Real Time Face Mask Detection Using Deep Learning

Prof. S. S. Muley[1], Akshay Suryawanshi[2], Apurva Sonawane[3], Pritesh Patil[4], Reuben Varghese[5]

Department of Computer Engineering, Marathwada Mitra Mandal's Institute of Technology, SPP University, Pune, India.

I. Abstract— Object detection is a computer-based technology that enables the user to identify and locate animate or inanimate objects present in an object or video. The advancement in technology is such that the entire globe can be put under surveillance with the implementation of object detection, computer vision research has been dominating for quite a while. Computer vision research deals with the programming of computers and designing an algorithm for understanding the input. the input can be derived from the real-world scene using video surveillance or image capture computer vision object detection has great influence in applications like image search, robot navigation, medical image analysis, the smartphone camera, and many more. One foremost safety method for human beings is to put on masks in public regions. The application detects faces and classifies if they are wearing a mask or not. We used a Deep learning method to perform face detection with OpenCV and TensorFlow/ Keras then we detect facial landmarks so that we know where the face is we used the MobileNetV2 classifier to fine tune this model.

Keywords— Artificial Intelligence, Deep Learning, Machine Learning, Object Detection, Face Mask Detection.

II. INTRODUCTION

As we all know Deep learning is an artificial intelligence function that helps to imitate the working of the human brain in processing data and creating patterns for use in decision making. With this deep learning week, we are using TensorFlow Keras, NumPy, OpenCV. Where Keras runs on top of the open-source machine libraries like TensorFlow, Theano, or Cognitive Toolkit TensorFlow used for creating a neural network and Deep model, it is the most famous symbolic mathematical library. TensorFlow is very flexible, and its primary benefit is distributed computing.

We had studied that NumPy is a Python package, NumPy is often used with packages like SciPy (Scientific Python). This combination is broadly utilized as a trade for MATLAB which is a popular platform for technical computing. Along with this we studied that NumPy can perform various operations like -Mathematical and logical operations on arrays, Fourier transforms and routines for shape manipulation, Operations related to linear algebra. NumPy has in-built functions for linear algebra and random number generation which majorly help us in process of developing the system of Face Mask Detection.

In our system for real-time computer vision the library of programming functions mainly aimed at OpenCV (Open-Source Computer Vision Library). In python, OpenCV is a library designed to solve computer vision problems.

As we are using Artificial Intelligence, Deep Learning, Machine Learning, Object Detection we are developing the system (Face Mask Detection) which helps us try to keep eye on public places as well as the huge crowd to control the situation. In this Current Pandemic Situation, the entire global decides to shut them out inside home strict for 15-20 days, the virus will starve to death as it will not get any host to survive. But here we are taking our chance the idea of face mask detection comes to me from a mundane thing. Our phone has a smile detector feature that captures images when it detects the smile on the user's face, without users using their hands. We imagined the same thing with my idea. If the crowd is brought under control by implementing computer vision the number of cases would be brought under control.

.III. Survey

1. Intelligence Face Mask Prediction System

In this paper, Covid-19 has constructed a very new frequency, and the humans have found out themselves getting into a brand-new world. While presently our society swiftly transforming, we want to be brief which will solution clean specifications, that have encircled all of us. Making the risk-loose environment concern in each human's thoughts in order that lifestyles may be conductive simply as before. Options want to be taken to stable all the ones going returned to our place of work and to maintain ourselves and our cherished ones without problems. Brand-new plans have methodized each day to satisfy regulations and regulations. Although face mask has become to be an entire new

important to be observant at some stage in the day and to behave towards the ones who've now no longer sporting mask in public locations or workplaces. Many components of society appear to be accepting a few Covid monitoring gears for safety. One of the maximum critical gear is a face mask detector. This device permits one to become aware of who's without a required face mask. These structures paintings with current surveillance structures alongside this idea are used in lots of fields along with crook utility as well.[1]

2. A Novel GAN Based Network for Unmasking or Masked faces

A Novel GAN Based Network for Unmasking or Masked faces on this method has been described the fashion of sporting face mask in public is growing because of the COVID-19 coronavirus epidemic everywhere in the world. Before Covid 19, People used to put on mask to guard their fitness from air pollution. While different human beings are self-aware of their looks, they conceal their feelings from the public via way of means of hiding their faces. Scientists proved that sporting face mask works on impeding COVID-19 transmission. COVID-19 (called coronavirus) is the modern-day epidemic virus that hit human fitness withinside the closing century]. In 2020, the fast spreading of COVID-19 has compelled the World Health Organization to claim COVID-19 as a worldwide pandemic. According to, greater than 5 million instances have been inflamed via way of means of COVID-19 in much less than 6 months throughout 188 countries. The virus spreads thru near touch and in crowded and overcrowded areas. It is awareness on interplay loose big item elimination from facial photograph that specialize in masked item it's far used GAN primarily based totally photograph inpainting thru photograph to photograph transaction method it's far used schooling schema discriminators for progressively getting to know worldwide coherence and deep lacking area is pretty powerful generating sensible and structurally is composed output.it successful to generating excessive perceptual first-class end result for big lacking hollow in face photograph as examine to different nation of the artwork different photograph enhancing method.[2]

3.Retina Face Mask: A Face Mask Detector

In this paper, it may make contributions to public healthcare. It used conventional item detection for multi-step processes. One main safety technique for human beings is to put on masks in public areas. Furthermore, many public provider carriers require clients to apply the provider most effectively in the event that they put on masks correctly. However, there are just a few studies research approximately face mask detection primarily based totally on picture analysis. In this paper, we advocate Retina Face Mask, which is an excessive accuracy and green face mask detector. The proposed Retina Face Mask is a one-level detector, which includes a function pyramid community to fuse excessive-stage semantic facts with a couple of function maps, and a singular context interest module to cognizance on detecting face masks. In addition, we additionally advocate a singular cross-elegance item elimination set of rules to reject predictions with low confidence and the excessive intersection of the union. Experiment outcomes display that Regina Face Mask achieves today's outcomes on a public face masks dataset with $2.3%$ and $1.5%$ better than the baseline bring about the face and masks detection precision, respectively, and $11.0%$ and $5.9%$ better than baseline for recall. Besides, we additionally discover the opportunity of enforcing Retina Face Mask with a light-weighted neural community Mobile Net for embedded or cell devices. The accuracy of the version is achieved, and the optimization of the version is a non-stop process. This particular version will be used as a use case of part analytics.[3]

4. Study of Masked Face Detection Approach in Video Analytics

In this paper, we've got analyzed 4 exceptional steps of masked face detection and their performance. Distance from the digital digicam being a greater dependable and correct step in comparison to different steps. Eye line detection is simple to put into effect however it results in fake detections in negative decision photos as depth degrees aren't actually distinguishable. Eye detection is dependable, however, it's miles liable to fake eye detection. Facial component detection is a strong and time-ingesting step.[4]

5. A Cascade Framework for Masked Face Detection

In this paper, we propose a new deep learning-based algorithm for masked face detection. Our algorithm is based on a newly designed CNN cascade framework consists of three CNNs. Besides, we propose a new dataset called the" MASKED FACE dataset" which has 160 images for training and 40 images for testing.[5]

6. Novel Presentation attack detection algorithm for face recognition system: Application to 3D face mask attack

In this paper, we deal with the trouble of appropriately detecting the presentation assault completed the use of a 3-d face masks at the face reputation system. We proposed a singular PAD set of rules primarily based totally on each neighborhood and international functions. The neighborhood functions are extracted to seize the artifacts in the attention and nostril area contributed because of the presence of the 3-d masks whilst international functions are used to extract the microtextured additives the use of BSIF.[6]

7. Facial Mask Detection using Semantic Segmentation

Facial Mask Detection using Semantic Segmentation in this approach we were able to generate accurate face masks for human objects from RGB channel images containing localized objects. We demonstrated our results on the Multi Human Parsing Dataset with mean pixel-level accuracy. Also, the problem of erroneous predictions has been solved and a proper bounding box has been drawn around the segmented region. The proposed network can detect non-frontal faces and multiple faces from a single image. The method can find applications in advanced tasks such as facial part detection.[7]

IV. PROPOSED SYSTEM

This system may be utilized in real-time packages that require face masks detection for safety motives because of the Covid 19 outbreak.

the video, it feeds and classifies the faces within the frame. If the individual isn't sporting the masks, the caution will sound.

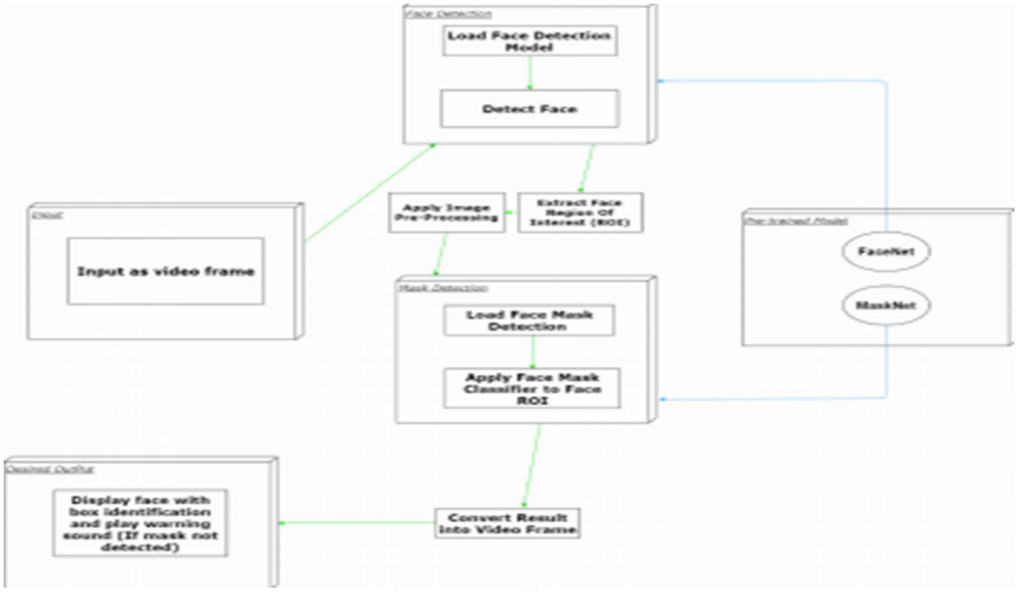

Fig.1 System Architecture

V. SYSTEM ARCHITECTURE

Here we use Deep Learning, OpenCV, TensorFlow / Keras, etc. to recognize the person who is wearing a mask or not. The system initializes the video/webcam to capture the video frame as input to the system. The system loads the face. The recognition model works as provided input. The image processing then classifies the human face, and the system applies image preprocessing to identify the face. The system then loads the recognition model for the face mask and the system applies the classifier mask to the face area of interest to determine "mask" or "no mask". The end-stage system would display the face with an identification box, if the detected mask system showed a green box around the face if the mask were not detected the system would show a red box around the face and play a warning tone.

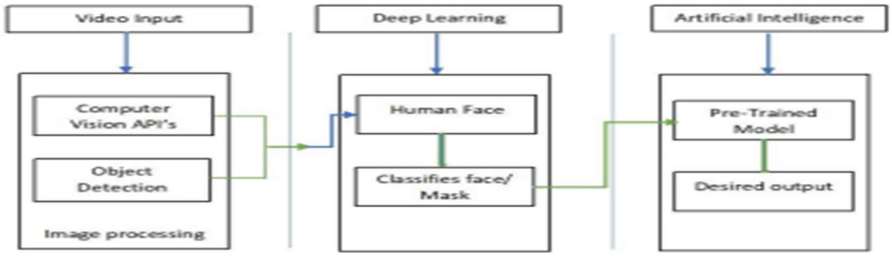

Fig. 2 System Overview

The Artificial Intelligence services will take the output of the previous two steps as an input. Artificial Intelligence will compare the data received with the pre-trained data models. Once the faces and mask are recognized as valid then it desired output.

VI. ALGORITHMS

Pre-Processing and Training on Dataset

INPUT: Images along with their pixel's values.

OUTPUT: Trained Model.

STEP 1: Load Images and their pixel values.

STEP 2: Process the images, i.e., resizing, normalization, and conversion to 1 D Array.

STEP 3: Load the filenames and their respective labels.

STEP 4: Perform Data Augmentation and the split data into training and testing batches.

STEP 5: Load MobilenetV2 model from Keras. Train it on training batches and compile it.

STEP 6: Save the model for future use.

Deployment of Face Mask Detector

INPUT: Video frame.

OUTPUT: Frame classified into mask or no mask.

STEP 1: Load saved classifiers from disk. Also, load face detector from OpenCV.

STEP 2: Load the frame captured from video.

Read the feed frame by frame.

STEP 2.1: Apply face detection model to detect face in frames read in real time.

STEP 2.2: If face detected:

Crop face to bounding box coordinates from face detection model

Get predictions from the face classifier model.

Show predictions.

Else:

Show normal feed.

STEP 3: Apply face mask detection model to detect face mask in frames read in real time.

STEP 4: If mask detected

Crop face to bounding box coordinates from face mask detection model.

Get predictions from the face mask detection model.

Show predictions.

STEP 5: End stream when q is pressed.

VII. ADVANTAGES

• Biometric facial recognition system being upgraded to detect if people are wearing mask.

VIII. CONCLUSIONS

The current study used Python, Deep Learning, OpenCV, NumPy, TensorFlow, Keras, and to detect whether people were wearing face masks or not. The models were tested with images and real-time video streams.

IX. ACKNOWLEDGMENT

We would love to explicit our gratitude to all individuals who helped us to finish this work. We need to thank our guide Prof. S. S. Muley for her non-stop assist and beneficial assistance. She helped in a wide variety of problems from giving us direction, assisting to discover the solutions, outlining the requirements, and constantly having the time to peer us. We have moreover to thank Mr. S. G. Rathod, Head of the Department of Computer Engineering to inspire us to move beforehand and for non-stop guidance. We additionally need to thank Prof. S. S. Muley for all his help on Deep Learning, OpenCV primarily based totally Real-time Face Mask Detection We would love to thank our colleagues who helped us every now and then in practice studies and giving correct suggestions. We additionally make bigger honest way to all of the group of workers participants of the Department of Computer Engineering for assisting us in diverse aspects. Finally, we're thankful to our dad and mom for all their help and encouragement.

X. REFERENCES

[1] N. Ozkaya, S. Sagiroglu ‘‘Intelligence Face Mask Prediction System,’’ 2018 International joint Conference of Neural Network (IJCNN 2018).

[2] NIZAM UD DIN, KAMRAN JAVED, SEHO BAE, AND JUNEHO YI, ‘‘Novel GAN-Based Network for Unmasking of Masked Face,’’ 2020 IEEE ACCESS.

[3] Mingjie Jiang. Xinqi Fan*, Hong Yan, “RETINAFACEMASK: A FACE MASK DETECTOR, rXiv:2005.03950v2 [cs.CV] 8 Jun 2020.

[4] Gayatri Deore, Ramakrishna Bodhula, Dr. Vishwas Udpikar, Prof. Vidya More, “Study of Masked Face Detection Approach in Video Analytics,’’ INTERNATIONAL JOURNAL OF COMPUTER VISION, 88(2):303–338, 2010.

[5] Wei Bu, Jiangjian Xiao, Chuanhong Zhou, Minmin Yang, Chengbin Peng, ‘‘A Cascade Framework for Masked Face Detection,’’ pages 346–361. Springer, 2014.

[6] R. Raghavendra,Christoph Busch, ‘‘ Novel Presentation attack detection algorithm for face recognition system: Application to 3D face mask attack,’’. Adv. Neural Inf. Process. Syst., 2012, pp. 122–127.

[7] Toshanlal Meenpal, Ashutosh Balakrishnan,Amit Verma , ‘‘Facial Mask Detection using Semantic Segmentation,’’ vol. 24, no. 7, pp. 971–987, July 2002.