Face Identification in The Era of Covid-19

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Abstract: Everyone's life in this Covid-19 era has been disrupted, as the crisis caused by the coronavirus has affected the movement and lifestyle very severely. Wearing masks has been made mandatory for every person to prevent the transmission of the virus. It is considered the best way to prevent the spread of coronavirus. But, due to this obligation**,** the identification of a particular person has proven to be a challenging task, as facial features are responsible for the recognition and authentication of a person. It is not easy for anyone to predict the identity of a masked person. This paper focuses on a simplified way to detect the mask on a face and identify the person wearing it. It is developed using a deep learning algorithm called Convolutional Neural Network (CNN), with image classification method MobileNet and machine learning packages like TensorFlow and OpenCV.

Index Terms **- Covid-19, Coronavirus, Face Identification, Convolutional Neural Network, TensorFlow, OpenCV.**

I. INTRODUCTION

The Covid-19, first declared a pandemic by the World Health Organization (WHO), is currently causing health crises all over the world [1] [2]. It rapidly spread since the massive outbreak in December 2019. The first case was reported in Wuhan City of Hubei province in China [3].

And now, the present situation of total cases, active cases, and total deaths are pretty clear to everyone. This pandemic has crippled almost every country's healthcare system, as no one has expected that it would profoundly affect their treatment facilities [4]. People get affected by the virus because of the transmission of tiny droplets during the inhalation and exhalation process. The main reason behind this rapid transmission of the virus is not maintaining enough social distance with people in public areas like markets, railway, bus stations, and airports [5].

Wearing masks proves to be an efficient step to curtail the widespread transmission among the people. Firstly, the World Health Organization told people to opt for face masks if they experience any symptoms related to the respiration process [6]. Face masks have proved to be the best preventive mechanism, which can prove helpful in breaking the chain of transmission of the deadly virus. But, the administrative authorities are finding it challenging to ensure that masks are being worn by the people every time in the public areas.

In 2020, the virus is still posing imminent threats to the livelihoods of millions of people. All the nations are recovering gradually from the pandemic and planning to come to their original state of normalcy. People are still anxious, especially those who intend to resume in-person activity. So much research has proved the significant drop in the number of cases just by wearing face masks properly. However, implementation of this policy is not at all feasible by manually tracking process. That is when Artificial Intelligence (AI) comes into play, as artificial intelligence will use it for a face mask recognition system to be able to differentiate between masked and mask-less faces [7] [8] [9].

Detection of the location of the face and then figuring out whether the look is masked or mask-less are both the process involved in masked face detection. Facial masks in the image or video format are conceived with fundamental neural network transfer learning [10]. Identifying facial features is used in various applications like in the education sector, self-driving cars, and surveillance [11].

The paper has a straightforward approach which first detects the facial features from an image and tell about masked or mask-less face. And then, it will identify the person while the front is in the state of motion. The work will be done using machine learning packages including TensorFlow and OpenCV [12].

The detection of face masks and identification and verification of a person's face will be made using Convolutional Neural Network (CNN), which is a deep learning algorithm used in the classification of image and identification. This model will help combat the outbreak of deadly viruses and maintain security with authentication and recognition of a human's face.

II. RELATED WORK

A face is identified from an image that contains various features in the face detection process. As per [13], face identification research necessitates gesture identification, facial recording, and pose prediction. Information from a single image, the task is to recognize the face in the picture. Face recognition is challenging because looks vary in scale, structure, colour, and other ways and are not eternal. It's really a difficult task when an obscured image is obstructed by something different than the shutter, and so on.

According to the researchers of [14], impermeable recognition software faces two main challenges: the scarcity of large databases featuring concealed and uncovered faces, and second the prohibition of facial movements in the protected area. Using the locally linear embedding (LLE) algorithm and dictionaries focused on a vast group of covered faces, extracted standardized faces, some misplaced emotions can be recovered, and the dominance of facial signals can be significantly reduced.

Prior face detectors, such as MTCNN [26], produced consistent results on unbounded faces. Such sensors, though, did not yield consistent outcomes for scaled, illuminated, and occluded faces. The presence of massive datasets such as WIDER FACE

[27] with complex facial structures and labels prompted modern algorithms to overcome these concerns. The output of multiple indicators was fine, but the rate was sluggish. Another detector marked targets with identification for quicker strategies by considering the image size of anchor boxes.

As per the research published in [15], convolutional neural networks (CNNs) in computer vision have a substantial limitation on the dimension of the source image. To overcome the resistance, the standard procedure is to modify the photos before integrating them further into the system. The primary concern of this activity is to accurately identify the object from the picture. To accomplish monitoring operations, the suggested technique can track a moving face as well as a mask.

Deep learning-based detectors have exhibited outstanding performance in recent years, owing to their high image retrieval efficiency [16], such as CNN, which contributes to the pattern detection tasks relevant to computer vision, owing to its unique spatial extracting features functionality [17]. CNN extracts vital functions by combining convolutional layers with the original images or interface charts. CNN is being used in image recognition as well as hand-written character recognition [18]. It is suggested a CNN approach for detecting face masks with high accuracy.

III. DATASET

For testing the existing model, two datasets were used. The first one includes pictures of individuals wearing as well as not wearing face masks. Figure 1 primarily depicts a front face position with a single photo in the image.

Figure 1 Sample photos from dataset 1

Dataset 2 includes all individuals wearing as well as not wearing masks. Figure 2 shows several face sets of head shift, tilt, and slant, as well as several faces in the shot.

Figure 2 Sample photos from dataset 2

IV. TECHNOLOGY USED

A. For prototyping, python is a fantastic language because of its easily interchangeable units. It is amongst the most approachable programming languages present due to its simple format and lack of complication, which places a greater focus on linguistic form. Python codes can be written and implemented even quicker than most programming languages due to their ease of understanding and use. Python is amongst the most approachable computer languages possible because of its more straightforward format and structure, emphasizing everyday language. It can be written and executed even quicker than most computer languages due to its simplicity of understanding and use.

B. TensorFlow, a library for interpreting machine learning algorithms, is used to integrate ML structures into computation in a variety of computer science fields, including sentiment classification, speech recognition, spatial information retrieval, image processing, language understanding, information processing, mathematical clinical research, and defect detection [19]. TensorFlow is used as the backend for the entire Sequential CNN architecture in the conceptual scheme. For restructuring the data, it has also been used in data analysis.

C. OpenCV stands for Open Source Computer Vision Library, a free, open-source computer vision and machine learning application library, is used to distinguish and identify faces, identify objects, collective movements in videos, identify advanced modules, observe eye signs, track camera movements, remove red eyes from photos taken with lighting, find similar pictures from

a dataset, visualize scenic and spherical images, and so on [20]. The recommended approach employs these OpenCV characteristics in the restructuring and color transfer of data images.

D. MobileNet is a CNN architecture that is both flexible and effective, and it is used in practical applications. MobileNets predominantly employ depth-wise separable convolutions rather than the regular convolutions used in previous architectures to construct lighter models. MobileNets adds two new global hyperparameters that enable model developers to exchange off frequency or precision for speed and small size based on their needs.

V. PROPOSED METHODOLOGY

A cascade classifier and a pre-trained CNN with two 2D convolution layers attached to tiers of dense neurons are used in the suggested model. The very first step is data processing by data visualization and image reshaping.

i) Data pre-processing is converting data from one format to a far more customer-friendly, preferred, and practical design. It can take any type, like tables, photographs, videos, charts, and so on. These ordered data are compatible with a knowledge model and collect the relationships between various entities [21]. NumPy and OpenCV are used in the preferred system to deal with multimedia content data.

The concept of translating unstructured data into concrete representations using information sharing and insight exploration by encodings is known as data visualization. It is beneficial to investigate a particular trend in the dataset [22].

All through picture relegation, the source is a three-dimensional tensor with a significant distinct pixel inside each path. All of the images must be the same size and correspond to the same 3D function tensor. Nevertheless, neither photos nor their corresponding function tensors are typically co-extensive [23]. Most CNNs can only consider images that have been perfectly alright. This causes several issues during data acquisition and model deployment. However, resetting the image data before amplifying them in the network will assist in overcoming this limitation [15].

Now, the second part is the training of the model by building a model using CNN and then splitting of data and training the CNN model.

ii) CNN has risen to prominence in a variety of machine vision challenges [24]. The new approach employs Sequential CNN. The Rectified Linear Unit (ReLU) and MaxPooling layers are added after the first Convolution layer. The kernel size is set to three by three, which defines the height and width of the two-dimensional convolution window. Since the model must be aware of the expected outline of the data, the first phase in the model must be supplied with data texture features.

After creating the schema for data analysis, the model must be equipped using a single dataset and then evaluated against a new dataset. When making a forecast, a correct model and already optimized train test break support yield reliable outcomes.

VI. RESULT AND ANALYSIS

Two datasets are used to train, verify, and analyse the model. The model achieves somewhat improved efficiency on dataset 1 than on dataset 2. Max-Pooling is indeed one of the primary factors for reaching this level of precision. It adds primitive translation invariance to the input file while also reducing the number of inputs that the model must master. The device can identify partly obscured faces effectively, whether they are obscured by a mask, clothing, or a hand. It compares the occlusion degree of four regions – nose, mouth, ear, and eye – to distinguish between the formatted mask and hand-covered face. As a result, a mask that completely covers the face, along with the nose and chin, can only be treated as "with mask" by the model [25]. In addition to the detection of the mask on the face, it is also identifying the person wearing a mask by showing his name on the screen.

VII. CONCLUSION

In conclusion, this research study has proposed a model using machine learning for detecting face masks and providing the identity of the person wearing them. After all the phases of training, testing, and authenticating, the model is showing good accuracy. Considering the current health crisis all over the world, the mask would remain an obligation. That is why it is necessary to have a robust model, which can quickly provide a person's identity, even in unfavourable situations. This model will contribute immensely towards the betterment of the people.

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