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Detection of Face Mask using Convolutional Neural Network

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Abstract

Recently, a huge family of various viruses, the coronavirus, has become widespread, contagious and dangerous to all humankind. By exhaling the infected breath, it spreads from person to person, leaving droplets of the virus on various surfaces and being inhaled by others to catch the infection. Therefore, it is important to protect the people around the place from this deadly virus. Everyone should take precautions such as social distance, hand washing every two hours, disinfectant use, social distance, and the most important thing about wearing a mask. Wearing masks in public places is now widespread all over the world. Extreme population of India in a small area has been the hardest and most devastating. This paper proposes a method for recognizing whether masks are turned on in offices and other workplaces with many people. The project used a convolutional neural network for the resolving this social issue. The model is trained on a real dataset and tested with live video streaming with honest accuracy. In addition, the accuracy of the model is perfected by various parameters and several people at different distances and frame positions.

Keywords— Face Mask Detection, Convolutional Neural Network, MobileNetV.

I. INTRODUCTION

Public use of face masks has been common in China and other countries around the world since the outbreak of the new coronavirus disease began. Recent studies have shown that a significant proportion of patients with coronavirus are asymptomatic ("asymptomatic") and who eventually develop symptoms ("presymptomatic") but others before they develop symptoms. It is known that it can infect the virus.

Health center information also provides clues about a new strain of coronavirus, the mutant coronavirus. In this case, the structure of the virus has changed and has been mutated. The new strain is the RTPCR test currently in use. Cannot be detected.

Therefore, in a densely populated country like India, it is inevitable that people will wear masks and continue to work. It is not possible to track whether everyone entering the workplace is wearing a mask. This created the need for face mask recognition. The model in this article uses a convolutional neural network. This is a deep neural network model used to analyze visual images. It takes image data as input, captures all the data and sends it to the neuron layer. There is a fully connected layer that handles the final output, which is the prediction for the image.

The convolutional neural network model used here is the MobileNet V2 architecture. The MobileNet model is a network model that uses creases that can be separated by depth as the basic unit. The fold, which can be separated by depth, has two layers. Depth folds and point folds [1].

It is based on a reverse residual structure with residual connections between the bottleneck layers. The intermediate expansion layer uses a small depth of convolution to filter the features as the cause of the non-linearity. Overall, the MobileNet V2 architecture includes the first complete convolution layer with 32 filters, followed by the remaining 19 bottleneck layers. Various hyperparameters of the model are also tried.

The hyperparameter tested is the learning rate. This is a tuning parameter used in optimized models that helps determine the step size of the model and reduce the loss function. This is a very important hyperparameter because it leads to convergence or

overshoots the model. Other hyperparameters used are batch size, epoch, etc. The model served the purpose of using OpenCV to capture the frames in the video stream using the video stream.

II. RELATED WORK

In [3], the proposed a pre-trained MobileNet with a global pooling block for face mask recognition. The prepared MobileNet gets the shading image and creates a multidimensional component map.

The worldwide pooling block used in the proposed model changes the element map to an element vector with 64 highlights. Finally, the softmax level performs a pair order with 64 highlights.Evaluated the proposed model using two open accessible datasets. The mode proposed achieved 99% and 100% accuracy separately for DS1 and DS2.

The worldwide pooling block used in the proposed model avoids overfitting the model. In addition, the proposed model outperforms existing models in a set of limits and preparation times. However, this model cannot detect multiple face masks at the same time.

In [5], this paper uses competent and powerful calculations of object positions to naturally identify appearances with and without veils, making plague prevention work smarter.

In particular, they collected a wide dataset of 9,886 images of people with and without face coverings and named them physically veiled. The analysis results show that the improved YOLO v3 computational model has an average average accuracy (mAP) of 86.3%.

This work can practically and naturally distinguish whether a person is wearing a veil. This reveals the urgent factor of submitting an HR to check the cover and has high functional applicability value.

III. METHODOLOGY

DATASET

Kaggle Dataset consists of 1006 images, showing his facial features with and without mask. Some face collections are twisted, tilted, and tilted heads with multiple faces in the frame and different types of masks in different colors.

PACKAGE TensorFlow

TensorFlow, an interface for expressing machine learning algorithms, is used to manufacture ML systems in various fields of computer science such as sentiment analysis, speech recognition, geographic information extraction, computer vision, text summary, and information.

TensorFlow is used to implement computational drug discovery, and fault detection to advance research. In the proposed model, the entire sequential CNN architecture (composed of multiple layers) uses TensorFlow on the back end. It is also used to convert data (images) in data processing.

Keras

Keras provides basic considerations and components for creating and transferring ML arrays with high iteration rates. Get the most out of TensorFlow's scalability and cross-platform capabilities.

Keras' core data structures are layers and models.

All layers used in the CNN model are implemented in Keras. Data processing transforms class vectors into binary class matrices and is useful for compiling the entire model.

OpenCV

OpenCV (Open Source Computer Vision Library) is an open source software library for Computer Vision and ML that identifies and recognizes faces, recognizes objects, moves groups in records, tracks progressive modules, and eyes. Used to track movement, track camera actions, drive away red eyes from images taken with flash, find comparison images from image libraries, recognize landscapes, set markings and overlay them more realistically Such. The proposed method leverages these features of OpenCV for resizing and color conversion. Data image.

CNN

This method consists of a cascade classifier and a pre-trained CNN containing two 2D convolutional layers connected to a layer of dense neurons.

The face mask detection algorithm is as follows:

A. Data Processing

Data preprocessing transforms data from a specific format into a much more user-friendly, desirable, and meaningful format. It can be in any format, including tables, images, videos, and graphics. This organized information fits into the information model or edit and captures the relationships between different entities. This method uses Numpy and OpenCV to process image and video data.

B. Training for Model

CNN is popular in a variety of computer vision tasks. The current method uses a sequential CNN.

The first convolution layer is followed by a Rectified Linear Unit (ReLU) layer and a Max Pooling layer. The convolution layer learns from 200 filters. The kernel size is set to 3 x 3, which is the height and width of the 2D convolution window.

Since the model needs to know the expected format of the input, it needs to provide information about the input format in the first layer of the model.

The images in the training set and test set fit the sequential model. Here, 20% of the training data is used as validation data. The model is trained at 20 epochs (repetitions), maintaining a trade-off between accuracy and the possibility of overfitting. Shows a visual representation of the proposed model.

A good model and optimized train_test_split will help you get accurate results while predictions are being made. test_size is set to 0.1. 90percentage of the dataset will be trained and the remaining 10% will be used for testing purposes.

IV. IMPLEMENTATION AND RESULTS

The implementation and results obtained for this project will be briefly described in this part.

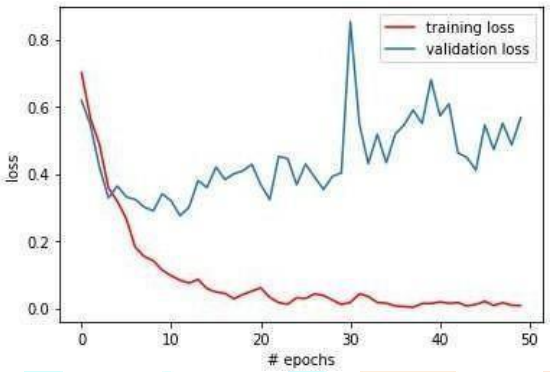

Fig – 1 Training loss and Validation loss

In Fig-1 after training the model, training loss and validation loss to be predicted through this graph.

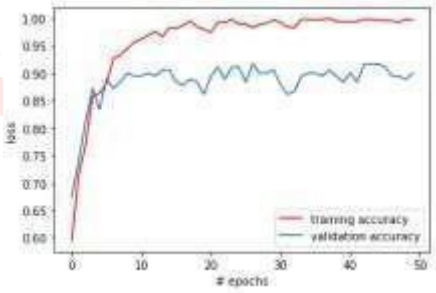

Fig – 2 Training accuracy and Validation accuracy

In Fig-2 plots the accuracy of training and validation with 50 epochs.

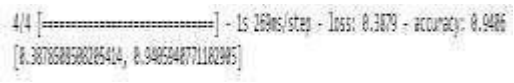

Fig – 3 Accuracy of target and data

In Fig-3 the output layer contains two neurons in it that gives the accuracy of with mask and without mask in target list. The output shows the 0.95% of accuracy for the dataset.

V. CONCLUSION

This paper presents a deep learning-based approach to recognizing facial masks in public places to limit the spread of coronavirus in the community. The proposed technique efficiently handles occlusion in tight situations by using an ensemble of 1- and 2stage detectors at the pretreatment level.

The ensemble approach not only contributes to a high level of accuracy, but also significantly improves recognition speed. In addition, the application of transfer learning to pre-trained models that have been extensively experimented with distortion-free datasets has resulted in a very robust and cost-effective system. Face identity recognition, which further violates Mask's norms, enhances the usefulness of the system for the public good. Finally, this research opens up interesting future directions for researchers. First, the proposed technology can be integrated into any high resolution video surveillance device and is not limited to mask recognition alone. Second, the model can be extended to recognize facial features using face masks for biometric purposes.

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