Global Journal on Innovation, Opportunities and Challenges in AAI and Machine Learning
http://eurekajournals.com/IJIOCAAIML.html
ISSN: 2581-5156

A Real time analysis of Face Mask: Safest Side from COVID-19

Surbhi Sharma[1], Ankur Mishra[2]

[1]Asst. Professor, Department of IT, SKIT, M&G Jaipur, Rajasthan.
[2]Asst. Professor, Department of CE, SKIT, M&G Jaipur, Rajasthan.

Abstract

In the present scenario of COVID -19 pandemic to detect the face mask is an important application of machine learning and Internet of Things and having highly significant for the same. In the recent time significance of machine learning project growing very fast day by day. In the proposed work, we will introduce the innovative face mask detection methods by using the visual features of face like facial tone, facial expression rather than conventional old face mask detection methods which was only based to detect eyes states and the position of eyes to identify the relative position of mask. face mask detection is very challenging task because it involves the many complex aspects like intensity variation due to the effect of lighting, person wears spaces and glasses or having beard on face or some dark makeup on face. In this work we propose to implement an IoT based hardware system based on infrared light sensor to overcome the challenges face during mask detection. In the proposed work, we have followed the face detection step, the facial component analysis and identify the features which is effective and important for face mask detection than we have to extract and track the features in the sequence of video frames. Proposed system has been tested and implemented in a real environment and the system generate the accuracy of 100%.

Keyword: Machine Learning, Face Mask Detection, facial components.

Introduction to Artificial Intelligence based Approach

AI (ML) is the logical investigation of calculations and factual models that PC frameworks use to play out a particular assignment without utilizing express guidelines, depending on examples and deduction all things being equal. It is viewed as a subset of computerized reasoning. AI calculations construct a numerical model dependent on example information, known as "preparing information", to settle on expectations or choices without being expressly customized to play out the assignment. AI calculations are utilized in a wide assortment of utilizations, for example, email separating and PC vision, where it is troublesome or infeasible to build up a regular calculation for successfully playing out the assignment. The name AI was begat in 1959

by Arthur Samuel. Tom M. Mitchell gave a broadly cited, more proper meaning of the calculations concentrated in the AI field: "A PC program is said to gain as a matter-of-fact E as for some class of undertakings T and execution measure P if its exhibition at assignments in T, as estimated by P, improves with experience E. "This meaning of the errands where AI is concerned offers an on a very basic level operational definition instead of characterizing the field in intellectual terms. This follows Alan Turing's proposition in his paper "Registering Machinery and Intelligence", in which the inquiry "Can machines believe?" is supplanted with the inquiry "Can machines do what we (as intuition elements) can do?". In Turing's proposition the different attributes that could be controlled by a reasoning machine and the different ramifications in developing one are uncovered. AI came to presence with the idea of man-made consciousness which gives the machine to get clever. It gives the machine another ability to learn and to anticipate things soon dependent on the learning. 2016 is the year when man-made reasoning (AI) grew up. With AlphaGo vanquishing the top human Go players, this has genuinely seen the enormous potential in man-made brainpower (AI), and have started to expect more perplexing, forefront AI innovation in numerous applications, including driverless vehicles, clinical consideration, money, and so on Today, AI innovation is demonstrating its qualities in pretty much every industry and different backgrounds. Nonetheless, glancing back at the advancement of AI, it is unavoidable that the improvement of AI has encountered a few high points and low points. AlphaGo in 2016 utilized a sum of 3,00,000 games as preparing information to accomplish the phenomenal outcomes. With AlphaGo's prosperity, individuals normally trust that large information driven AI like AlphaGo will be acknowledged soon in all parts of our lives. Nonetheless, this present reality circumstances are to some degree frustrating: with the special case 9 of few ventures, most fields have just restricted information or low-quality information, making the acknowledgment of AI innovation more troublesome than we suspected. Would it be conceivable to meld the information in a typical site, by moving the information across associations? Indeed, it is exceptionally troublesome, if certainly feasible, by and large to break the boundaries between information sources. By and large, the information needed in any AI project includes various sorts. For instance, in an AI-driven item suggestion administration, the item merchant has data about the item, information of the client's buy, yet not the information that portrays the client's buying capacity and instalment propensities. In many businesses, information exists as segregated islands. Because of industry rivalry, protection security, and confounded regulatory methodology, even information mix between various branches of a similar organization faces weighty obstruction. It is practically difficult to incorporate the information spread around the country and establishments, or the expense is precluded.

Requirement of Face Mask Detection

The task is about the location of mask on human face. It is finished utilizing the Artificial Neural Network, where we need to prepare a fake neural organization to accomplish crafted by recognition of mask on human face. After the preparation of the model the prepared model is utilized on the planet to execute the genuine condition. It turns out like for distinguishing the face since the camera is centred around individual, we can try not to deal with the picture at the corners along these lines lessening a lot of preparing required. When the district of interest is characterized, the face has been distinguished, the area of interest is presently the face, as the

subsequent stage includes identifying eyes, nose, mouth and so on to recognize the eyes, nose, mouth and so on, rather than preparing the whole face locale, we mark an area of interest inside the face district which further aides in accomplishing the essential objective of the proposed framework. Then, we need a picture of a mask (with a straightforward foundation, for example, the one underneath. This cover will be naturally applied to the face by utilizing the facial tourist spots (in particular the focuses along the jawline and nose) to register where the mask will be set. The mask is then resized and turned, setting it on the face.

Literature Survey

Article discovery is one of the moving subjects in the field of picture preparing and PC vision. Going from limited scope individual applications to enormous scope modern applications, object identification and acknowledgment is utilized in a wide scope of enterprises. A few models incorporate picture recovery, security and knowledge, OCR, clinical imaging and agrarian checking. In article identification, a picture is perused and at least one items in that picture are classified. The area of those items is additionally determined by a limit called the jumping box. Customarily, scientists utilized example acknowledgment to foresee faces dependent on earlier face models. An advancement face location innovation at that point was created named as Viola Jones locator that was a streamlined strategy of utilizing Haar [1], computerized picture highlights utilized in article acknowledgment. Be that as it may, it fizzled on the grounds that it didn't perform well on appearances in dim territories and non-frontal countenances. From that point forward, specialists are anxious to grow new calculations dependent on profound figuring out how to improve the models. Profound learning permits us to learn highlights with start to finish way and eliminating the need to use earlier information for framing highlight extractors. There are different strategies for object identification dependent on profound realizing which are partitioned into two classes: one phase and two phase object indicators.

The task relies upon the fake neural organization wherein we have prepared a neural organization to recognize if the individual is wearing a cover. The past rendition of the undertaking was concentrated over the IEEE research paper it recognizes the substance of the human, the eyes, ears and nose of the human. In this task we distinguish the facial highlights of the human utilizing the Haar Cascade calculation. To make our face veil identifier, we prepared a two-class model of individuals wearing covers and individuals not wearing covers. We adjusted MobileNetV2 on our cover/no veil dataset and acquired a classifier that is ~99% accurate. We at that point took this face veil classifier and applied it to the two pictures and constant video transfers by:

Detecting faces in images/video

- Extracting each individual face
- Applying our face mask classifier

Problem Area and Feasible Solution

Masks are a vital measure to smother transmission and save lives. Masks ought to be utilized as a feature of an extensive 'Do everything! ' approach including physical separating, evading

swarmed, shut and close-contact settings, great ventilation, cleaning hands, covering wheezes and hacks, and that's just the beginning. Presently what you occur on the off chance that you were not to wear veils in a public region, you put yourself in peril as well as puts you family in danger, to battle such issue and to screen such zones Face Mask Detection apparatus is created.

Requirement Analysis of Problem Domain

We have been feeling down and discouraged about the condition of the world-a huge number of individuals are passing on every day, and for a considerable lot of us, there is next to no (regardless) we can do.

To help keep everybody spirts up, we chose to apply PC vision and profound figuring out how to take care of a true issue. The proposed work is needed for the identification of the cover on a human face i.e if the human is wearing a mask. It helps the experts in packed region to recognize individuals wearing mask and not wearing mask. By making this data into thought appropriate move can be taken against individuals not wearing cover.

In order to train a custom face mask detector, we need to break our approach into two distinct phases, each with its own respective sub-steps (as shown by Figure 1 below):

1. Training: Here we'll focus on loading our face mask detection dataset from disk, training a model (using Keras/ TensorFlow) on this dataset, and then serializing the face mask detector to disk
2. Deployment: Once the face mask detector is trained, we can then move on to loading the mask detector, performing face detection, and then classifying each face as with_mask or without_mask

We'll review each of these phases and associated subsets in detail in the remainder of this tutorial, but in the meantime, let's take a look at the dataset we'll be using to train our COVID-19 face mask detector.

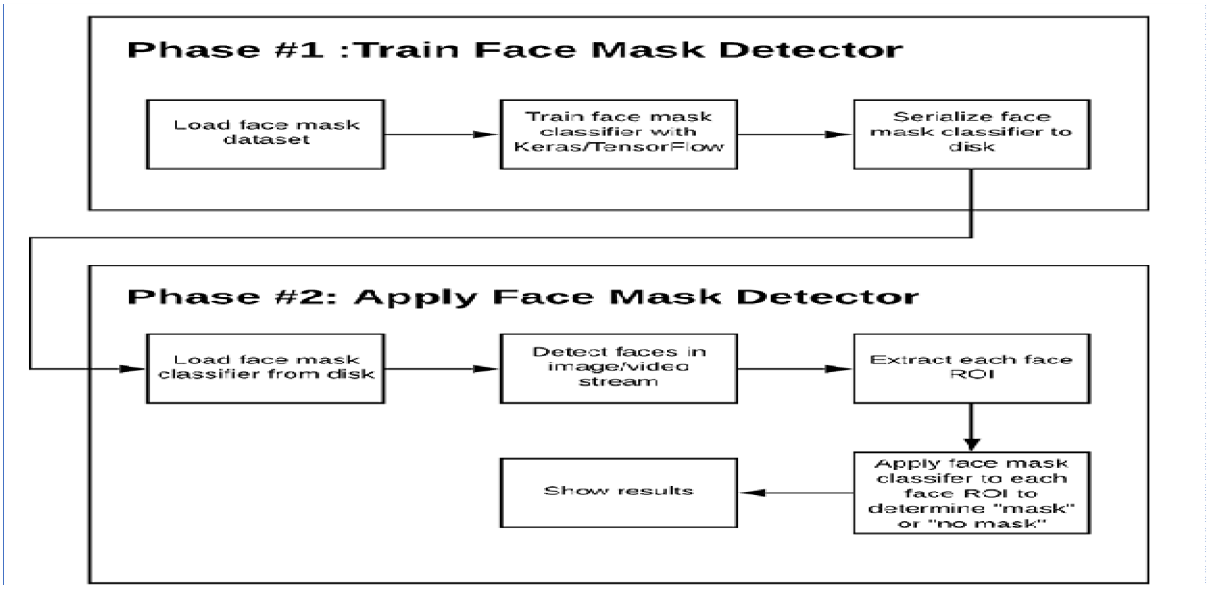

Figure 1.Face mask Detection Steps

Design and Implementation of Proposed Work

Software design is a process to transform user requirements into some suitable form, which helps the programmer in software coding and implementation. Here, we design a system that detects whether a person Is wearing a mask or not. So, to prevent spread of COVID-19. It also helps the authorities to make sure whether the person should be allowed in a premises or not.System Diagrams are models used to visually express the dynamic forces acting upon the components of a process and the interactions between those forces. System Diagrams are more than process flow charts. In this system diagram, we have to represent the full process of the Face Mask Detection starting from the video acquaintance to the Face Mask detection.

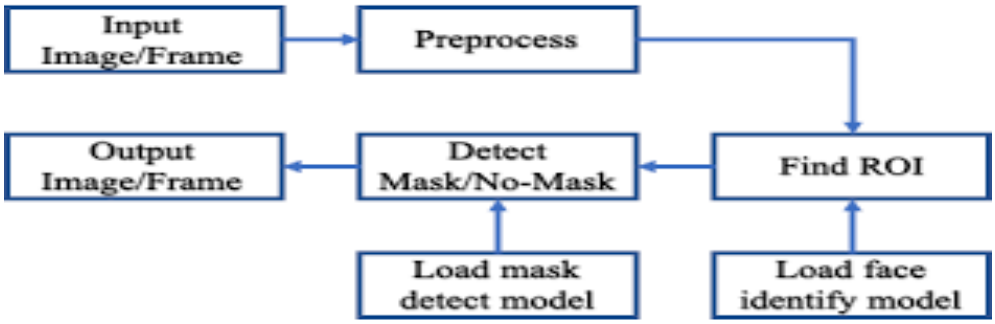

Figure 2.System Diagram of face mask Detection

Execution steps of Proposed Work

Facial landmarks allow us to automatically infer the location of facial structures, including:

- Eyes
- Eyebrows
- Nose
- Mouth
- Jawline

Step-1 &2 To use facial landmarks to build a dataset of faces wearing face masks, we need to first start with an image of a person *not* wearing a face mask after that we apply face detection to compute the bounding box location of the face in the image:

Figure 3.Step 1 and 2 of face mask implementation

Step 3: Once we know *where* in the image the face is, we can extract the face Region of Interest (ROI):

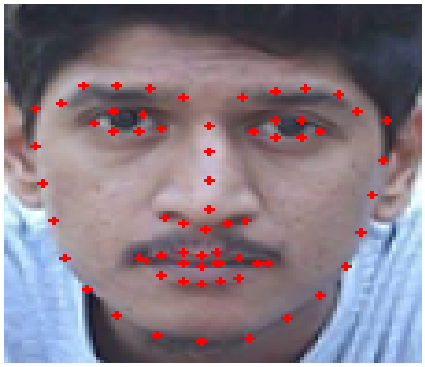

Figure 4.Region of interest highlighted with red colour

Step 4: After that, we need an image of a mask (with a transparent background) such as the one below:

Figure 5.Transparent background face mask

Step 5: This mask will be *automatically* applied to the face by using the facial landmark (namely the points along the chin and nose) to compute *where* the mask will be placed.The mask is then resized and rotated, placing it on the face:

Figure 6.Face Mask applied successfully

We can then repeat this process for all of the input images, thereby creating our artificial face mask dataset for further processing and research analytics.

Conclusion and future outcomes

To mitigate the spread of COVID-19 pandemic, measures must be taken. In the proposed work a face mask detector using SSD architecture and transfer learning methods in neural networks. To train, validate and test the model, we used the dataset that consisted of 1916 masked faces images and 1919 unmasked faces images. These images were taken from various resources like Kaggle and RMFD datasets. The model was inferred on images and live video streams. To select a base model, we evaluated the metrics like accuracy, precision and recall and selected MobileNetV2 architecture with the best performance having 100% precision and 99% recall. It is also computationally efficient using MobileNetV2 which makes it easier to install the model to embedded systems. This face mask detector can be deployed in many areas like shopping malls, airports and other heavy traffic places to monitor the public and to avoid the spread of the disease by checking who is following basic rules and who is not.

Future Enhancements

More than fifty countries around the world have recently initiated wearing face masks compulsory. People have to cover their faces in public, supermarkets, public transports, offices, and stores. Retail companies often use software to count the number of people entering their stores. They may also like to measure impressions on digital displays and promotional screens. We are planning to improve our Face Mask Detection tool and release it as an open-source project. Proposed work can be equated to any existing USB, IP cameras, and CCTV cameras to detect people without a mask. This detection live video feed can be implemented in web and desktop applications so that the operator can see notice messages. Software operators can also get an image in case someone is not wearing a mask. Furthermore, an alarm system can also be implemented to sound a beep when someone without a mask enters the area. This system can also be connected to the entrance gates and only people wearing face masks can come in and it's a beneficial example of IoT when implemented using hardware along with proposed software system.

References

P. Viola and M. Jones, “Rapid object detection using a boosted cascade of simple features,” in Proceedings of the 2001 IEEE computer society conference on computer vision and pattern recognition. CVPR 2001, vol. 1. IEEE, 2001, pp. I-I.

R. Girshick, J. Donahue, T. Darrell, and J. Malik, “Rich feature hierarchies for accurate object detection and semantic segmentation,” in Proceedings of the IEEE conference on computer vision and pattern recognition, 2014, pp. 580-587.

R. Girshick, “Fast r-cnn,” in Proceedings of the IEEE international conference on computer vision, 2015, pp. 1440-1448.

S. Ren, K. He, R. Girshick, and J. Sun, “Faster r-cnn: Towards real-time object detection with region proposal networks,” in Advances in neural information processing systems, 2015, pp. 91-99.

W. Liu, D. Anguelov, D. Erhan, C. Szegedy, S. Reed, C.-Y. Fu, and A. C. Berg, “Ssd: Single shot multibox detector,” in European conference on computer vision. Springer, 2016, pp. 21-37.

J. Redmon, S. Divvala, R. Girshick, and A. Farhadi, “You only look once: Unified, real-time object detection,” in Proceedings of the IEEE conference on computer vision and pattern recognition, 2016, pp. 779-788.

T.-Y. Lin, P. Goyal, R. Girshick, K. He, and P. Dollar, “Focal loss for dense object detection,” 2017.

Haddad, J., 2020. How I Built A Face Mask Detector For COVID-19 Using Pytorch Lightning. [online] Medium. Available at: https://towardsdatascience.com/how-i-built-a-face-mask-detector-for-COVID-19-usingpytorch-lightning-67eb3752fd61.

Rosebrock, A., 2020. COVID-19: Face Mask Detector With Opencv, Keras/Tensorflow, And Deep Learning-Pyimagesearch. [online] PyImageSearch. Available at: https://www.pyimagesearch.com/2020/05/04/COVID19-face-mask-detector-with-opencv-keras-tensorflow-and-deep-learning/.

W. Liu, D. Anguelov, D. Erhan, C. Szegedy, S. Reed, C.-Y. Fu, and A. C. Berg, “Ssd: Single shot multibox detector,” in European conference on computer vision. Springer, 2016, pp. 21-37.

Francois Chollet “Xception: Deep Learning with Depthwise Separable Convolutions” in Proceedings of the IEEE conference on computer vision and pattern recognition (CVPR), 2017, pp. 1251-1258.

M. Sandler, Andrew Howard, Menglong Zhu, Andrey Zhmoginov, and Liang-Chieh Chen, “MobileNetV2: Inverted Residuals and Linear Bottlenecks,” in Proceedings of the IEEE conference on computer vision and pattern recognition(CVPR), 2018.

Keras code inspiration taken from https://github.com/chandrikadeb7/Face-Mask-Detection.