

Face Mask Recognition using Machine Learning

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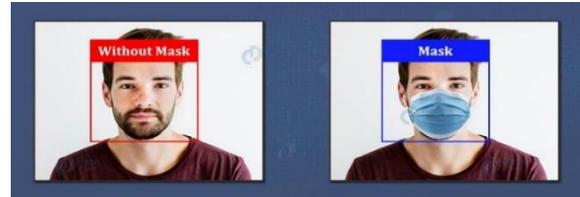
Abstract - COVID-19 has affected the world badly. Studies have proved that wearing a face mask is one of the precautions to reduce the risk of viral transmission. And many public places as well as public service providers require customers to use the service and place only if they wear mask correctly. So, it is not possible to manually track the customer, whether they have the mask or not. That's why this technology holds the key here. In this paper, we propose face mask detection using image processing which is one of the high-accuracy and efficient face mask detector. This proposed system mainly consists of three stages i.e. 1. Image pre-processing 2. Face detection and crop 3. Face mask classifier. Our system is capable of detecting masked and unmasked faces and can be integrated with webcam cameras. This system will help to tack safety violations, promote the use of face masks and it ensure a safe working environment.

Index Terms - Computer vision, COVID-19, Deep Learning, Face Masks, Face mask detection, Image processing, Safety improvement.

I.INTRODUCTION

The whole world today, is facing the COVID-19 pandemic. People are using various measures to control the spread of Corona virus. There are so many vital measures which are needed to fight against COVID-19 and one of such most important is face mask. Lots of research and studies on COVID-19 are still going on. Studies have also proved that wearing a face mask remarkably reduces the problem of viral transmission. Also, a person wearing a face mask recognises a sense of protection. At our homes, we consciously take care of each and everything but when it comes to public places like offices, malls, colleges, etc., it becomes somewhat challenging to maintain the safety of people. However, it is not feasible to manually check whether a person is wearing a face mask or not. Technology comes into picture here. Machine Learning and Artificial Intelligence consist of various technologies which provide effective

solutions to complex problems in different areas. In order to prevent the spread of Corona virus, we have made an attempt to develop a face mask recognition system using machine learning. This is an effective system to detect a face mask. It is capable of recognising masked and unmasked faces. By the development of this system, one can detect if a person is wearing a face mask or not. If the person is not wearing a face mask, then system will show some message like 'No Mask' otherwise it will show 'Mask detected' message.



Also, allowing the entry of those who are wearing a face mask, will be of great help towards maintaining the safety among people. System can generate some statistical data which will be helpful to predict the future outbreaks of COVID-19. Ultimately, we are trying to contribute some effective system to detect a face mask with the help of technology for the battle against COVID-19.



II.TODAY'S NEED OF THE SYSTEM

- As the virus outbreak continues, business leaders are coming up with innovative digital solutions.

One of them is a face mask detection system to identify people with face masks.

- Analyzing the current scenario, government and private organizations want to make sure that everyone working or visiting a public or private place is wearing masks throughout the day.
- The face mask detection platform can quickly identify the person with a mask, using cameras and analytics. Depending upon the requirements, the system is also adaptable to the latest technology and tools i.e., you can add contact numbers or email addresses in the system to send an alert to the one who has not worn the mask. You can also send an alert to the person whose face is not recognizable in the system.

III. OBJECTIVES

The main objective of “Face mask recognition” project is to provide some effective technology for preventing the spread of Corona virus. Primary objectives behind the development of this system are as follows: -

- Prevent the spread of Corona virus by promoting the use of face masks with the help of effective technology to detect the face mask.
- Help to take necessary precautions for the safety of society by predicting the future outbreaks of COVID-19.
- Ensure a safe working environment.
- Save the lives of people.

IV. MATHEMATICAL MODEL

System Description:

- Input: Image showing masked/unmasked faces
- Output: Detect face showing ‘Mask’ or ‘No Mask’ message.
- Functions: Extract (), Detect(), Classify(), Display().
- Mathematical Formulation:
 - $S = (I, F, O)$
 - where, Input = (I1, I2, I3, ..., In)
 - Function = (F1, F2, F3, ..., Fn)
 - Output = (O1, O2, O3, ..., On)
- Success Conditions: Masked and unmasked faces are successfully detected and expected output is displayed on screen.

Failure Conditions: 1. Camera is not capturing input frame. 2.Face is not available for detection purpose.

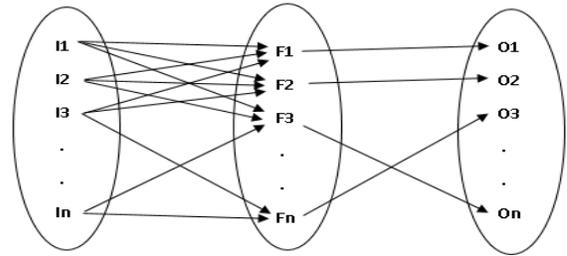


Fig: Venn Diagram

V. SYSTEM ARCHITECTURE

- Initially we will capture an image through webcam to detect person’s face.
- Extraction of images from frames.
- Then face mask detector will be loaded.
- Operation on images will be performed for detection by Image preprocessing.
- Respective results will be converted into image frames.
- If person is wearing mask properly then system will display message like “Thank u for wearing mask” with green signal.
- If the person is not wearing mask or not wearing in proper way, then system will display message like “please wear mask” with red signal.

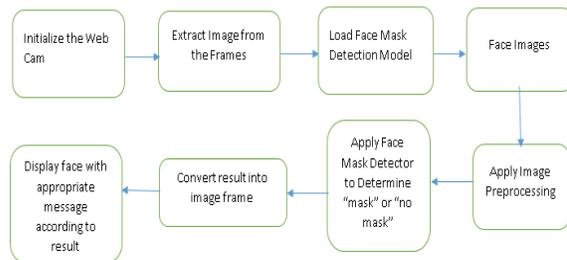


Fig. System Architecture

As Deep Learning is sub part of Machine Learning. Deep Learning Frameworks to implement this deep learning network we have the following options.

1. TensorFlow: That eases the process of acquiring data, training models, solving the predictions, and refining future results. It is created by google brain team TensorFlow is an open-source library for numerical computation and large-scale Machine learning. Tensors are also a standard way of representing data in deep learning. TensorFlow helps developers to create graphs

which are structures that describe how the data moves through graphs.

2. Keras: Keras is a deep learning framework which is easy-to-use. And also, it is a free open-source library in Python. Keras is a powerful framework and effective. Used for developing and evaluating different deep learning models. It wraps the efficient and effective numerical computation libraries Theano and TensorFlow. And also, it allows you. to define as well as train neural network models in just a few lines of code.
3. PyTorch: PyTorch is a Python machine learning package based on Torch, also a deep learning framework, which is an open-source package in machine learning. PyTorch has two main features: Tensor computation (like NumPy) with a strong GPU acceleration. Automatic differentiation for building as well as training neural networks.
4. OpenCV: The Standard definition of OpenCV (Open-Source Computer Vision Library) is an open-source computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and also to accelerate the use of machine perception in the commercial products.
5. Caffee
6. MxNet
7. Microsoft Cognitive Tool Kit

VI. CONCLUSION

- In this pandemic situation, where whole world is dreaming to return to normal routine, this system will play effective role in monitoring the use of face masks at workplaces.
- By the development of this system, we can detect the mask on one's face and allow his entry in the workplace.
- This system also contributes to public healthcare, as it helps in keeping environment healthy.
- This system can be aptly used in public areas with embedded systems for application in airports, railway stations, offices, schools, and public places to ensure that public safety guidelines are followed.

REFERENCES

- [1] Toshanlal Meenpal, Ashutosh Balakrishnan, Amit Verma, "Facial Mask Detection using Semantic Segmentation", in 2019 4th International Conference on Computing, Communications and Security (ICCCS), 2019.
- [2] A. Kumar, A. Kaur and M. Kumar, "Face detection techniques: a review", *Artificial Intelligence Review*, vol.52, no.2, pp.927-948, 2019.
- [3] Amit Chavda, Jason Dsouza, Sumeet Badgujar, Ankit Damani, "Multi-Stage CNN Architecture for Face Mask Detection", September 2020.
- [4] Vinitha.V, Velantina.V, "COVID-19 Facemask Detection with Deep Learning and Computer Vision", in IRJET, August 2020.
- [5] Mingjie Jiang, Xinqi Fan, Hong Yan "Retina FaceMask: A Face Mask Detector", June 2020.
- [6] S. Feng, C. Shen, N. Xia, W. Song, M. Fan and B.J.Cowling, "Rational use of Face masks in the covid-19 pandemic", *The Lancet Respiratory Medicine*, 2020.