

Real Time Face Mask Detector Using Machine Learning

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Abstract:- The current situation of COVID needs an efficient way to check masked and non-masked faces. The main objective of the project is to build this system at entrances of public spaces like organizations, educational institutions, temples where there is a high probability of spread of COVID. WHO (World health organization) reported that covering face and nose with masks during the work reduces the risk of spread. The process works like while entering the public place everybody should scan their face and then move forward making sure they are wearing a mask or not. If anyone is without covering their face with mask, sound alert will be given. As all the organizations are opening. The number of Covid cases are still getting to increase in the country. If everybody maintains the safety measures, then we can end this pandemic all together. Hence to check whether the people wear Face masks while coming to any public spaces we ensure this paper will help in detecting it.

Keywords:- COVID, Keras, OpenCV, Safety measures, Facemask Dataset, Without Facemask Dataset.

I. INTRODUCTION

Attractive course of action to prevent COVID pandemic need excessive awareness to reduce harmful impact of network health and global economy, with complete of boundary that's unfolded. In the no need of antibacterial and finite clinical resources, many motion where pronounced by way of WHO to govern the pandemic instances and prevent the use of dangerous medical resources. Protecting nostril and mouth with the face mask is considered one of the medicine loose remedies that's used to reduce the initial resources of excessive acute respiratory syndrome coronavirus 2 drops thrown out by using an affected character. Nonetheless, of discuss is on on clinical assets and multiplicity in sporting the face mask, each and all nations are ordering to cover their nose and mouth in public location compulsorily. To provide closer to community health, this module focuses to construct a relatively precise and concurrent method that can flawlessly discover the man or woman without face masks in public spaces and subsequently, imposing to wear mask. Face masks detection refers to stumble on whether or not a person is sporting a mask or now not. Face mask detection is a method of determining masks and Non mask faces.

The hassle is without delay linked to general detection for detecting the training of items. Face identification categorically deals with distinguishing an entity of specific group of a.e., Face. It has numerous forms of applications, together with self-using, education, remarkable vision, and so on. This newsletter offers a simplified technique for serving the above goal through the use of primary gadget learning (ML) applications along with TensorFlow, Keras, OpenCV and Scikit-learn.

II. RELATED WORK

In detection of face mask challenge, a person face is identified from an picture that carries extra attributes in it. Consistent with, facial detection research requires reputation of expression, face tracking, and estimation of pose. With an image alone, the challenging mission is to discover the folks face from the photograph. There may be more issue in detecting the face because there are unique faces of various sizes, shapes, and colorings and many others. And they are no longer invariable. It's a hard task for blurred or grimy photos troubling via some other various things but not tough camera, and so forth. The people assume detection of face include fundamental demanding situations:

- 1) Datasets of sizably voluminous is unavailable which has each masked and non-masked faces.
- 2) removal of facial expression inside the protected area.

Multiple misplaced expressions may be recovered, and the ascendancy facial cues can be significantly alleviated. There's strict constrain with recognize to the scale of inputting picture which changed into said by way of CNNs in pc vision. The common steps reform the picture before fixing them into the network to recover from the drawback. To understand the picture effectively with respect to masked and non-masked faces is a challenging undertaking. The proposed mission need to additionally stumble on a face along side a mask in motion to carry out the surveillance activities.

III. DATASET

Two datasets have been used for experimenting the current method. Dataset 1 consists of 1915 images, which consists of people wearing face masks. Fig. 1 shows people wearing facemask.



Fig.1 Persons with mask dataset

Dataset 2 consists of 1918 images which consists of people not wearing face mask. In fig. 2 shows people not wearing face masks.



Fig. 2. Persons without masks dataset

IV. INTEGRATED PACKAGES

A. TensorFlow

A terminal for expressing gadget trendy algorithms, is make use for executing device ultra-modern structures into production over a package deal today's regions latest computer science, along with video detection, time collection, textual content-based totally application. TensorFlow is a symbolic math library used for neural networks and is best suited for dataflow programming throughout more than a few duties. It offers more than one abstraction levels for constructing and education fashions. It's an cease-to-give up open-source platform for device gaining knowledge statemodern. It has a complete, bendy ecosystem modern-day gear, libraries and network sources that shall we researchers push the 49a2d564f1275e1c4e633abc331547db in ML and builders easily build and set up ML powered packages.

B. Keras

Keras is used for developing deep models which can be productized on smartphones. Keras is also used for disbursed training of deep getting to know models. Keras is used by organizations along with Netflix, Yelp, Uber, and so forth. in data processing, it helps to collect the general version.

C. OpenCV

OpenCV (Open-supply laptop vision Library) is an open-supply pc imaginative and prescient and gadget learning software program library. OpenCV was constructed to provide a not unusual infrastructure for pc imaginative and prescient applications and to boost up using machine notion within the business products. OpenCV is used in wide variety of utility which includes street view picture sewing, computerized inspection and surveillance, robotic and driving force-much less car navigation and manage, clinical photograph evaluation, Video/image seek and retrieval, films - 3-d shape from movement, Interactive art installations.

V. THE SUGGESTED METHOD

The Proposed approach includes of a cascade classifier and a pre- organized CNN which incorporates second convolution layers associated to layers of thick neurons. The confront veil place incorporates of the taking after calculations:

A. Data Preprocessing

Data preprocessing, a aspect of records practice, describes any type of processing completed on uncooked records to put together it for some other information processing system. It has historically been an critical preliminary step for the data mining system. The recommended method involves the image and video facts the use of NumPy and OpenCV.

B. Data Visualization

Data preprocessing, a component of data preparation, describes any type of processing performed on raw data to prepare it for another data processing procedure. It has traditionally been an important preliminary step for the data mining process.

The total number of images in the dataset is visualized in both categories–‘with mask’ and ‘without mask’. The statement `categories=os.listdir(data path)` categorizes the list of directories in the specified data path. The variable `categories` now look like: ['with mask', 'without mask'] Then to find the number of labels, we need to distinguish those categories using `labels=[I for I in range (Len(categories))]`. It sets the labels as: [0, 1]

Now, each category is mapped to its respective label using `label dict=dict(zip(categories, labels))` which at first returns an iterator of tuples in the form of zip object where the item in each passed iterator is paired together consequently. The mapped variable `label dict` looks like: {'with mask': 0, 'without mask': 1}

C. Conversion of RGB image to gray image

The primary purpose why grayscale representations are often used for extracting descriptors in preference to working on color images directly is that grayscale simplifies the set of rules and reduces computational requirements. Grayscale only includes luminance (brightness) statistics and no coloration statistics; that is why maximum luminance is white and 0 luminance is black; everything in among is a shade of gray. that is why grayscale pix comprise handiest sunglasses of grey and no color. Grayscale is also known as achromatic.

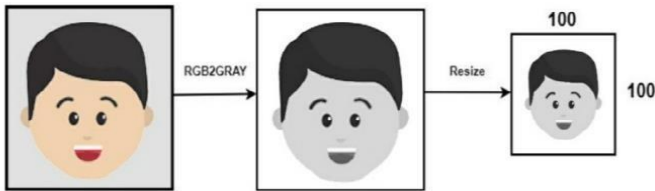


Fig. 3. RGB image to grey scale image conversion

We use the function `cv2.cvtColor(enter image, flag)` for changing the color space. right here flag determines the form of conversion. In this case, the flag `cv2.COLOR_BGR2GRAY` is used for grey conversion. Deep CNNs require a certain-size input picture. consequently, we need a certain common size for all of the photographs in the dataset. the grey scale photo is resized into a hundred x 100 the use of `cv2.resize()`.

D. Image Reshaping

maximum convolutional neural networks are designed in a way so as to handiest receive pictures of a set length. This creates several demanding situations throughout data acquisition and version deployment. The commonplace exercise to overcome this limitation is to reshape the input pics in order that they can be fed into the networks. The pics are normalized to converge the pixel range among zero and 1. Then they may be transformed to four di- mensional arrays the use of `records=np. reshape (statistics, (facts. shape [0], img size, img size,1))` where 1 indicates the Grayscale photo. As, the very last layer of the neural community has 2 outputs – with masks and without mask i.e., it has specific representation, the data is converted to express labels.

E. Training of Model

a) building the model using CNN structure: CNN has turn out to be ascendant in miscellaneous pc vision tasks. The present day method uses Sequential CNN.

The first Convolution layer is followed by Rectified Linear Unit (ReLU) and MaxPooling layers. The Convolution layer learns from 200 filters. Kernel size is ready to 3 x three which specifies the peak and width of the 2nd convolution window. because the model must be aware of the shape of the enter predicted the primary layer inside the model desires to be furnished with records approximately enter shape. Following layers can carry out instinctive form reckoning. In this situation, in-positioned form is specific as information. shape [1:] which

returns the dimensions of the statistics array from index

1. Default padding is “valid” wherein the spatial dimensions are sanctioned to truncate, and the enter quantity is non-0 padded. The activation parameter to the Conv2D magnificence is ready as “relu”. It represents an approximately linear function that possesses all of the assets of linear models that can without difficulty be optimized with gradient-descent methods. thinking about the performance and generalization in deep gaining knowledge of, it's miles higher compared to different activation functions. Max Pooling is used to reduce the spatial dimensions of the output extent. Pool size is ready to 3 x three, and the ensuing output has a form (wide variety of rows or columns) of: form of output = (enter shape - pool size+ 1) / strides), in which strides have default price (1,1).

As shown in fig, four, the second one Convolution layer has one hundred filters and Kernel length is ready to a few x 3. it's far followed by means of Relu and MaxPooling layers. To insert the facts into CNN, the long vector of enter is surpassed via a Flatten layer which transforms matrix of features right into a vector that can be fed into a totally linked neural network classifier. To reduce overfitting a Dropout layer with a 50% danger of placing inputs to 0 is introduced to the version. Then a Dense layer of sixty four neurons with a Relu activation characteristic is added. The very last layer (Dense) with outputs for 2 instructions makes use of the SoftMax activation characteristic.

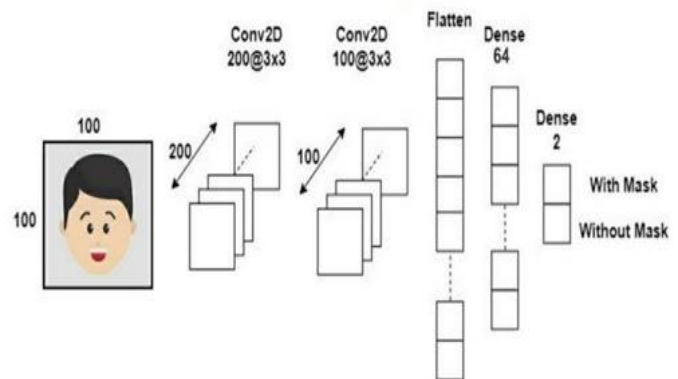


Fig. 4. Convolutional Neural Networkarchitecture

The studying manner needs to be configured first with the assemble approach. here “Adam” optimizer is used. express move entropy which is also known as multiclass log loss is used as a loss function (the goal that the model tries to minimize). as the hassle is a classification problem, metrics is set to “accuracy”.

F. Plotting the data and training the CNN model:

Fixing the blueprint to survey the records, the project calls for to be teaches the use of a selected dataset after which to be tested with respect to a distinct dataset. A proper venture and more advantageous teach check split assist to produce precised end result at the same time as taking a prediction. The test

length is ready to 0.1 i.e.,90% records of the dataset undergoes schooling and the relaxation 10% is going for testing functions. The validation loss is monitored using version Checkpoint. subsequent, the photos inside the schooling setand the test set are positioned to the Sequential version. here, 20p.cof the training statistics is used as validation statistics. The version is trained for 20 epochs (iterations) which continues a change-off among accuracy and probabilities of overfitting. Fig. five depicts visible representation of the proposed version.

VII. CONCLUSIONS

this text, concisely make clear the inspiration of the task at the start. Then, we embellished the enlightenment and execution of venture of the assignment. with the aid of the usage of the essential device mastering matters and clean method the version has reached valid accuracy charge which may be utilized in diverse form of software. protecting the face and nostril with face mas may be made obligatory soon, gazing the Covid scenario. all the public servants will order their personnel to put on face mask well for persevering with the work inside the company. The carried out undertaking will be enormously committed to maintaining the fitness of the public. destiny enhancement canbe done by extending to detect if the mask is disease prone ornot i.e., the different types of masks like N95 or not.

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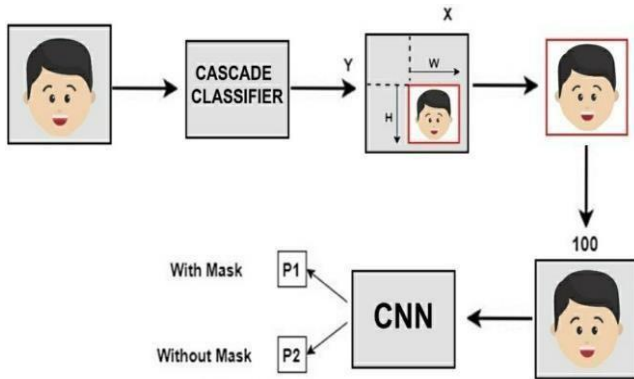


Fig. 5. Summary of the project

VI. RESULT AND ANALYSIS

The challenge is fashioned, authenticated, and trialed on two sort of datasets specifically masked and non-masked datasets. With appreciate to dataset no 1 i.e., masked dataset, the procedure reaches the precision as much as 98.23%. It represents how this most appropriate precision relieve the rate of error. Dataset quantity 2 is highly adaptable than dataset number 1 as it has multiple faces in the information body and numerous sorts of face masks having numerous colors too. therefore, the venture reaches an precision of 94.fifty nine% on dataset represent the difference between formed and authenticated loss with appreciate to dataset number 2. The critical cause for attaining this precision lies in calculating the maximum price in every patch. It gives an elementary transferal unchanging to the internal description with minimization in the wide variety of parameters the project has to examine. This finite distinction method down-samples the enter description containing of photograph, by using minimizing its dimensions. the whole variety of neurons has the greatest value of sixty four which isn't always clearly huger. a far higher quantity of neurons and filters can cause worse execution. The ultimate clear out values and pool size help to kind out the primary element to come across the photograph to locate the presence of the face masks nicely with out creating the over fittingness.

Important query as a result of the challenge are specially associated with different converting angles and shortage of clearness. blurred constantly converting faces within the video like format tough to understand. therefore, the distinct issues of the data frames video assist to take an correct decision – “the character is with or without masks”.