

# Real-Time Facemask Recognition With Voice Alert Using Deep Learning

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**Abstract-** The corona virus COVID-19 pandemic is causing a global health crisis so the effective protection methods is Wearing a face mask in public areas according to the World Health Organization (WHO). The COVID-19 pandemic forced governments across the world to impose lockdowns to prevent virus transmissions. Reports indicate that wearing facemasks while at work clearly reduces the risk of transmission. An efficient and economic approach of using AI to create a safe environment in a manufacturing setup. A hybrid model using deep and classical machine learning for face mask detection will be presented. A face mask detection dataset consists of with mask and without mask images, we are going to use OpenCV to do real-time face detection from a live stream via our webcam. We will use the dataset to build a COVID-19 face mask detector with computer vision using Python, OpenCV, and PyTorch and Keras. Our goal is to identify whether the person on video stream is wearing a face mask or not with the help of computer vision and deep learning.

**Keywords-** Machine Learning, Deep Learning, OpenCV, Tensorflow, Keras, PyTorch.

## I. INTRODUCTION

The trend of wearing face masks in public is rising due to the COVID-19 corona virus epidemic all over the world. Before Covid-19, People used to wear masks to protect their health from air pollution. While other people are self-conscious about their looks, they hide their emotions from the public by hiding their faces. Scientists proved that wearing face masks works on impeding COVID-19 transmission. COVID-19 (known as corona virus) is the latest epidemic virus that hit the human health in the last century. In 2020, the rapid spreading of COVID-19 has forced the World Health Organization to declare COVID-19 as a global pandemic.

More than five million cases were infected by COVID-19 in less than 6 months across 188 countries.

The corona virus epidemic has given rise to an extraordinary degree of worldwide scientific cooperation. Artificial Intelligence (AI) based on Machine learning and Deep Learning can help to fight Covid-19 in many ways.

Machine learning allows researchers and clinicians evaluate vast quantities of data to forecast the distribution of COVID-19, to serve as an early warning mechanism for potential pandemics, and to classify vulnerable populations. The provision of healthcare needs funding for emerging technology such as artificial intelligence, IoT, big data and machine learning to tackle and predict new diseases. In order to better understand infection rates and to trace and quickly detect infections, the AI's power is being exploited to address the Covid-19 pandemic. People are forced by laws to wear face masks in public in many countries. These rules and laws were developed as an action to the exponential growth in cases and deaths in many areas. However, the process of monitoring large groups of people is becoming more difficult. The monitoring process involves the detection of anyone who is not wearing a face mask.

Here we introduce a mask face detection model that is based on computer vision and deep learning. The proposed model can be integrated with surveillance cameras to impede the COVID-19 transmission by allowing the detection of people who are wearing masks not wearing face masks. The model is integration between deep learning and classical machine learning techniques with opencv, tensor flow and keras. We have used deep transfer learning for feature extractions and combined it with three classical machine learning algorithms. We introduced a comparison between them to find the most suitable algorithm that achieved the highest accuracy and consumed the least time in the process of training and detection

## II. LITERATURE REVIEW

[1] S. Ge, J. Li, Q. Ye and Z. Luo, "Detection of Masked Faces in the Wild with LLE-CNNs,"

The growth rate. Z., Luo studies the identification of people with full-face or partial occlusion. This approach categorizes into way, people with hand over their faces or occluded with objects. This approach is not suited to our scenario, which requires, in essentially, to detect faces that have their mouths covered with masks such as scarves, mufflers, handkerchiefs, etc

**[2] Glass RJ, Glass LM, Beyeler WE, Min HJ. Targeted social distancing face mask architecture for pandemic influenza. *Emerging Infectious Diseases*.**

Compared to OpenCV which is used in a number of computed components, it is unable to resolve the imbalanced workload issue experienced during the implementation of the Viola Jones face detection algorithm in GPUs. Glass et al. addressed the importance of social differencing and how the risk of pandemic growth can be slowly decreased by successfully preserving social distance without the use of vaccines or antiviral drugs.

**[3] P. Viola and M. Jones, “Rapid object detection using a boosted cascade of simple features,”.**

Viola Jones detector optimized the features of Haar , but failed to tackle the real world problems and was influenced by various factors like face brightness and face orientation. Viola Jones could only detect frontal well lit faces. It failed to work well in dark conditions and with non-frontal images. These issues have made the independent researchers work on developing new face detection models based on deep learning, to have better results for the different facial conditions.

**[4] J. Li, J. Zhao, Y. Wei, C. Lang, Y. Li, and J. Feng, “Towards real world human parsing: Multiple-human parsing in the wild,” .**

We have developed our face detection model using Multi Human Parsing Dataset, based on fully convolution networks, such that it can detect the face in any geometric condition frontal or non-frontal for that matter. Convolution Networks have always been used for image classification tasks.

**[5].M. Kavitha, S. M. M. Roomi, K. Priya, K. B. Devi, “State model based face mask detection”.**

However, performance-wise, it is too heavy for low-power IoT devices, such as Raspberry Pi. On the other side, in this work, a state model-based solution for face mask detection relying on Viola-Jones algorithm in context of ATM center security was described.

**[6].R. Biswas, A. Roy, Real Time Temperature Graph using MATLAB and Arduino”**

When it comes to temperature sensing, there are several variants of Arduino-based solutions. In this work, Arduino was used for real-time temperature visualization

using MATLAB. However, the used sensor does not allow contactless temperature sensing.

**[7].J. Davies, R. Studer and P. Warren, Semantic Web Technologies: Trends and Research in Ontology-based Systems**

The role of semantic technology is to enable encoding the meaning of data separately from the content itself and related applications, which provides the ability to understand data, exchange its understanding and perform reasoning on top of it. In this case, the formalization of knowledge is done in a form that is understandable for both humans and machines. Within the semantic knowledge bases, the data is represented with respect to ontologies.

### III. EXISTING SYSTEM

In this existing method of obtaining segmentation masks directly from the images containing one or more faces in different orientation. Initially the pixel values of the face and background are subjected to global thresholding. After that its passed through median filter to remove the high frequency noise and then subjected to Closing operation to fill the gaps in the segmented area. After this bounding box is drawn around the face segmented area.

### IV. PROPOSED SYSTEM

To identify the person on video stream wearing face mask with the help of computer vision and deep learning algorithm by using the PyTorch library. The dataset collected contains 3000 images using 224x224 pixel resolution and achieved an increased accuracy rate to the performance of the trained model. The system develops a python based real-time facemask recognition that voice alert and detect the face if the person is not wearing a facemask and mail notification also send by using SMTP protocol..

### V. MODULES

#### A. IMAGE EXTRACTION MODULE:

In this module, the video captured in the camera will be segmented and the images will be extracted as frames. Its respective keyword for efficient search result.

#### B. PROCESSING MODULE:

In this module, the extracted images will be processed by predicting hue saturation value, key descriptors and by performing gray level conversion.

### C. DEEP CONVOLUTIONAL NEURAL NETWORK MODULE:

In this module, neural network performs the feature extraction from the pre-stored images to predict the presence of faces in the input image.

### D. COMPARISON MODULE:

This module will compare the images stored in the database and the input image to recognize the face in the image using facial landmark algorithm.

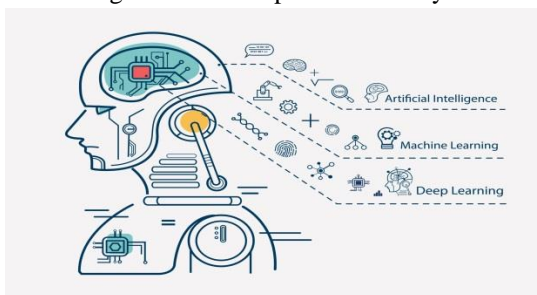
### E. ALERTING MODULE:

This module will alert the person who is not wearing face mask which is detected by using image processing technique. This will warn the person to wear face mask. In this module also, the mail notification alert also sending by using SMTP protocol.

## VI. BACKGROUND OF THE STUDY

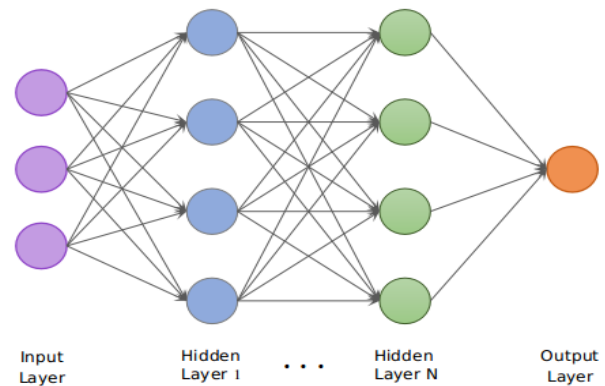
### A. MACHINE LEARNING:

Machine Learning or ML is a study of computer algorithms that learns and enhance automatically through experience. It seems to be a subset of artificial intelligence. A machine learning algorithm builds a mathematical model based on "training data", in order to make decisions or predictions without being explicitly programmed to do so. Machine learning algorithms are used in a variety of applications from email filtering to computer recognition, where it is difficult or impossible to develop general skills to perform the required tasks. These studies are closely related to computer statistics, which focus on computer-generated domain. The data prediction and mining is a coherent field of study, focusing on the analysis of experimental data by unsupervised learning. In its application to business problems, machine learning is also called predictive analytics.



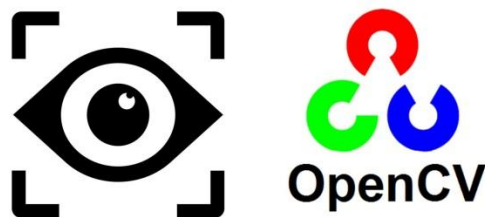
### B. DEEP LEARNING:

Deep learning methods aim to learn feature hierarchies with a high-level hierarchy which is structured by the construction of lower-level features. Automated learning at multiple levels of extraction allows a system to learn complex tasks to do input mapping directly from data to output, without relying entirely on man-made features. Deep learning algorithms capture unspecified structure inside the input distribution to find better characterization frequently at multiple levels, with high-level learning features in the context of low-level features.



### C. OpenCV:

OpenCV is a library which is used to develop computer based real-time applications. It majorly focuses on analysis including features like image processing, video capture and object detection and face detection. OpenCV We use the OpenCV library to execute infinite loops using our webcam, which detects faces using cascade classifications. The library has over 2000 optimized and advanced algorithms for computer vision based machine learning. These algorithms can be used for face detection and recognition, object detection, classifying human movements in video, tracking camera actions, tracking objects, taking 3D objects, adaptive thresholding and assembling together to produce high resolution image. It can also be useful in finding similar images from the database, removal of red eyes from photos taken with flash, follow the facial movements, and add tags to transition with advanced reality. It is continuously adding new modules to the latest algorithms from machine learning.

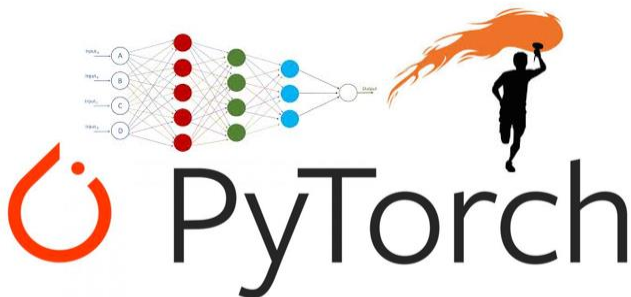


### D. KERAS:

Keras is an API for high level neural networking. It follows best practices to reduce the major burden and provides consistent and flexible APIs that reduce the number of user actions required for normal usage situations and provide clear and actionable error messages. It is written in Python programming language and has a large developer community and support. Keras includes several implementations of commonly used neural-network architecture, such as hosting devices to simplify the coding required to write layers, targets, optimizers, activation tasks, and an intensive neural network. It make easy to work with image and text data. The Keras models are easily deployable among various platforms.

**E. PYTORCH:**

PyTorch is an open source machine learning library based on the Torch library, used for applications such as computer vision and natural language processing, primarily developed by Facebook's AI Research lab. It is free and open-source software released under the Modified BSD license. Although the [Python](#) interface is more polished and the primary focus of development, PyTorch also has a [C++](#) interface. A number of pieces of [deep learning](#) software are built on top of PyTorch, including [Tesla Autopilot](#), [Uber's Pyro](#), [HuggingFace's Transformers](#), [PyTorch Lightning](#), and [Catalyst](#).



**VII. CONCLUSION**

As the technology are blooming with emerging trends the availability so we have novel face mask detector which can possibly contribute to public healthcare. In this proposed system, deep learning, video processing and CNN are used to detect whether people were wearing face masks or not. The models were tested with images and real-time video streams. By the development of face mask detection we can detect if the person is wearing a face mask and allow their entry would be of great help to the society. If not wearing mask it gives voice alert to user and send mail alert by using SMTP protocol.

**VIII. RESULTS**

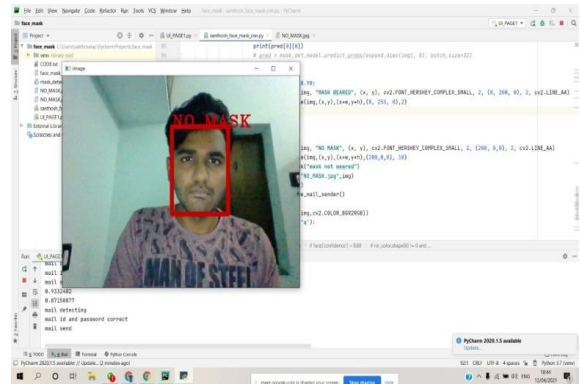


Fig.1. Mask Not Worned

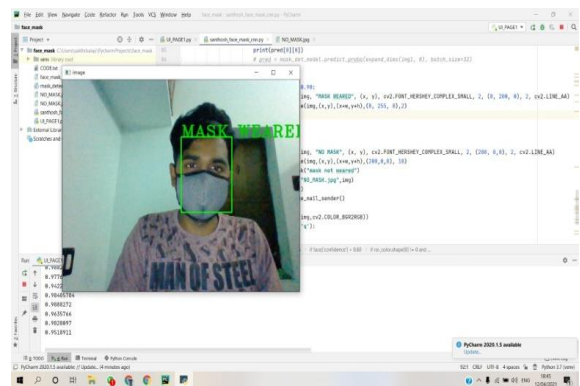


Fig.2. Mask Worned

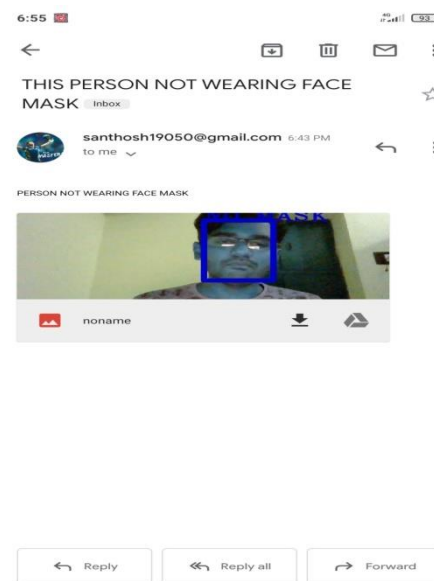


Fig.3. Mail Alert

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