identification of masks from faces that have been identified.
2. **Face Recognition in a Live Video Stream:** When an object (human) passes in front of the real-time camera, a frame is taken and analysed, and the processing leads to face identification and extraction.
3. **Extraction of Features from Each Face:** The features are retrieved from the cropped facial picture identified by the camera in this stage. These qualities aid in increasing the mask detection accuracy rate.
4. **Output:** The final stage is to compile all of the data, including face extraction to detection, and checking whether the person is wearing a mask.

Phase 3: Results: After 20 epochs of training and a batch size of 32, the validation accuracy of this model is 99.8 percent for MobileNetV2.

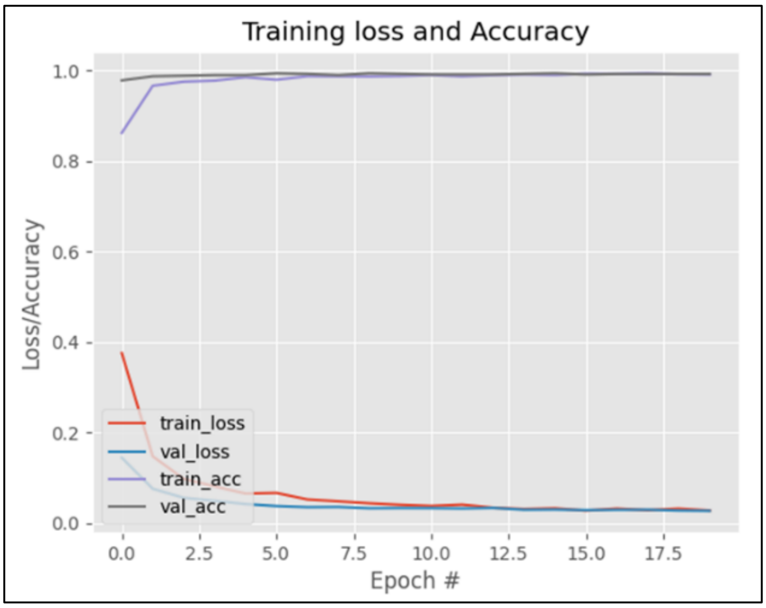

Fig 5

Table 1

Epochs	Accuracy
5	98.06
10	99.22
15	99.35
20	99.81

Comparison Table for MobileNetV2

Fig 6: Detection of Mask

Conclusion

Wearing a face mask all the time is a demanding and tedious duty, but it has been mandatory since the Covid-19 crisis since wearing a face mask can help restrict the virus's spread. In order to perform their services, several public service providers need clients to wear masks. At the outset of this paper, we briefly discussed the work's motivation. The model's learning and performance task was then demonstrated. The method has attained a reasonable level of accuracy using basic machine learning tools and simplified methodologies. In the future, the model might be expanded to determine whether a person would correctly wear the mask (as recommended by WHO) as well as the type of mask. This trained model may be used in public spaces with the use of IP cameras to detect whether or not a person is wearing a mask, and it is a valuable tool in the fight against the COVID-19 virus. We can utilise another source of information for future investigation. This model may be integrated with an alarm system, a social distancing system, and a SMS alert system. This model may also be evaluated with various optimizers and adaptive learning approaches can be used.

References

1. WHO. Coronavirus disease 2019 (covid-19): Situation report, 205, 2020
2. Coronavirus Disease 2019 (COVID-19)-Symptoms, Centers for Disease Control and Prevention, 2020. [Online]. Available: https://www.cdc.gov/coronavirus/2019-ncov/symptomstesting/symptoms.html.2020
3. F Hohman, M Kahng, R Pienta, DH Chau. Visual Analytics in Deep Learning: An Interrogative Survey for the Next Frontiers, in IEEE Transactions on Visualization and Computer Graphics. 2019; 25(8):2674-2693, doi: 10.1109/TVCG.2018.2843369.
4. Bosheng Qin, Dongxiao Li. Identifying Facemask-Wearing Condition Using Image Super-Resolution with Classification Network to Prevent COVID-19, Sensors. 2020; 20(18):5236.
5. C Kanan, G Cottrell. Color-to-Grayscale: Does the

Method Matter in Image Recognition?, PLoS ONE. 2012; 7(1):e29740. Available: 10.1371/journal.pone.0029740.
6. Shou Yang, Ping Luo, Chen Change Loy, Xiaoou Tang. From Facial Parts Responses to Face Detection: A Deep Learning Approach, www.arXiv.org, September-2015, arXiv: 1509.06451
7. Wei Liu, Dragomir Anguelov, Dumitru Erhan, Christian Szegedy, Scott Reed, Cheng-Yang Fu, *et al*. SSD: Single Shot MultiBox Detector, European Conference on Computer Vision, Springer, 2016, 21-37.
8. Hoanh Nguyen. Fast Object Detection Framework based on MobileNetV2 Architecture and Enhanced Feature Pyramid", Journal of Theoretical and Applied Information Technology, 2020, 98(05).
9. Nwankpa C, Ijomah W, Gachagan A, Marshall S. Activation Functions: Comparison Of Trends In Practice And Research For Deep Learning, 2020. [Online] arXiv.org. Available at: https://arxiv.org/abs/1811.03378v1.