Automatic Face Mask Detection Using Python

[1]Madan Mohan.M, [2]Sojasomanan, [3]M.Kaleeswari

[1]Assistant Professor, [1,2,3]Department of Computer Science Engineering,
Nehru Institute of Engineering and Technology Coimbatore.

[1]madhanaceit@gmail.com, [2]sojasomannan@gmail.com, [3]suryakaleessurya@gmail.com

Abstract:

The corona virus COVID-19 pandemic is causing a global health crisis so the effective protection methods is wearing a face mask in public areas according to the World Health Organization (WHO). The COVID-19 pandemic forced governments across the world to impose lockdowns to prevent virus transmissions. Reports indicate that wearing facemasks while at work clearly reduces the risk of transmission. An efficient and economic approach of using AI to create a safe environment in a manufacturing setup. A hybrid model using deep and classical machine learning for face mask detection will be presented. A face mask detection dataset consists of with mask and without mask images, we are going to use OpenCV to do real-time face detection from a live stream via our webcam. We will use the dataset to build a COVID-19 face mask detector with computer vision using Python, OpenCV, and Tensor Flow and Keras. Our goal is to identify whether the person on image/video stream is wearing a face mask or not with the help of computer vision and deep learning.

Key words: Machine learning, R-CNN algorithm, MobilenetV2, Keras OpenCV. Face Mask Detection.

INTRODUCTION:

The reason for this is that the virus that causes COVID-19 can be spread even before symptoms appear, by such things as coughing, sneezing, or even speaking at close range. Cloth face coverings have been recommended due to their low cost and ready availability. By using cloth face coverings, it preserves surgical masks and N-95 masks for healthcare workers who may be involved in direct care of patients with COVID-19.

Corresponding Author: M.Madan Mohan, Asst. Professor,
Department of CSE, Nehru Institute of Engineering and Technology Coimbatore.
Mail: madhanaceit@gmail.com

The importance of using face coverings in public is illustrated in the graphic seen here. If I wear my face covering to protect you from me, and you wear your face covering to protect me from you, then we can all dramatically decrease our risk of transmission of the virus that causes COVID-19. This, in conjunction with social distancing and frequent handwashing or use of hand sanitizer, will be important in limiting the spread of COVID-19 as we return to our usual activities.

The wearing of the face masks appears as a solution for limiting the spread of COVID-19. In this context, our projects Aims to create a mask detecting system which will enable us with the information using image processing that if a person is wearing mask on real time or not.

A face mask detection dataset consists of with mask and without mask images. we are going to use OpenCV to do real-time face detection from a live stream via our webcam. We will use the dataset to build a COVID-19 face mask detector with computer vision using Python, OpenCV, and Tensor Flow and Keras. Our goal is to identify whether the person on image/video stream is wearing a face mask or not with the help of computer vision and deep learning.

Here we introduce a mask face detection model that is based on computer vision and deep learning. The proposed model can be integrated with surveillance cameras to impede the COVID-19 transmission by allowing the detection of people who are wearing masks not wearing face masks. The model is integration between deep learning and classical machine learning techniques with OpenCV, tensor flow and Keras. We have used deep transfer learning for feature extractions and combined it with three classical machine learning algorithms. We introduced a comparison between them to find the most suitable algorithm that achieved the highest accuracy and consumed the least time in the process of training and detection.

LITERATURE SURVEY

[1] An Automated System to Limit COVID-19 Using Facial Mask Detection in Smart City Network (Base Paper):

COVID-19 pandemic caused by novel coronavirus is continuously spreading until now all over the world. The impact of COVID-19 has been fallen on almost all sectors of development. The healthcare system is going through a crisis. Many precautionary measures have been taken to reduce the spread of this disease where wearing a mask is one of them. In this paper, we propose a system that restrict the growth of COVID-19 by finding out people who are not wearing any facial mask in a smart city network where all the public places are monitored with Closed-Circuit Television (CCTV) cameras. While a person without a mask is detected, the

corresponding authority is informed through the city network. A deep learning architecture is trained on a dataset that consists of images of people with and without masks collected from various sources. The trained architecture achieved 98.7% accuracy on distinguishing people with and without a facial mask for previously unseen test data. It is hoped that our study would be a useful tool to reduce the spread of this communicable disease for many countries in the world.

[2] Case cade framework for masked face detection:

Accurately and efficiently detecting masked faces is increasingly meaningful, since it can be applied on tracking and identifying criminals or terrorists. As a unique face detection task, masked face detection is much more difficult because of extreme occlusions which leads to the loss of face details. Besides, there is almost no existing large-scale accurately labeled masked face dataset, which increase the difficulty of masked face detection. The CNN-based deep learning algorithms has made great breakthroughs in many computer vision areas including face detection. In this paper, we propose a new CNN-based cascade framework, which consists of three carefully designed convolutional neural networks to detect masked faces. Besides, because of the shortage of masked face training samples, we propose a new dataset called "MASKED FACE dataset" to fine-tune our CNN models. We evaluate our proposed masked face detection algorithm on the MASKED FACE testing set, and it achieves satisfactory performance.

[3] Face mask detection using Mobile Net and Global Pooling Block:

Coronavirus disease is the latest epidemic that forced an international health emergency. It spreads mainly from person to person through airborne transmission. Community transmission has raised the number of cases over the world. Many countries have imposed compulsory face mask policies in public areas as a preventive action. Manual observation of the face mask in crowded places is a tedious task. Thus, researchers have motivated for the automation of face mask detection system. In this paper, we have presented a Mobile Net with a global pooling block for face mask detection. The proposed model employs a global pooling layer to perform a flatten of the feature vector. A fully connected dense layer associated with the soft max layer has been utilized for classification. Our proposed model outperforms existing models on two publicly available face mask datasets in terms of vital performance metrics.

[4] Study of the Performance of Machine Learning Algorithms for Face Mask Detection:

Nowadays, the situation of the Covid-19 virus still intensifying throughout the world. The number of populations of each country is severely infected and deaths. One solution to prevent is to wearing a masked face. Many businesses and organization need to adapt and protect an infected person by detecting whoever does not wear masked face; however, the number of

users or customers are more than staffs result in difficult checking. This paper studies the performance of the three algorithms: KNN, SVM and Mobile Net to find the best algorithm which is suitable for checking who wearing masked face in a real-time situation. The results show that Mobile Net is the best accuracy both from input images and input video from a camera (real-time).

[5] Face recognition based on modular histogram of oriented directional features:

This paper presents an illumination invariant face recognition system that uses local directional pattern descriptor and modular histogram. The proposed Modular Histogram of Oriented Directional Features (MHODF) is an oriented local descriptor that is able to encode various patterns of face images under different lighting conditions. It employs the edge response values in different directions to encode each sub-image texture and produces multi-region histograms for each image. The edge responses are very important and play the main role for improving the face recognition accuracy. Therefore, we present the effectiveness of using different directional masks for detecting the edge responses on face recognition accuracy, such as Prewitt kernels, Kirsch masks, Sobel kernels, and Gaussian derivative masks. The performance evaluation of the proposed MHODF algorithm is conducted on several publicly available databases and observed promising recognition rates.

[6] Masked Face Recognition Using Convolutional Neural Network:

Recognition from faces is a popular and significant technology in recent years. Face alterations and the presence of different masks make it too much challenging. In the real-world, when a person is uncooperative with the systems such as in video surveillance then masking is further common scenarios. For these masks, current face recognition performance degrades. An abundant number of researches work has been performed for recognizing faces under different conditions like changing pose or illumination, degraded images, etc. Still, difficulties created by masks are usually disregarded. The primary concern to this work is about facial masks, and especially to enhance the recognition accuracy of different masked faces. A feasible approach has been proposed that consists of first detecting the facial regions. The occluded face detection problem has been approached using Multi-Task Cascaded Convolutional Neural Network (MTCNN). Then facial features extraction is performed using the Google Face Net embedding model. And finally, the classification task has been performed by Support Vector Machine (SVM). Experiments signify that this mentioned approach gives a remarkable performance on masked face recognition. Besides, its performance has been also evaluated within excessive facial masks and found attractive outcomes. Finally, a correlative study also made here for a better understanding.

[7] Control The COVID-19 Pandemic:

Face Mask Detection Using Transfer Learning Currently, in the face of the health crisis caused by the Coronavirus COVID-19 which has spread throughout the worldwide. The fight against this pandemic has become an unavoidable reality for many countries. It is now a matter involving many areas of research in the use of new information technologies, particularly those related to artificial intelligence. In this paper, we present a novel contribution to help in the fight against this pandemic. It concerns the detection of people wearing masks because they cannot work or move around as usual without protection against COVID-19. However, there are only a few research studies about face mask detection. In this work, we investigated using different deep Convolutional Neural Networks (CNN) to extract deep features from images of faces. The extracted features are further processed using various machine learning classifiers such as Support Vector Machine (SVM) and K-Nearest Neighbors (K-NN). Were used and examined all different metrics such as accuracy and precision, to compare all model performances. The best classification rate was getting is 97.1%, which was achieved by combining SVM and the MobileNetV2 model. Despite the small dataset used (1376 images), we have obtained very satisfactory results for the detection of masks on the faces.

[8] Facial Mask Detection using Semantic Segmentation:

Face Detection has evolved as a very popular problem in Image processing and Computer Vision. Many new algorithms are being devised using convolutional architectures to make the algorithm as accurate as possible. These convolutional architectures have made it possible to extract even the pixel details. We aim to design a binary face classifier which can detect any face present in the frame irrespective of its alignment. We present a method to generate accurate face segmentation masks from any arbitrary size input image. Beginning from the RGB image of any size, the method uses Predefined Training Weights of VGG - 16 Architecture for feature extraction. Training is performed through Fully Convolutional Networks to semantically segment out the faces present in that image. Gradient Descent is used for training while Binomial Cross Entropy is used as a loss function. Further the output image from the FCN is processed to remove the unwanted noise and avoid the false predictions if any and make bounding box around the faces. Furthermore, proposed model has also shown great results in recognizing non-frontal faces. Along with this it is also able to detect multiple facial masks in a single frame. Experiments were performed on Multi Parsing Human Dataset obtaining mean pixel level accuracy of 93.884 % for the segmented face masks

[9] Deep Learning Based Assistive System to Classify COVID-19 Face Mask for Human Safety with YOLOv3:

Computer vision learning pay a high attention due to global pandemic COVID-19 to enhance public health service. During the fatality, tiny object detection is a more challenging task of computer vision, as it recruits the pair of classification and detection beneath of video illustration. Compared to other object detection deep neural networks demonstrated a helpful object detection with a superior achievement that is Face mask detection. However, accession with YOLOv3 covered by an exclusive topic which through certainly happening natural disease people get advantage. Added with face mask detection performed well by the YOLOv3 where it measures real time performance regarding a powerful GPU. whereas computation power with low memory YOLO darknet command sufficient for real time manner. Regarding the paper section below we have attained that people who wear face masks or not, its trained by the face mask image and nonface mask image. Under the experimental conditions, real time video data that finalized over detection, localization and recognition. Experimental results that show average loss is 0.0730 after training 4000 epochs. After training 4000 epochs map score is 0.96. This unique approach of face mask visualization system attained noticeable output which has 96% classification and detection accuracy.

[10] Deep Learning Framework to Detect Face Masks from Video Footage:

The use of facial masks in public spaces has become a social obligation since the wake of the COVID-19 global pandemic and the identification of facial masks can be imperative to ensure public safety. Detection of facial masks in video footages is a challenging task primarily due to the fact that the masks themselves behave as occlusions to face detection algorithms due to the absence of facial landmarks in the masked regions. In this work, we propose an approach for detecting facial masks in videos using deep learning. The proposed framework capitalizes on the MTCNN face detection model to identify the faces and their corresponding facial landmarks present in the video frame. These facial images and cues are then processed by a neoteric classifier that utilizes. The MobileNetV2 architecture as an object detector for identifying masked regions.

Related Work

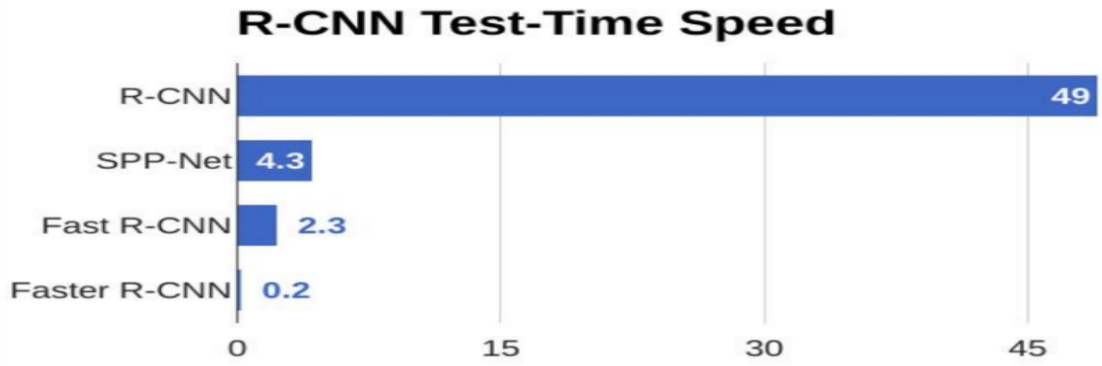
We have collected and analyzed several years IEEE papers to get a refined visualization on face mask detection system using different methods. Previously the system propose a new CNN-based cascade framework, which consists of three carefully designed convolutional neural networks to detect masked faces. Besides, because of the shortage of masked face training samples, we propose a new dataset called "MASKED FACE dataset" to fine-tune our CNN

models. The current study used OpenCV, Pytorch and CNN to detect whether people were wearing face masks or not. The models were tested with images and real-time video streams. Even though the accuracy of the model is around 60%, the optimization of the model is a continuous process and we are building a highly accurate solution by tuning the hyperparameters. MobileNetV2 was used to build the mobile version of the same. This specific model could be used as a use case for edge analytics.

Proposed work:

The proposed project will be able to analyze the images through camera and detects the presence of mask and create masked face images from unmasked face images by appending the mask on the face recognized on the image and store it. the project works by integration of python OpenCV tensor flow for implementing the detection of face mask.

We are using R CNN which is really efficient compared to the other machine learning model. The data modeling and analysis tools, such as data mining, machine learning, have the potential to generate a knowledge-rich environment which can help to significantly improve the quality of clinical decisions. MobileNetV2 builds upon the ideas from MobileNetV1 [1], using depth wise separable convolution as efficient building blocks. However, V2 introduces two new features to the architecture: 1) linear bottlenecks between the layers, and 2) shortcut connections between the bottlenecks1. The basic structure is shown below.



CONCLUSION

The current study used OpenCV, Pytorch and CNN to detect whether people were wearing face masks or not. The models were tested with images and real-time video streams. Even though the accuracy of the model is around 60%, the optimization of the model is a continuous process and we are building a highly accurate solution by tuning the hyperparameters. MobileNetV2 was used to build the mobile version of the same. This specific model could be used as a use case for edge analytics.

As the technology are blooming with emerging trends the availability so we have novel face mask detector which can possibly contribute to public healthcare. The architecture consists of Mobile Net as the backbone it can be used for high and low computation scenarios. In order to extract more robust features, we utilize transfer learning to adopt weights from a similar task face detection, which is trained on a very large dataset. We used OpenCV, tensor flow, keras , Pytorch and CNN to detect whether people were wearing face masks or not. The models were tested with images and real-time video streams. The accuracy of the model is achieved and, the optimization of the model is a continuous process and we are building a highly accurate solution by tuning the hyper parameters. This specific model could be used as a use case for edge analytics. Furthermore, the proposed method achieves state-of-the-art results on a public face mask dataset. By the development of face mask detection. we can detect if the person is wearing a face mask and allow their entry would be of great help to the society.

REFERENCES

1. Z. Allam and D. S. Jones, “On the Coronavirus (COVID-19) Outbreak and the Smart City Network: Universal Data Sharing Standards Coupled with Artificial Intelligence (AI) to Benefit Urban Health Monitoring and Management,” Healthcare, vol. 8, no. 1, p. 46, 2020.
2. M. Jiang, X. Fan, and H. Yan, “Retina Mask: A Face Mask detector,” 2020. [Online]. Available: http://arxiv.org/abs/2005.03950.
3. M. Gupta, M. Abdel Salam, and S. Mittal, “Enabling and Enforcing Social Distancing Measures using Smart City and ITS Infrastructures. A COVID-19 Use Case,” 2020. [Online]. Available: https://arxiv.org/abs/2004.09246.
4. J.Won Sonn and J. K. Lee, “The smart city as time-space cartographer in COVID-19 control: the South Korean strategy and democratic control of surveillance technology,” Eurasian Geogra , Econ., pp. 1–11, May. 2020.
5. J. W. Sonn, M. Kang and Y. Choi, "Smart city technologies for pandemic control without lockdown", Int. J. Urban Sci., vol. 24, no. 2, pp. 149-151, 2020.
6. R. Jaiswal, A. Agarwal and R. NEGI, "Smart Solution for Reducing the COVID-19 Risk using Smart City Technology", IET Smart Cities, vol. 2, pp. 82-88, 2020.

7. X. Wang, X. Le and Q. Lu, "Analysis of China's Smart City Upgrade and Smart Logistics Development under the COVID-19 Epidemic", J. Phys. Conf. Ser., vol. 1570, pp. 012066, 2020..
8. Karthick, R., et al. "Overcome the challenges in bio-medical instruments using IOT–A review." Materials Today: Proceedings (2020). https://doi.org/10.1016/j.matpr.2020.08.420
9. Karthick, R., et al. "A Geographical Review: Novel Coronavirus (COVID-19) Pandemic." A Geographical Review: Novel Coronavirus (COVID-19) Pandemic (October 16, 2020). Asian Journal of Applied Science and Technology (AJAST)(Quarterly International Journal) Volume 4 (2020): 44-50.
10. Sathiyanathan, N. "Medical Image Compression Using View Compensated Wavelet Transform." Journal of Global Research in Computer Science 9.9 (2018): 01-04.
11. Karthick, R., and M. Sundararajan. "SPIDER-based out-of-order execution scheme for Ht-MPSOC." International Journal of Advanced Intelligence paradigms 19.1 (2021): 28-41. https://doi.org/10.1504/IJAIP.2021.114581
12. Sabarish, P., et al. "An Energy Efficient Microwave Based Wireless Solar Power Transmission System." IOP Conference Series: Materials Science and Engineering. Vol. 937. No. 1. IOP Publishing, 2020. doi:10.1088/1757-899X/937/1/012013
13. Vijayalakshmi, S., et al. "Implementation of a new Bi-Directional Switch multilevel Inverter for the reduction of harmonics." IOP Conference Series: Materials Science and Engineering. Vol. 937. No. 1. IOP Publishing, 2020. doi:10.1088/1757-899X/937/1/012026
14. Karthick, R., and M. Sundararajan. "Hardware Evaluation of Second Round SHA-3 Candidates Using FPGA (April 2, 2014)." International Journal of Advanced Research in Computer Science & Technology (IJARCST 2014) 2.2.
15. Karthick, R., et al. "High resolution image scaling using fuzzy based FPGA implementation." Asian Journal of Applied Science and Technology (AJAST) 3.1 (2019): 215-221.
16. P. Sabarish, R. Karthick, A. Sindhu, N. Sathiyanathan, Investigation on performance of solar photovoltaic fed hybrid semi impedance source converters, Materials Today: Proceedings, 2020, https://doi.org/10.1016/j.matpr.2020.08.390
17. Karthick, R., A. Manoj Prabaharan, and P. Selvaprasanth. "Internet of things based high security border surveillance strategy." Asian Journal of Applied Science and Technology (AJAST) Volume 3 (2019): 94-100.
18. Karthick, R., and M. Sundararajan. "A novel 3-D-IC test architecture-a review." International Journal of Engineering and Technology (UAE) 7.1.1 (2018): 582-586.

19. Karthick, R., and M. Sundararajan. “Design and implementation of low power testing using advanced razor based processor.” International Journal of Applied Engineering Research 12.17 (2017): 6384-6390.
20. Karthick, R., and M. Sundararajan. “A Reconfigurable Method for TimeCorrelatedMimo Channels with a Decision Feedback Receiver.” International Journal of Applied Engineering Research 12.15 (2017): 5234-5241.
21. Karthick, R., and M. Sundararajan. “PSO based out-of-order (ooo) execution scheme for HT-MPSOC.” Journal of Advanced Research in Dynamical and Control Systems 9 (2017): 1969.
22. Karthick, R. “Deep Learning For Age Group Classification System.” International Journal Of Advances In Signal And Image Sciences 4.2 (2018): 16-22.
23. Karthick, R., and P. Meenalochini. “Implementation of data cache block (DCB) in shared processor using field-programmable gate array (FPGA).” Journal of the National Science Foundation of Sri Lanka 48.4 (2020). http://doi.org/10.4038/jnsfsr.v48i4.10340
24. Suresh, Helina Rajini, et al. “Suppression of four wave mixing effect in DWDM system.” Materials Today: Proceedings (2021). https://doi.org/10.1016/j.matpr.2020.11.545
25. M. Sheik Dawood, S. Sakena Benazer, N. Nanthini, R. Devika, R. Karthick, Design of rectenna for wireless sensor networks, Materials Today: Proceedings, 2021. https://doi.org/10.1016/j.matpr.2020.11.905
26. M. Sheik Dawood, S. Sakena Benazer, R. Karthick, R. Senthil Ganesh, S. Sugirtha Mary, Performance analysis of efficient video transmission using EvalSVC, EvalVid-NT, EvalVid, Materials Today: Proceedings,2021. https://doi.org/10.1016/j.matpr.2021.02.287.