



## **AN AUTOMATED SYSTEM TO LIMIT COVID-19 USING FACIAL MASK DETECTION AND FACE RECOGNITION SYSTEM USING DEEP NEURAL NETWORK**

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### **ABSTRACT**

COVID-19 pandemic caused by novel corona virus is ceaselessly spreading so far everywhere the planet. The impact of COVID-19 has been fallen on most sectors of development. The attention system goes through a crisis. several preventative measures are taken to scale back the unfold of this sickness wherever carrying a mask is one in all them. during this paper, we have a tendency to propose a system that limit the expansion of COVID-19 by checking out those that aren't carrying any facial mask in an exceedingly sensible town network wherever all the general public places area unit monitored with television system (CCTV) cameras. whereas someone while not a mask is detected, the corresponding authority is knowledgeable through town network. A deep learning design is trained on a dataset that consists of pictures of individuals with and while not masks collected from varied sources. The trained design achieved ninety 88% accuracy on identifying folks with and while not a facial mask for antecedently unseen check knowledge. it's hoped that our study would be a useful gizmo to scale back the unfold of this disease for several countries within the world. COVID-19 epidemic has fleetly discontinuous our regular lives poignant the international trade and movements. carrying a mask to guard one's face has become the new traditional. within the close to future, several public service suppliers can expect the purchasers to wear masks fittingly to partake of their services. Therefore, mask detection has become a important duty to help worldwide civilization. This paper provides an easy thanks to accomplish this objective utilising some basic Machine Learning tools as TensorFlow, Keras, OpenCV and Scikit-Learn. The prompt technique with success recognises the face within the image or video then determines whether or not or not it's a mask thereon. As a police investigation job entertainer, it also can recognise a face along with a mask in motion yet as in an exceedingly video. The technique attains wonderful accuracy. we have a tendency to investigate best parameter values for the Convolutional Neural Network model (CNN) so as to spot the existence of masks accurately while not generating over-fitting.

**Keywords:** *Deep learning, Facial Mask Detection, COVID-19, Deep Learning, Convolutional Neural Network*

### **1. INTRODUCTION**

The field of computing (AI) analysis has advanced considerably in recent years, particularly within the space of machine learning. Any new developed technology is indivisible from the term AI. while not AI it's terribly troublesome these days to create any important progress in terms of technical innovation. AI is being thought of because the next massive factor that may modification the globe enormously. the utilization of neurobiology in market research could be a new field that provides an incredible promise, and the way neuro sciences need discipline that discipline needs nice expertise and expensive technology, that is usually not found in market research firms. several preventive measures are taken to fight against coronavirus. Among them cleanup hands, maintaining a secure distance, sporting a mask, refraining from touching eyes, nose, and mouth are the most, wherever sporting a mask is that the simplest one. COVID-19 could be a malady that unfold from human to human which may be controlled by making certain correct use of a facial mask. The unfold of COVID-19 will be restricted if folks strictly maintain social distancing and use a facial mask. Very sadly, folks aren't obeying these rules properly that is rushing the unfold of this virus. sleuthing the folks not obeying the principles and informing the corresponding authorities will be an answer in reducing the unfold of coronavirus. A mask detection could be a technique to seek out whether or not somebody is sporting a mask or not. it's the same as discover any object from a scene. several systems are introduced for object detection. Deep learning techniques are extremely utilized in medical applications. Recently, deep learning architectures have shown an interesting role in object detection. These architectures will be incorporated in sleuthing the mask on a face. Moreover, a sensible town means that associate degree geographic region that consists of the many IoT sensors to gather knowledge. These collected knowledge are then accustomed perform completely different operations across town. This includes watching traffic, utilities, water network, and lots of a lot of. Recently, the expansion of COVID-19 will be reduced by sleuthing the facial mask during a sensible town network. This paper aims at planning a system to seek out whether or not an individual is employing a mask or not and informing the corresponding authority during a sensible town network. Firstly, CCTV cameras are accustomed capture period of time video footage of various public places within the town. From that video footage, facial pictures are extracted and these pictures are accustomed establish the mask on the face. the educational formula Convolutional Neural Network (CNN) is employed for feature extraction from the pictures then these options are learned

by multiple hidden layers. Whenever the design identifies folks while not mask this info is transferred through town network to the corresponding authority to require necessary actions. The planned system appraised promising output on knowledge collected from completely different sources. we tend to additionally portrayed a system that may guarantee correct social control of the law on people that aren't following basic health tips during this pandemic state of affairs.

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## 2. RELATED WORK

In the meanwhile, several systems are developed for COVID-19 in good town networks. BlueDot and HealthMap services are introduced in [2]. BlueDot methodology was initial accustomed mark the cluster of bizarre malady[respiratory illness[respiratory disorder] in Wuhan that finally detected the disease as a scourge. It conjointly expected that the virus would unfold from Wuhan to national capital, Taipei, Singapore, Yeddo and urban center. HealthMap service, supported city, noticed the patients with a cough that is that the initial sign of COVID-19, victimization computer science (AI) and large knowledge. A study on victimization facemask to limit the expansion of COVID-19 is introduced in [4]. The study indicated that the masks that area unit adequately work, effectively interrupt the unfold of droplets expelled once coughing or innate reflex. Masks that don't seem to be utterly fitted, conjointly capable of holding mobile particles and viruses. Allam and Jones [3] planned a framework on good town networks specializing in however knowledge sharing ought to be performed throughout the eruption of COVID-19. P. Gupta, N. Saxena, M. Sharma, J. Tripathi (2018) has printed the paper on face recognition that introduces a brand new means people ing a deep neural network (another variety of deep network). during this planned approach, solely the extracted face expression area unit provided rather than providing raw component values as input. face expression area unit being extracted with the assistance of Haar Cascade and feeding these face expression instead of raw component values. because the range of re dundant input options has been weakened, the quality of the neural network-based recognition framework is additionally weakened. It conjointly makes the method lighter and quicker by victimization DNN rather than Convolutional Network. The planned methodology doesn't com promise the accuracy of the framework, as average accuracy therefore obtained is 96.05% [4]. K. J. Bhojane, S. S. Thorat (2018) has create use of embedding face detection and face pursuit system algorithmic rule found in MAT science lab with the assistance of Raspberry pi B, for face recognition system. to make a secure surroundings for ignition and access to the automotive, it uses the Haarlike perform that was accustomed acknowledge and recognize the documented user's face. The face of a private is that the main facet of the automotive ignition in secure surroundings. The ges ture identification and management analysis area unit taken into consideration for future work [5]. M. Rahman, S. Mahmud, J. Kim, Md. M. Manik, Md. M. Islam (2020) printed a document geared toward developing a system for deciding whether or not an individual uses a mask or not and informing the relevant authority within the good town network. It makes use of period of time motion-picture photography of assorted public places of the town to capture the facial pictures. The facial pictures extracted from this video is being accustomed establish the cloaked faces. The convolutional neural network (CNN) learning algorithmic rule is employed to extract options from pictures, when that those options area unit learned through multiple hidden layers. Whenever the design identifies individuals while not a mask, this info is more established the town network to the acceptable authority so as to require the mandatory actions. The planned system assessed promising results supported knowledge collected from varied sources. In these documents, they conjointly taken off a system that may guarantee correct enforcement against folks that don't follow basic health tips during this pandemic scenario [6].

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## 3. CONVOLUTION NEURAL NETWORK

A convolutional neural network may be a special design of artificial neural network planned by Yann Lecun in 1988. one among the foremost common uses of the design is image classification. CNNs have wide applications in image and video recognition, recommender systems and linguistic communication process. during this article, the instance that this project can take is expounded to pc Vision. However, the fundamental thought remains an equivalent and may be applied to the other use-case! CNNs, like neural networks, are created from neurons with learnable weights and biases. every somatic cell receives many inputs, takes a weighted total over them, pass it through associate activation perform associated responds with an output. the full network encompasses a loss perform and every one the information and tricks that we tend to developed for neural networks still apply on CNNs. in additional detail the image is suffered a series of convolution, nonlinear, pooling layers and totally connected layers, then generates the output. In deep learning, a convolutional neural network (CNN, or ConvNet) may be a category of deep, feed-forward artificial neural networks, most typically applied to analyzing visual mental imagery. Convolutional networks were galvanized by biological processes in this the property pattern between neurons resembles the organization of the cortical region. CNNs use comparatively very little pre-processing compared to different image classification algorithms. CNN may be a special reasonably multi-layer NNs applied to 2-d arrays (usually images), supported spatially localized neural input. CNN Generate 'patterns of patterns' for pattern recognition. every layer combines patches from previous layers. Convolutional Networks are trainable period architectures composed of multiple stages Input and output of every stage are sets of arrays known as feature maps. At output, every feature map represents a specific feature extracted in the least locations on input. every stage consists of: a filter bank layer, a non-linearity layer, and a feature pooling layer. A ConvNet consists of one, a pair of or three such 3-layer stages, followed by a classification module.

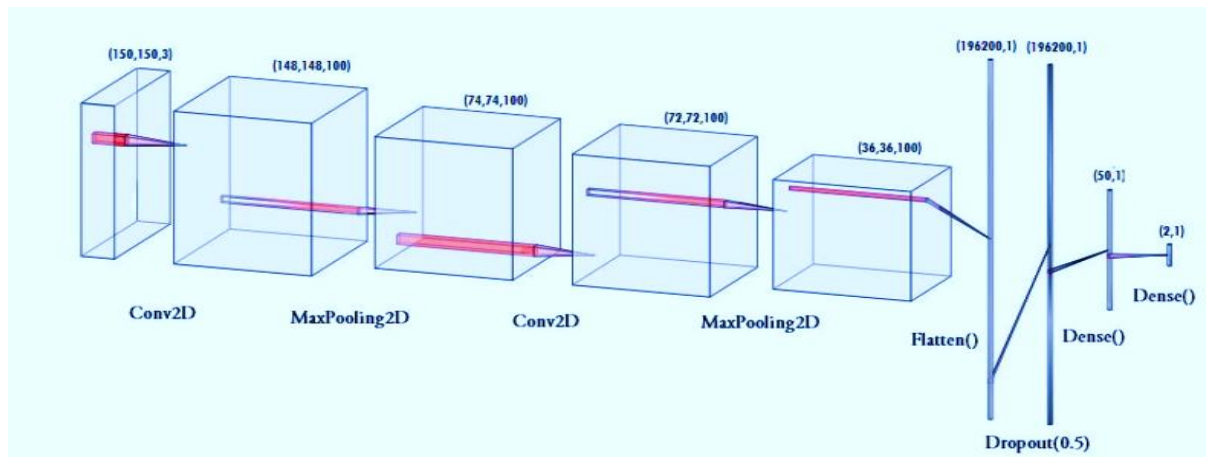


Fig.1 can proposed model

#### 4. METHODOLOGY

Our objective is to coach a specialised CNN model to sight whether or not or not somebody is sporting a mask. This project will instantly recognise the faces of the mask from any angle. It generates output from an RGB input image of any orientation. The first responsibility of this perform is to extract characteristics from pictures and predict that category they belong to. The feature extraction approach sketches the image and transforms it into a replacement image, that is additional economical than the previous image. The spatial property of pictures is reduced to AN economical illustration during this section. We projected an automatic good framework for screening persons United Nations agency don't seem to be employing a mask during this paper. within the good town, all public places are monitored by CCTV cameras. The cameras are accustomed capture pictures from public places; then these pictures are feed into a system that identifies if a person while not mask seems within the image. If a person while not a mask is detected then this data is distributed to the right authority to require necessary actions. The diagram of the developed framework is pictured in Fig. All the blocks of the developed system are delineating as follows.

- A) Image Preprocessing the pictures captured by the CCTV cameras needed preprocessing before progressing to following step. within the preprocessing step, the image is reworked into a grayscale image as a result of the RGB color image contains such a lot redundant data that's not necessary for mask detection. RGB color image hold on twenty four bit for every pel of the image. On the opposite hand, the grayscale image hold on eight bit for every pel and it contained spare data for classification. Then, we have a tendency to reshaped {the pictures|the pictures|the photographs} into (64×64) form to take care of uniformity of the input images to the design. Then, the pictures are normalized and once standardization, the worth of a pel resides within the vary from zero to one. standardization helped the training algorithmic program to be told quicker and captured necessary options from the pictures.
- B) Deep Learning design The deep learning design learns numerous vital nonlinear options from the given samples. Then, this learned design is employed to predict antecedently unseen samples. to coach our deep learning design, we have a tendency to collected pictures from completely different sources. The design of the training technique extremely depends on CNN. All the aspects of deep learning design are delineate below.
  - i) informationset Collection: Data from 2 completely different sources [9] are collected for coaching and testing the model. we have a tendency to collected a complete of 855 pictures of individuals with masks and 681 pictures of individuals while not a mask. For coaching functions, eighty three pictures of every category are used and also the remainder of the pictures are utilised for testing functions. Fig shows a number of the pictures of 2 completely different categories.
  - ii) design Development: the training model is predicated on CNN that is incredibly helpful for pattern recognition from pictures. The network contains AN input layer, many hidden layers ANd an output layer. The hidden layers carries with it multiple convolution layers that learn appropriate filters for vital feature extraction from the given samples. The options extracted by CNN are utilized by multiple dense neural networks for classification functions. they'd return to the neck of the woods wherever the person while not a mask was detected and took necessary actions. If correct actions are taken, then folks won't are available public places while not a facial mask that may facilitate greatly to limit the expansion of COVID-19.

#### 5. PROPOSED MODEL

Data visualisation begins by visualising the whole variety of images in each classes in our dataset. we will observe that the 'yes' category has 698 images whereas the 'no' category has 685 photos. information Augmentation within the next step, we tend to augment our dataset to incorporate additional variety of pictures for our coaching. during this step of information augmentation, we tend to rotate and flip every of the pictures in our dataset. cacophonous the information during this step, we tend to split our information into the coaching set which is able to contain the pictures on that the CNN model are trained and therefore the check set with the pictures on that our model are tested. Building the Model within the next step, we tend to build our consecutive CNN model with numerous layers like Conv2D, MaxPooling2D, Flatten, Dropout and Dense. when building our model, allow us to produce the 'train\_generator' and 'validation\_generator' to suit them to our model within the next step. coaching the CNN model it's a very important step wherever the pictures slot in the coaching set and to the check set for consecutive model

by victimization keras library. This model is trained for thirty epochs (iterations). For high accuracy we've got to use additional variety of epochs in its coaching there it happens over-fitting. Labeling the knowledge when building the model, we tend to label 2 possibilities for our results. ['0' as 'without\_mask' and '1' as 'with\_mask']. I'm conjointly setting the boundary parallelogram color victimization the RGB values, mercantilism the Face detection Program when this, we tend to will use it to notice if we tend to square measure sporting a mask victimization our PC's digital camera. For this, first, we want to implement face detection. In this, I'm victimization the Haar Featurebased Cascade Classifiers for detective work the options of the face. detective work the Faces with and while not Masks within the last step, we tend to use the OpenCV library to run an infinite loop to use our internet camera within which we tend to notice the face victimization the Cascade Classifier.

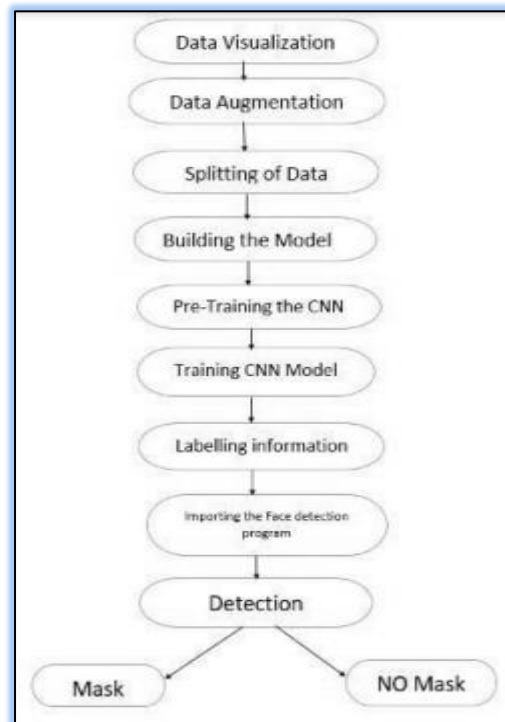


Fig.2.setup model flowchart

## 6. RESULTS

By conserving an inexpensive proportion of various categories, the dataset is divided into coaching and testing set. The dataset contains of 1638 samples in total wherever eighty three is employed in coaching section and twenty second is employed in testing section. The coaching and testing dataset contains 1281 and 303 pictures severally. The developed design is trained for a hundred epochs since any coaching results cause overfitting on the coaching knowledge. Over fitting happens once a model learns the unwanted patterns of the coaching samples. Hence, coaching accuracy will increase however check accuracy decreases. It show the graphical read of accuracy and loss severally. The trained model showed 98.6% accuracy and AUC of 0.985 on the unseen check knowledge

## 7. CONCLUSION

Measures should be taken to regulate the unfold of the COVID19 pandemic. This mask recognition system may be a superb and economical thanks to do therefore. The system can separate the individuals from the group World Health Organization aren't sporting mask. The identification of people, violating the COVID norms will increase the ability of the mask detection system for the general public sake. If applied in a very correct approach, the mask detection system may be wont to certify our safety and for others too. This approach offers not solely helps in achieving high preciseness however conjointly enhance the face detection tempo significantly. The system may be applied in several areas like railroad line stations, markets, schools, railway stations and plenty of alternative jammed places to observe the group and to make sure that eV everyone is sporting mask. Finally, this work may be used for future researchers and enthusiasts. Firstly, this model may be utilized in any high-definition camcorders, this can certify that this model isn't restricted to solely mask detection system. Secondly, this may be used for biometric scans with a mask on the face.

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