Face mask detection using convolutional neural network

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1 Introduction

Due to the COVID-19 pandemic situation, People have to wear masks to stay safe, there is no efficient mask detection application that is currently in high demand to ensure the safety of means of transportation, densely populated areas, residential districts, larger producers, and other enterprises. Also at the entrance of shopping malls, airports need to use a face mask detector for safety. This system can therefore be used in real-time applications that require mask detection for protection due to the prevalence of Covid-19. This can be integrated with embedded systems to ensure that the airport, railway station, office, shopping malls, school, and public safety guidelines are followed. Face Mask Detection is going to be the leading technology in both retail and corporate sectors as well.

1.1 Objectives:

We aim to use a convolutional neural network to detect a face with a mask or without a mask. So the objective of this project is to identify accurately whether a person is wearing a mask or not.

1.2 Motivation:

The goal of the project is not to identify or punish individuals who do not wear masks but to create anonymous statistical data that will help authorities predict future COVID-19 outbreaks. It is also necessary for our country. There are many thefts in the shopping malls of our country. Thieves often cover their faces with their mask or something else. If we set the mask detection system in the main gate of shopping malls and fix that the person with a face mask and covering face with something cannot get inside the mall. I think it is possible to reduce theft and robbery in this way. Many banks and other organizations in our country will also face this problem so it will help them.

1.3 Exiting works:

There is a lot of work to be done about-face mask detection. In study [1] they show the use of deep learning methods to identify people who do not wear masks. The motivation of the research of C.Jagadeeswari and M.Uday Theja is to identify accurately whether a person is wearing a mask or not. When the algorithm identifies a person without a mask, an alarm should be generated to alert the people around or the concerned authorities nearby, so that necessary actions can be taken against such violators. This system aims to categorize whether a person is wearing a mask with input from images and real-time streaming videos. The study found that the best performance was achieved by placing MobileNetV2 as the backbone for feature extraction, object detection, and semantic segmentation. RESNET introduced the skip connection concept in this system. VGG16 is a CNN architecture that is considered to be one of the excellent vision models to date in this research[1]. Study[3] shows that researchers used OpenCV to detect real-time faces from a live stream via their webcam. Using Python, OpenCV, and Tensor Flow, and Keras, researchers used datasets to create a COVID-19 face mask identifier with computer vision. Their goal in this study is to identify whether the person in the image/video stream is wearing a face mask or not with the help of computer vision and deep learning. In this paper, a mask face detection model is introduced which is based on a computer approach and deep learning. The proposed model could be integrated with surveillance cameras to prevent COVD-19 infection by identifying non-masked individuals. Face detection technology was a breakthrough with the famous Viola Jones Detector[7], which greatly improved real-time face detection. The Viola Jones Detector optimizes the features[6], but fails to address real-world problems and is affected by a variety of factors, such as facial brightness and facial orientation. Viola Jones can only detect illuminated faces on the face. It was dark and failed to work well with the front-facing images.

1.4 Necessity:

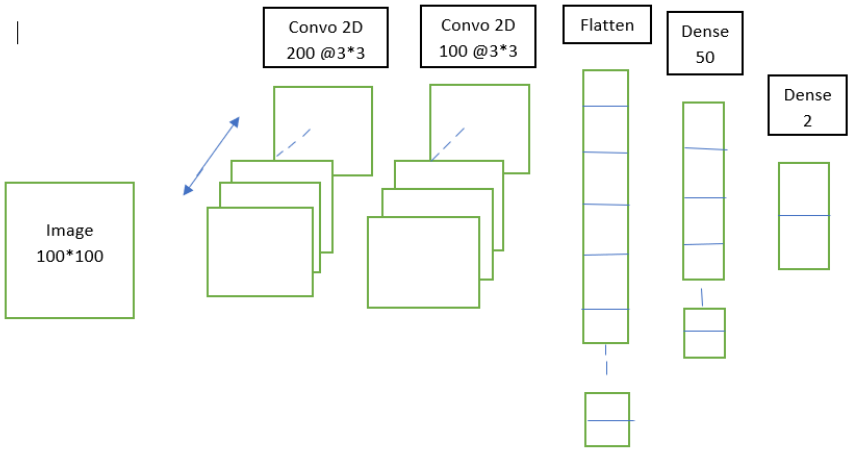
The world is fighting with Covid19 pandemic. There is so much essential equipment needed to fight against the Coronavirus. One of such most essential is Face Mask. Firstly face mask was not mandatory for everyone but as the day progresses scientists and Doctors have recommended everyone to wear a face mask. Utilizing Face Mask Detection System, Hospitals can screen if their workers are wearing masks during their workday or not. If any health worker is found without a mask, they will get a warning with a suggestion to wear a face mask. We have seen the different types of applications of the Face Mask Detection technique. Hope this project will help us to understand the importance of wearing masks. In this scenario of Covid19, a low investment Face Mask Detection is here to stay for a long time. So investing money or time behind this project will not waste for anyone but will benefit everyone. This project can sometimes be inconsistent with violations of human privacy.

2 Methodology

In this work, Convolutional Neural Networks (CNN) is employed to classify whether each pixel is a component of a face then determine the situation of the face through another CNN. In recent years, deep learning approaches have significantly promoted the event of pc vision technology, including face detection. CNN specification for rapid face detection, which may be a multi-resolution network structure that will quickly eliminate background regions within the low-resolution stage and punctiliously evaluate challenging candidates within the last high-resolution stage. Proposed a way called Convolutional Channel Feature (CCF) by combining the benefits of both filtered channel features and CNN, which features a lower computational cost and storage cost than the overall end-to-end CNN method. Recently, witnessing the many advancements of object detection using region-based methods, researchers have gradually applied the R-CNN series of methods to face detection. The neural networks based methods are already the mainstream of face detection due to their high efficiency and stability. During this work, we propose a scheme, which achieves fairly progress in face detection tasks compared to the first architecture[2]. Here we can find out binary and multi faces[4].

The proposed method is extended from the Mask R-CNN framework, which is that the state-of-the-art object detection scheme and demonstrated impressive performance on various object detection benchmarks. In the convolutional neural network, data will pass two convolutional layers. Then data will get into the flatten convolution layer then it will be connected with a dense layer that was 50 neuron length. Then finally it will be connected with another dense layer which was the output layer. This output layer was 2 neuron length. The result will show here that with a mask and without a mask. Data will be divided categorically here. Here we can try to find out loss, accuracy, validation loss, and validation accuracy for training data. After getting the result we will show the training loss and validation loss graph. Here we are going to input one image in cascade classifier then crop the image accurately by 100*100. Then it will be passed into CNN. It will give two probabilities that with a mask and without a mask.

Convolutional Neural Network Architecture:



3 Implementation

In this project, we will use Keras along with Tensorflow to train our model. The first part of the training includes storing all labels of the images in a Numpy array and the corresponding images are also reshaped for the base model. Image augmentation will increases our dataset with images with a whole new perspective. Before inputting, we will perform the following image augmentations randomly: rotations up to 20 degrees, zooming in and out up to 15
Here we are going to input one image in cascade classifier then crop the image accurately by 100*100. Then it was passed into CNN. It gives two probabilities with a mask and without a mask.

3.1 Data Collection:

The data was collected from Kaggle. Here the full dataset has 1376 pictures. In the dataset 690 pictures are with mask and 686 pictures are without the mask. We set label dictionary in code for with mask label 0 and without mask label 1.

3.2 Data processing:

For our project, we need to do some preprocessing in our dataset. The images in our dataset are of different colors and sizes. So for convenience, we took all the pictures in the same color and size. We were set all pictures color gray and size 100*100. In our project, we have committed 80

3.3 Model Development:

To develop the model we use jupyter notebook, kaggle, Keras, Tensorflow and OpenCV here.

3.4 Results:

We get loss, accuracy, validation loss and validation accuracy as a result
Loss 0.04 Accuracy 0.9899 Validation loss 0.1575 Validation Accuracy 0.9476

4 Conclusion

We had the option to create exact face covers for human objects from pictures containing limited articles. We showed our outcomes on a multi human parsing dataset with mean pixel level exactness. We use here python and convolutional neural networks, Keras, and OpenCV. Likewise, the issue of incorrect forecasts has been tackled and a legitimate bounding box has been drawn around the fragmented area. The proposed organization can recognize non-frontal[4].

4.1 Challenges:

1. Face masks Detection with python was a big challenge.
2. It was a big challenge to analyze it properly.
3. Doing this project in an online session was a big challenge.
4. One of the big challenges of our project was to accurately identify whether a person has used a mask in COVID-19.

4.2 Limitations:

There were relatively few difficulties challenges faced that was consuming time and made the errands repetitive are talked about as follows.
1. One was the inordinate information stacking time in Google while stacking the dataset into it. Since the runtime restarting revives all the cells, the cell for dataset stacking took more often than not while running.
2. Besides, the entrance issue in Google Colab didn't permit the entrance of the webcam which represented an obstacle in testing pictures and live video transfer through Google Colab Notepad. In this manner, we needed to run the code locally on the PC through which we tried the code on the live video transfer[5].
3. We are facing some problems while doing the project. We could work with many larger data sets but we could not work with large data sets due to time constraints and short semester. And because of the online session, we could not discuss directly with the group members.

4.3 Future Directions:

More than fifty nations around the globe have as of late started wearing face veils obligatory. Individuals need to cover their appearances in broad daylight, markets, public vehicles, workplaces, and stores. Retail organizations regularly use programming to tally the number of individuals entering their stores. They may likewise like to quantify impacts on computerized shows and special screens. We are intending to improve our Face Veil Discovery instrument and delivery it as an open-source project. Our product can be likened to any current USB, IP cameras, and CCTV cameras to identify individuals without a cover. This recognition live video feed can be executed in web and work area applications so the administrator can see notice messages. Programming administrators can likewise get a picture of somebody who isn't wearing a cover. Moreover, a caution framework can likewise be actualized to sound a blare when somebody without a cover enters the zone. This product can likewise be associated with the passageway entryways and just individuals wearing face veils can come in[5]

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