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Mask detection as Covid combat using Transfer learning and Haar Cascade

Chintan Patel[1], Revati Bhavsar[2], Shriya Upasani[3], Atharva Shirude[4], Simran Vaishya[5]
[1, 2, 3, 4, 5]*MIT-WPU*

Abstract: The World is going through a pandemic due to the rapid transmission of COVID-19. According to the several guidelines issued by WHO (World Health Organization), wearing a mask is the most effective preventive measure in public/crowded places. We hope for the future social health and safety of the people around the world with this project. To detect the people who are not following the COVID-19 guidelines in public/crowded areas a convolutional neural network under the framework of the TensorFlow VGG-19 algorithm is proposed which has trained and tested a collection of more than 1350 images. One flat layer and two FC layers with reduced parameters are optimized from three FC layers. The 2-label softmax classifier replaced the softmax classification layer of the original model. Our experimental results show a training accuracy of 99.73% and an accuracy of 98.78% during testing.
Keywords: Transfer learning, covid19, mask detection, artificial intelligence, coronavirus

I. INTRODUCTION

A. Motivation

Due to the widespread of coronavirus all over the world, it is necessary to follow all the guidelines issued by the government and WHO (World Health Organization) to keep control of the rise of covid cases. Everyone does not have a job which can be achieved by working from home. There are many jobs such as janitors, shopkeepers, doctors, police, etc which are not possible by working from home, so to automate and detect the people who are ignoring the rules we have made this project.

B. Objective

With covid-19 on rising and resulting lockdown, it has become absolutely necessary to find ways to now live our daily life with the covid norms and regulations. Masks so far have shown to be the most useful in trying to prevent the covid spread. Thus to begin with our regular life it is necessary to find a way to detect that the public doesn't break the rules. It is almost impossible for a human force to identify the people flouting this norm in a large public. Thus we use Artificial Intelligence to do our work. Our main objective is to accurately detect using a live camera the people not wearing masks by using the transfer learning algorithm of VGG-19 which is a concept-based model of deep learning.

II. LITERATURE REVIEW

Sr. No.	Author(s)	Title/Year	Methodology	Significance
1	Sandip MaityPrasanta DasKrishna Kumar JhaHimadri Sekhar Dutta	Applications of Artificial Intelligence and Machine Learning pp 495-509 27 July 2021	Deep Learning, ResNetV2, CNN, OpenCV's ImageNet	The results show mask detector has an accuracy of 99.9%
2	G. Jignesh ChowdaryEmail author Narinder Singh PunnSanjay Kumar SonbhadraSonali Agarwal	Face Mask Detection Using Transfer Learning of InceptionV3, International Conference on Big Data Analytics, 03 January 2021	InceptionV3	Image augmentation technique, 99.9% during training and 100% during testing

3	Jian Xiao, Jia Wang, Shaozhong Cao and Bilong Li	Application of a Novel and Improved VGG-19 Network in the Detection of Workers Wearing Masks, 4th International Conference on Machine Vision and Information Technology (CMVIT 2020) 20-22 February 2020	Improved convolutional neural network VGG-19 algorithm	The precision of identifying the workers without masks is 96.82%, the recall is 94.07%
4	Arjya Das, Mohammad Wasif Ansari, Rohini Basak	Covid-19 Face Mask Detection Using TensorFlow, Keras, and OpenCV, 2020 IEEE 17th India Council International Conference (INDICON)	TensorFlow, Keras, OpenCV and Scikit-Learn, Sequential Convolutional Neural Network model	Accuracy up to 95.77% and 94.58% respectively on two different datasets
5	Shilpa Sethi, Mamta Kathuria, and Trilok Kaushik	Face mask detection using deep learning: An approach to reduce risk of Coronavirus spread, US National Library of Medicine National Institutes of Health, 2021	ResNet50, AlexNet and MobileNet	Accuracy (98.2%) when implemented with ResNet50
6	Xinbei Jiang, Tianhan Gao, Zichen Zhu, Yukang Zhao	Real-Time Face Mask Detection Method Based on YOLOv3, MDPI Journal of Electronics, 1 April 2021	GIoUloss, YOLOv3	Real-time mask detection

III. PROPOSED METHODOLOGY

Transfer learning concept-based model is used to build the model that identifies whether a person is with a mask or without a mask.

A. Dataset

We used a dataset of 1376 images created by PyImageSearch reader Prajna Bhandary. Of these images, 690 were with masks and 686 were without masks.80% of the total set was used for training and 20% for testing purposes. The images are a combination of both the genders male and female.

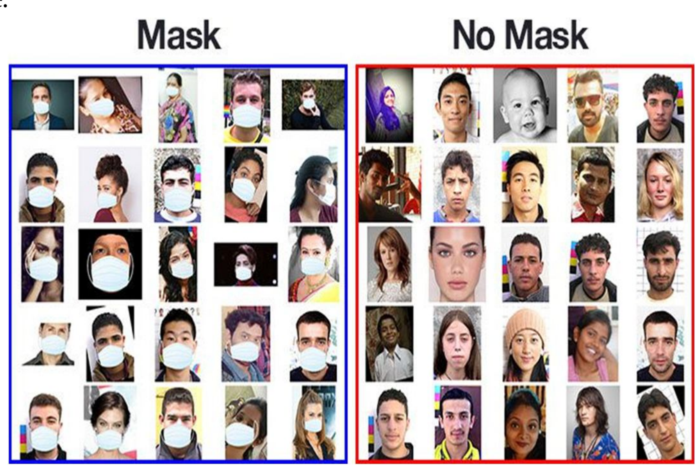

Fig. A dataset consisting of with mask and without mask dataset

B. Labeling and Pre-processing

Folder directory specified if the image was with or without a mask. So, labels were extracted from the file path and mapped to its corresponding image. In this flow itself, the images are preprocessed, that is, converting into the array format and passing the array to inbuilt library preprocess_input under imagenet_utlis lib. Labels are later converted in binary format and categorized by python libraries.

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C. Network Details

VGG19, one variant amongst the VGG model, invented by Visual Geometry Group, consists of 19 layers. These 19 layers are 6 convolutions layers, 3 fully connected layers, 5 MaxPool layers, and 1 SoftMax layer, which help achieve great performance for image competition. VGG11, VGG16, and many more are other variants of the VGG model.

1) Fixed-size of (224 * 224) RGB image was given as input to this present network which implies that the matrix was of the form (224,224,3).
2) Kernels of (3 * 3) size with a stride size of 1 pixel, enabled them to cover the whole notion of the image.
3) Spatial padding is used to preserve the spatial resolution of the image.
4) Max pooling is performed over 2 * 2-pixel windows with stride 2

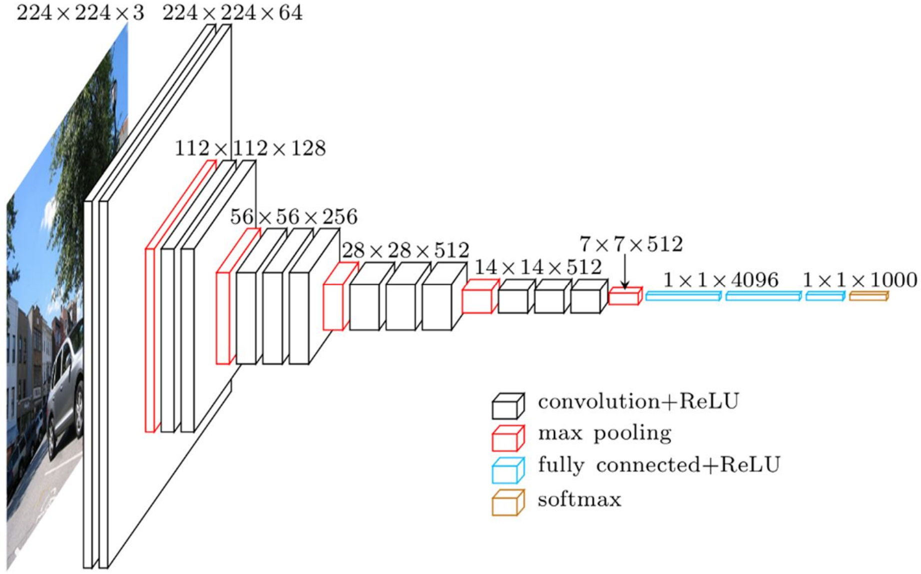

Fig. VGG19 architecture

D. *Improved Model*

Convolution neural network-based VGG19 is used as a pre-trained model for our model of detecting masks. The original model is designed for the classification of 1000 classes and was trained on the ImageNet competition dataset that consisted of over 14 million images. Our area of focus is only on two classes(with and without masks). Hence, we replaced the fully connected network of VGG19 with one flatten layer and 2 fully connected and one dropout layer in between. Flatten layer is used because the convolution layer cannot be connected directly to the FC layer.

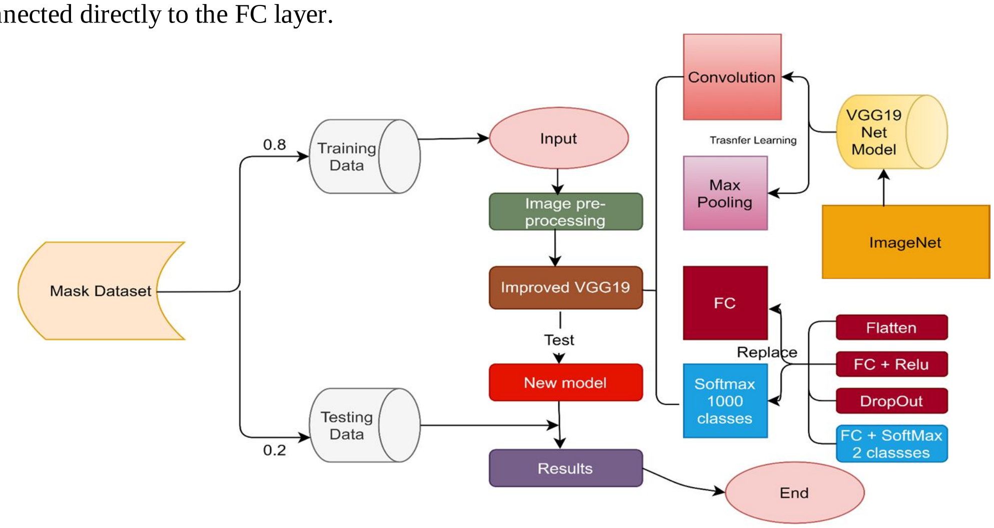

Fig. Improved VGG19 model flow

Layer (type)	Output Shape	Param #
input_3 (InputLayer)	[(None, 224, 224, 3)]	0
block1_conv1 (Conv2D)	(None, 224, 224, 64)	1792
block1_conv2 (Conv2D)	(None, 224, 224, 64)	36928
block1_pool (MaxPooling2D)	(None, 112, 112, 64)	0
block2_conv1 (Conv2D)	(None, 112, 112, 128)	73856
block2_conv2 (Conv2D)	(None, 112, 112, 128)	147584
block2_pool (MaxPooling2D)	(None, 56, 56, 128)	0
block3_conv1 (Conv2D)	(None, 56, 56, 256)	295168
block3_conv2 (Conv2D)	(None, 56, 56, 256)	590080
block3_conv3 (Conv2D)	(None, 56, 56, 256)	590080
block3_conv4 (Conv2D)	(None, 56, 56, 256)	590080
block3_pool (MaxPooling2D)	(None, 28, 28, 256)	0
block4_conv1 (Conv2D)	(None, 28, 28, 512)	1180160
block4_conv2 (Conv2D)	(None, 28, 28, 512)	2359808
block4_conv3 (Conv2D)	(None, 28, 28, 512)	2359808
block4_conv4 (Conv2D)	(None, 28, 28, 512)	2359808
block4_pool (MaxPooling2D)	(None, 14, 14, 512)	0
block5_conv1 (Conv2D)	(None, 14, 14, 512)	2359808
block5_conv2 (Conv2D)	(None, 14, 14, 512)	2359808
block5_conv3 (Conv2D)	(None, 14, 14, 512)	2359808
block5_conv4 (Conv2D)	(None, 14, 14, 512)	2359808
block5_pool (MaxPooling2D)	(None, 7, 7, 512)	0
flatten (Flatten)	(None, 25088)	0
dense_4 (Dense)	(None, 256)	6422784
dropout_2 (Dropout)	(None, 256)	0
dense_5 (Dense)	(None, 2)	514

Total params: 26,447,682
Trainable params: 6,423,298
Non-trainable params: 20,024,384

Fig. Improved model architecture

E. *Implementation Pipeline*

Before classifying the person with or without a mask directly from the image or real-time video; it is first sent through an Object Detection Algorithm used to identify faces called Haar Cascade. This in turn gives the coordinates of the faces from the image. Clearing the noise from the image in the form of background we are left with solely a facial frame. The real image is cropped by bounding box coordinates and resized to send for actual predictions by a trained model.

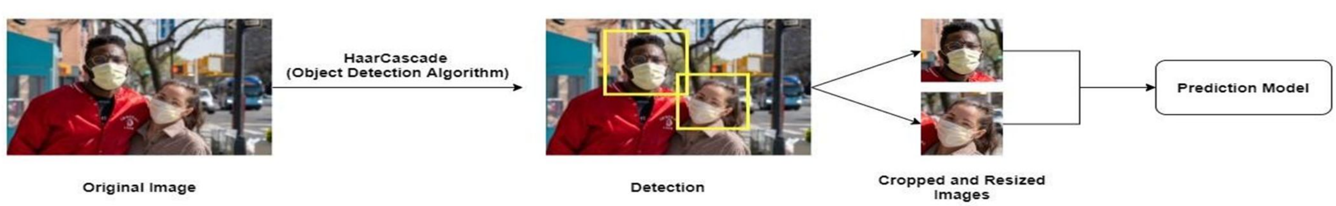

Fig. HaarCascade (Object Detection Algorithm)

IV. COMPARATIVE ANALYSIS

Application of a Novel and Improved VGG-19 Network in the Detection of Workers Wearing Masks by Jian Xiao el. had an accuracy of 96 percent but to its limitation, it was only able to detect a single person at a time. Covid-19 Face Mask Detection Using TensorFlow, proposed by Arjya Das, was also able to attain an accuracy of 95 to 96 percent. The drawback to it was it requires more time to train the model as built from scratch also follows a bit of a complex procedure compared to ours that requires few minutes and only seven iterations to reach optimal accuracy.

V. RESULTS AND DISCUSSION

In this work, a model framework for mask detection based on the VGG-Transfer learning algorithm for training and testing through Python language is proposed. Here we used data created by PyImageSearch reader Prajna Bhandary. Preprocessing operations such as scaling, rotation, and translation are performed on the image. The model was trained and tested on a google collab notebook using the NVIDIA Tesla K80 GPU. On 80% of the training data, the model reached an accuracy of 99.73% and 98.53% on the 20% testing data. To avoid the imbalance in results, almost an equal number of data was used for both the classes(690 masks and 686 unmasks). Images were given in a batch of 43 and the iteration performed to achieve the above-mentioned accuracy was 7. Data augmentation was also performed before sending images to the training so that side cases were also handled with models being used in real-world scenarios at a later stage.

VI. CONCLUSION

This paper replaces the older VGG variants with VGG19 to provide better accuracy. As data augmentation was performed this model displays a greater probability of real-world application. The training and testing tests on masked people and unmasked people conclude that tests on the detection of masks worn through live cameras show that this novel algorithm can achieve a greater recognition outcome in the detection of mask-wearing, which verifies the effectiveness and feasibility of the algorithm's practical application.

REFERENCES

[1] Sandip Maity, Prasanta Das, Krishna Kumar Jha, Himadri Sekhar Dutta, "Face Mask Detection Using Deep Learning", Applications of Artificial Intelligence and Machine Learning pp 495-509, 27 July 2021.

[2] G. Jignesh Chowdary, Narinder Singh Punn, Sanjay Kumar Sonbhadra, Sonali Agarwal, "Face Mask Detection Using Transfer Learning of InceptionV3", International Conference on Big Data Analytics, 03 January 2021.

[3] Jian Xiao, Jia Wang, Shaozhong Cao, Bilong Li, "Application of a Novel and Improved VGG-19 Network in the Detection of Workers Wearing Masks", 4th International Conference on Machine Vision and Information Technology (CMVIT 2020) 20-22, February 2020.

[4] Arjya Das, Mohammad Wasif Ansari, Rohini Basak, "Covid-19 Face Mask Detection Using TensorFlow, Keras and OpenCV", IEEE 17th India Council International Conference (INDICON), 10-13 Dec. 2020

[5] Shilpa Sethi, Mamta Kathuria, Trilok Kaushik, "Face mask detection using deep learning: An approach to reduce risk of Coronavirus spread, US National Library of Medicine", National Institutes of Health, 2021

[6] Xinbei Jiang, Tianhan Gao, Zichen Zhu, Yukang Zhao, "Real-Time Face Mask Detection Method Based on YOLOv3", , MDPI Journal of Electronics, 1 April 2021.

[7] HaarCascades [Source]