FACE MASK DETECTION USING DEEP LEARNING

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Abstract: The World Health Organization (WHO) acknowledged that the novel Corona virus illness (COVID-19) that spread fast in Wuhan, China in December 2019 is a hazardous virus that can pass from humans to humans. The global health is being ravaged by the COVID-19 corona virus epidemic. The healthcare industry is a complete disaster. Many preventative measures have been taken to avoid the transmission of this disease, including the use of a mask, which the World Health Organization strongly recommends (WHO). We used deep learning approaches for face mask recognition in this research, and we used the CNN model to carry out our project and demonstrate the methods' detection accuracy. We gathered a dataset of 1645 photos from different persons, from which the test data set – with mask 181, without – 656 – was created. Data set for training - 658 with mask, 656 without. To train a deep learning architecture, these were captured with a webcam and a cell phone camera. The model has a training accuracy of 98.3 percent and a validation accuracy of 64 percent.

Keywords: Deep learning model, Face mask Detection, Convolutional Neural Network, Dataset, Face mask, Open Source Computer Vision Library.

1. INTRODUCTION

Mask usage has expanded dramatically in recent years. COVID-19's proliferation is becoming increasingly concerning for everyone on the planet. This virus can spread from person to person through droplets. To prevent the spread of COVID-19, WHO recommends that everyone wear a face mask, practise social distancing, avoid crowds, and keep their immune systems in good shape. As a result, everyone should wear a face mask when they are outside to protect each other. However, most people do not follow the requirements and do not properly use the face mask for a variety of reasons.

"A survey shows that 90% of Indians are informed, yet only 44% are using a mask," according to the Economic Times India. This survey clearly shows that people are informed, but they are unwilling to wear the mask owing to discomfort and carelessness. This could make it easier for covid-19 to spread in public settings. Face mask detection must be developed to address this problem. The object detection technique can be used to detect a face mask. Corona virus illness 2019 (COVID-19) has infected over 20 million individuals worldwide, causing over 0.7 million fatalities, according to the World Health Organization's official Situation Report – 205. Individuals with this have reported a wide range of symptoms, ranging from moderate to life- threatening.

One of them is respiratory issues such as shortness of breath or difficulty breathing. Because they appear to be at increased risk, elderly adults with lung disease can have catastrophic problems. 229E, HKU1, OC43, and NL63 are some of the most frequent human corona viruses that infect people all over the world. Viruses like 2019-nCoV, SARS-Co V, and MERS-Co V infect animals and evolve into human corona viruses before infecting humans. The environment of a tainted person can trigger contact transmission because virus-carrying droplets can land on his nearby surfaces. Wearing a clinical mask is essential for controlling certain respiratory viral illnesses, such as COVID-19.

The public should know whether to wear the mask for source control or COVID-19 aversion. Masks may be useful in limiting vulnerability to risk from an individual during the "pre-symptomatic" period of discrete people wearing masks to prevent viral spread. The WHO emphasises the use of medical masks. Face mask detection has thus become a critical task in today's global society. Face mask detection entails identifying the location of a person's face and then assessing whether or not they are wearing a mask. The problem is related to general object detection, which is used to identify different types of things. Face identification is the process of identifying a certain collection of entities, namely faces. This study uses the CNN model to provide a simplified technique to achieve the above goal.

2. METHODOLOGY

2.1. Problem Formulation:

Coronavirus is a highly infectious disease, and the WHO and other health organisations recommend that people cover their faces to prevent it from spreading. All state-run administrations strive to guarantee that facial coverings are worn openly, but it might be difficult to physically discern those who are not wearing them in crowded locations. Researchers are working on developing programmed ways to recognise and permit the use of facial coverings in public spaces. The problem can be summarised as follows: given a face photo as input, the order model should sort the facial picture using the characterisation model in a veil discovery process. Using Convolutional Neural Networks, As shown in this study, we present an approach for covering recognition-driven face picture order that is both speedy and precise. We used traditional convolutional layers to create a model with fewer learnable boundaries and more effective learnable boundaries.

2.2. Data Insights:

We gathered information. We have two sets of data. One is for testing and the other is for training.

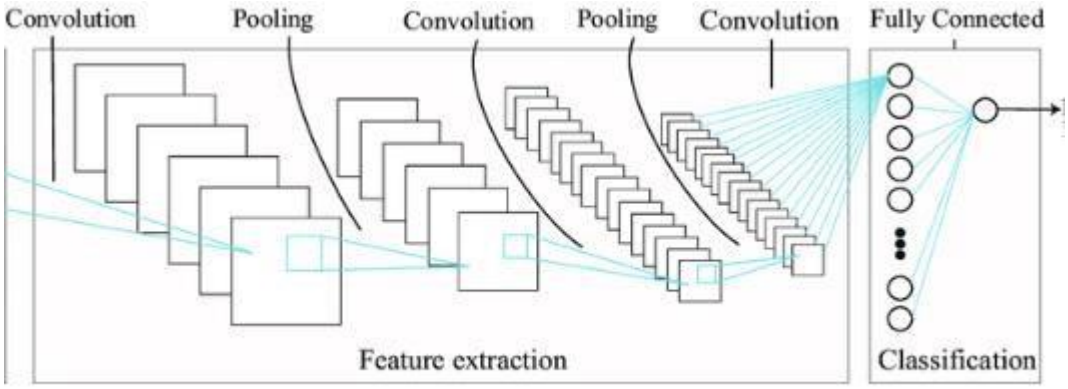
Training Dataset: This dataset contains 1300 photos, with 650 images relating to persons wearing a face mask and the remaining 650 images relating to people not wearing a face mask.

Testing Dataset: This dataset contains 180 photos, 140 of which are of people wearing face masks while the remaining 50 are of people not wearing face masks.

2.3. Deep learning Model:

The algorithms utilised in the project are discussed in this section. To identify and recognise photos, we employed Convolutional Neural Networks (CNN).
CNNs are used in a variety of tasks and purposes, including image processing, computer vision tasks such as localization and segmentation, video analysis, and obstacle detection. CNNs are generally used to classify and recognise images. The capacity to convolutionalize is a CNN's expertise. The potential for more usage of CNNs is unlimited, and it must be studied and pushed to new limits to find all that this intricate machinery is capable of.

The suggested approach is summarised in the following paragraphs.



Equation: The mathematical symbol for convolution is an asterisk *. If we have an input image of X and a filter of 'f', the expression is:

$$Z = X * f.$$

About CNN

CNN is more precise.

Classification is of three types binary, multiclass, multilabel.

Activation function:

for binary classification - Sigmoid Activation

for multiclass classification - Softmax Activation

for multilabel classification - Sigmoid Activation

It is simple to comprehend and implement.

It predicts photos with the highest accuracy of any algorithm.

CNNs are generally used to classify and recognise images.

The capacity to convolutionalize is a CNN's expertise.

Because of its great accuracy, CNNs are utilised for picture categorization and recognition.

2.4. Deep Learning Model Performance:

Customized CNN model has 3 convolutional layers and 3 max pooling layers.
The feature is extracted from the image matrix and matrix is, further reduced, the matrix is passed to top layer.
The trained CNN model takes an image as input and classifies whether the person is wearing a mask or not.

3. RESULTS ANALYSIS

3.1. Deep Learning Model Performance:

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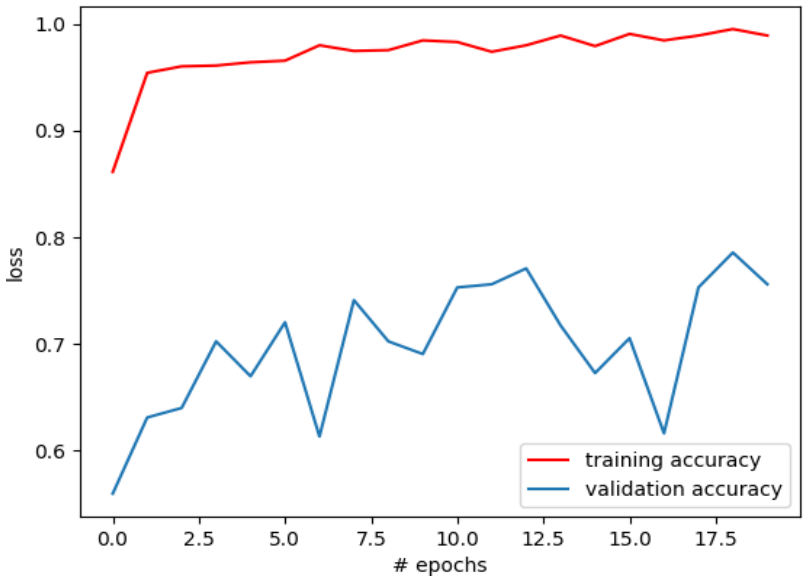

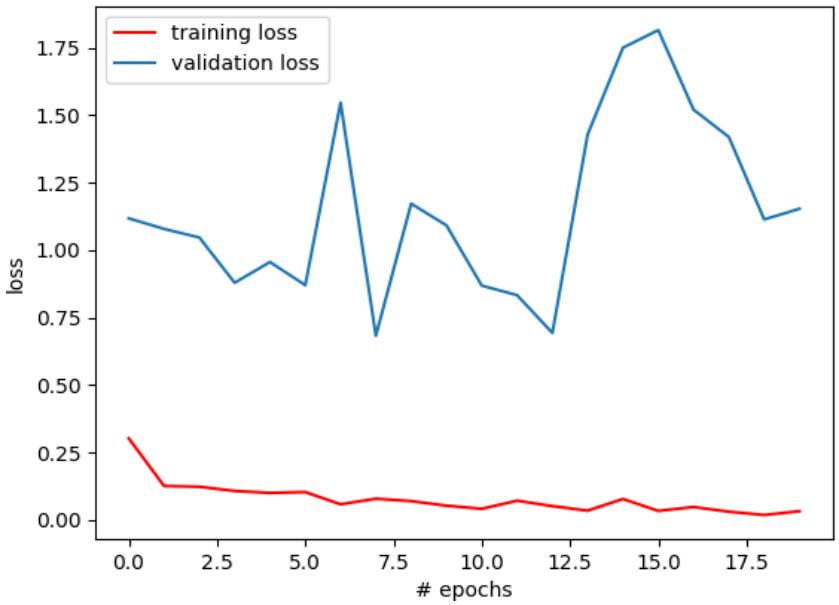

3.2. Comparative Analysis:

JosephRedmon et al proposed the You Only Look Once (YOLO) technique for real-time object detection in the content-based picture categorization using deep learning paper. Sanzidul Islam et al., published a deep learning-based assistance system to categorise COVID-19 Face Mask in rasbperrypi-3 in the year 2020. Velantina et. al., 2020, used the Caffe model to detect COVID-19 facemasks. In his work for face recognition, Senthilkumar et al. 2017 examined the two most often used machine learning algorithms K-Nearest Neighbor and Support Vector Machine.

3.3. Application:

We implemented the CNN algorithm to construct real-time face mask detection algorithm. (as it has the highest testing accuracy)

The camera streams a video in real time and send it to the trained CNN model, the CNN model will classify whether the people in the video are wearing masks or not.

4. CONCLUSION:

Finally, this project's "Facemask Detection" model will be utilised to recognise a person's face and determine whether or not they are wearing a mask. This is a successful development of a cost-effective face mask detector using WEB CAM. According to the results of the experiments, the real-time face identification system has a high accuracy in recognising masks, which can help control the spread of covid-19 in public spaces by stopping people from entering without wearing a face mask. This face mask detection system has high mask identification accuracy and can be linked with the Internet of Things (IoT) to allow simultaneous streaming of many devices.

This proposed system can also be improved by integrating it with any high-resolution video surveillance device, not just mask detection. Second, this idea can be expanded to include temperature detection. This programme can be utilised in any working environment where correct use of a face mask with great accuracy and precision is necessary, such as public places, banks, business environments, streets, shopping malls, examination centres, colleges, and so on.

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