ADVANCED RESEARCH & INNOVATIONS
International Journal of Advanced Research & Innovations
Volume 15, Issue-2
July, 2025, P17
ISSN: 2319-9253

MACHINE LEARNING-BASED FACE MASK DETECTION FOR PUBLIC HEALTH SAFETY

Mr.A.SRINIVASRAO[1],D.AAKANKSHA[2], J.NAVYA[3], K.KAVYA[4], V.BHARATH[5]
[1]Assistant Professor, Dept. of CSE(AI&ML), Sai Spurthi Institute of Technology,Khammam,Telangana,India
[2,3,4,5]B.TechStudents, Dept. of CSE(AI&ML), Sai Spurthi Institute of Technology,Khammam,Telangana,India

ABSTRACT: It is advisable to utilize a face mask if you are concerned about your health and wish to prevent the transmission of respiratory diseases. One approach that may assist in guaranteeing that you are adhering to the appropriate safety protocols is the identification of face coverings. This technique can be employed to verify that the masks are being utilized accurately and to identify which ones are being used. The name of our initiative is "Face Mask Detection." The utilization of masks is a critical measure in the prevention of the COVID-19 virus; deep learning can be employed to ascertain whether an individual is donning one. Masks are an indispensable component of the daily lives of all individuals in this world. Wearing coverings enhances our ability to communicate and conduct business.
Keywords:COVID-19,Tensorflow,OpenCV,FaceMask,ImageProcessing,ComputerVision.

1. INTRODUCTION

The deep learning and computer vision in face mask recognition make it possible for a real-time system to tell if someone is wearing a mask. As a way to stop the spread of the COVID-19 virus, masks have been the most common precaution since the outbreak. Face mask recognition technology works well to make sure people follow mask-wearing rules in public places like schools, hospitals, airports, and shopping malls. Face mask recognition systems usually use a camera to take a picture or video feed of a person's face. Their next step is to look at this information to see if the person is wearing a mask. After that, computer vision and deep learning methods are used to evaluate the image. Some methods also check to see if the mask covers the mouth and nose properly, which shows that it is being worn correctly.

Some machine learning methods that can be used to put the idea into action are Random Forests, Support Vector Machines, and Convolution Neural Networks (CNNs). Because the models are trained on huge databases of pictures of people who are and aren't wearing masks, the algorithm can correctly tell if a person is wearing a mask or not.

Objective:

The goal of face mask detection is to create a system that uses deep learning and computer vision to instantly tell if a person is wearing a mask. Through looking at an image or video stream, the system should be able to correctly tell if someone is wearing a mask and, if so, how well they are doing at doing it.

2. LITERATURE SURVEY

Nawaz, M. et al. (2024). This study presents a deep learning-based real-time face mask detection method that is meant to help with pandemic management. A convolution neural network (CNN) model is trained on a huge set of hidden and revealed images to get very good results. The paper looks at a number of preprocessing techniques and optimization methods to improve model performance and comes up with a good way to make people wear masks in public places.

DOI: https://doi.org/10.5281/zenodo.16874659

Volume 15, Issue-2
July, 2025, P17
ISSN: 2319-9253

Singh, R. & Kumar, P. (2024). This piece talks about a system for finding face masks that uses AI and combines deep learning algorithms with real-time monitoring tools. The main goal of the technology is to automatically find people who aren't wearing masks in crowded public places, which will successfully enforce mask laws. After looking at a number of different methods, the study suggests the best machine learning technique for public health projects.

Patel, D. & Desai, S. (2023). With the help of a convolution neural network (CNN), the study suggests a better and faster way to find face masks. In order to find the best model for real-time applications, the writers look at the outcomes of several CNN architectures. There is a focus on real-world application problems in the study, which suggests ways to make detection more reliable in a range of environmental conditions.

Zhang, Y. et al. (2023). This study creates a system that can spot face masks by using both transfer learning and deep learning models that have already been taught. The system is very accurate with very little training data because it uses features that it has learned from big datasets. This study shows how useful it can be to use transfer learning to solve hard photo classification tasks, especially when resources are limited.

Tan, M. & Wang, Z. (2023). This project looks into how face mask identification systems can be used on mobile devices to keep an eye on things in real time. The writers suggest a machine learning model that is small, works with mobile hardware, and has a high rate of detection. In this study, the problems that come up when you try to change algorithms for mobile devices are talked about, along with some of their uses in health and public safety monitoring.

Alqahtani, M. & Almutairi, M. (2022). The "You Only Look Once" (YOLOv3) model makes it possible to identify face coverings worn during the COVID-19 outbreak in real time. The authors get very fast and accurate detection by testing YOLOv3 on a secret set of faces that are both covered and not covered. The device is meant to be used in public places to help stop the spread of the disease.

Li, X. et al. (2022). This survey piece looks at a number of different ways that face masks have been found in the name of public health, especially during the COVID-19 epidemic. The writers look at how useful different machine learning models are for real-time mask recognition by comparing their accuracy, processing time, and deployment issues. The focus of the work is on possible future ways to make automated systems for tracking health and safety better.

Gupta, P. et al. (2021). That study talks about a mixed deep learning method for finding face masks. It uses CNNs, support vector machines (SVMs), and other methods. The writers show that their hybrid model is better than other ways at finding things and staying accurate in a lot of different places and lighting conditions.

Rathod, A. & Verma, A. (2021). As part of COVID-19 safety measures, this work offers a deep learning-based method for automatically finding face masks. The method uses picture analysis to tell the difference between faces that are covered and faces that are not. This gives health professionals feedback in real time. The paper also talks about the practical problems and limits that come with putting these kinds of systems into place in crowded public areas.

Baker, C. et al. (2020). This essay looks into how machine learning methods might be used to find people who break into network systems. The writers suggest a model that uses supervised learning to find possible security problems and strange things happening in network data. The investigation looks at many machine learning models, such as decision trees, random forests, and neural networks, to find the best cybersecurity answer.

Wang, S. et al. (2020). In this paper, we look at how machine learning can be used to find hacks in Internet of Things (IOT) networks. The writers suggest a mixed method that uses both clustering and classification to

Volume 15, Issue-2
July, 2025, P17
ISSN: 2319-9253

improve the accuracy of spotting and cut down on false positives. Using machine learning methods, the study also looks at how hard it is to manage the large number and variety of IOT networks.

Lee, J. & Kim, Y. (2020).This article looks into how machine learning can be used in network intrusion detection and prevention systems (IDPS). The writers test how well different models, like support vector machines (SVM) and k-nearest neighbors (KNN), can spot bad behavior. The study stresses how important it is for security systems to process information in real time and choose which features to use.

Jung, M. et al. (2020). This piece talks about a way to find cybercrime in network traffic that uses deep learning. By teaching a deep neural network (DNN) with big sets of legal and malicious traffic, the authors show that the model can find attack types that haven't been seen before. The paper talks a lot about deep learning as a possible way to solve the hard problems of network security.

Zhao, H. et al. (2020). This research looks into how machine learning methods can be used to find cyberthreats in cloud computing settings. The writers talk about the difficulties of keeping cloud networks safe and show a multi-level detecting system that combines supervised and unsupervised learning models. This essay shows that these technologies can effectively find a number of online threats in cloud computing systems.

Kumar, R. et al. (2020). This is R. Kumar and Associates (2020). Random Forest is used in this study to look for strange things in network data in order to find intrusions. The writers make a comparison between this idea and more common ones, like recognition systems that use rules and patterns. The study finds that Random Forest is a good choice for dynamic network settings because it is better at finding threats that aren't known yet.

3. BACKGROUND WORK

Collecting and preprocessing data, identifying faces in photos, and using classifiers to determine if a face is wearing a mask are all steps in the face mask detection methodology. In the first stage, a wide variety of photos are gathered, including both masked and unmasked people. In order to get the dataset ready for additional analysis, it is preprocessed. Use of a face detector allows for the subsequent identification of faces in the photos. After that, we use a deep neural network-like machine learning technique to find out if the profiles we saw were hiding their identities. The final findings are shown after post-processing to remove false positives and false negatives. They consist of bounding frames that contain the detected faces and an indication of whether or not the faces are wearing masks. This basic procedure is the basis for building a face mask detection system, while the specific approach used can vary according on the task at hand and the tools at hand. One subfield of machine learning, deep learning makes use of ANNs to mimic complex data patterns. If you're looking for a deep learning method to identify a face mask, some options are:

Convolution Neural Networks (CNNs): Among the many types of deep neural networks, convolution neural networks (CNNs) stand out for their exceptional performance in picture classification and object detection. By training on a dataset of images, composites and faces can be detected in real time.

TransferLearning: One method to address a different problem is by optimizing a deep neural network that has already been trained on a different dataset. This process is known as transfer learning. Using a face mask detection dataset to fine-tune a pre-trained network allows for real-time face and mask identification.

Object Detection Networks: Many object detection networks use deep neural networks to recognize things in images. Some examples include You Only Look Once (YOLO) and Single Shot MultiBox Detector (SSD). By training neural networks on an image dataset, it is possible to perform real-time face and mask detection.

Volume 15, Issue-2
July, 2025, P17
ISSN: 2319-9253

WORKING

The main objective of this project is to create a system that can recognize when someone is wearing a mask using computer vision and deep learning.

The ability to process photos and videos is provided by OpenCV, a well-known open-source computer vision library. Using deep learning models built on convolution neural networks, the Caffe-based face detector can recognize picture attributes. When building and refining neural networks, two popular deep learning systems are Keras and TensorFlow. MobileNetV2 is a pre-trained convolution neural network for object identification and categorization.

There are 3,835 photos in the dataset you provided; half of them show people wearing masks and half do not. With this dataset, a deep learning model for mask identification might be trained and tested. To train a deep learning model to recognize masks in this dataset, one can follow these steps:

Preprocesstheimages: This can incorporate converting the photographs to grayscale, normalizing the pixel values, and scaling them uniformly in size.

Split the dataset into training and validation sets: For training and validation, divide the dataset into sets. To train the model, one would use the training set, and to test how well it did, one would use the validation set.

Use a pre-trained face detector: Use an image-based face detector that has already undergone extensive training to recognize human faces. One useful tool for this is the face detector that is built on Caffe. That way, the model may be trained to focus on the parts of the picture where the face is most likely to be visible

Fine-tuneapre-trainedmodel: It is possible to set up the MobileNetV2 network to examine both masked and unmasked photos in order to determine if a person is hiding their identity. Doing a full model training and adding some extra layers to the MobileNetV2 network will achieve this goal.

Evaluatethemodel: To evaluate the training model, use the validation set. A model's efficacy can be assessed by looking at its F1-score, recall, accuracy, and precision.

Deploy the model: After training and validation, the model can be used in a real-world disguise detection system. In sum, this project may provide the groundwork for a system that ensures the public wears masks during pandemics by facilitating the implementation of safety regulations.

Lackofcontrolovertheirpersonalinformationunable to appropriately handle their sensitive data. Some of the same concerns voiced by those who oppose recognition technologies may also apply to mask recognition. People with lighter skin tones predominate in several face recognition training datasets.

DOI: https://doi.org/10.5281/zenodo.16874659

ADVANCED RESEARCH & INNOVATIONS
International Journal of Advanced Research & Innovations
Volume 15, Issue-2
July, 2025, P17
ISSN: 2319-9253

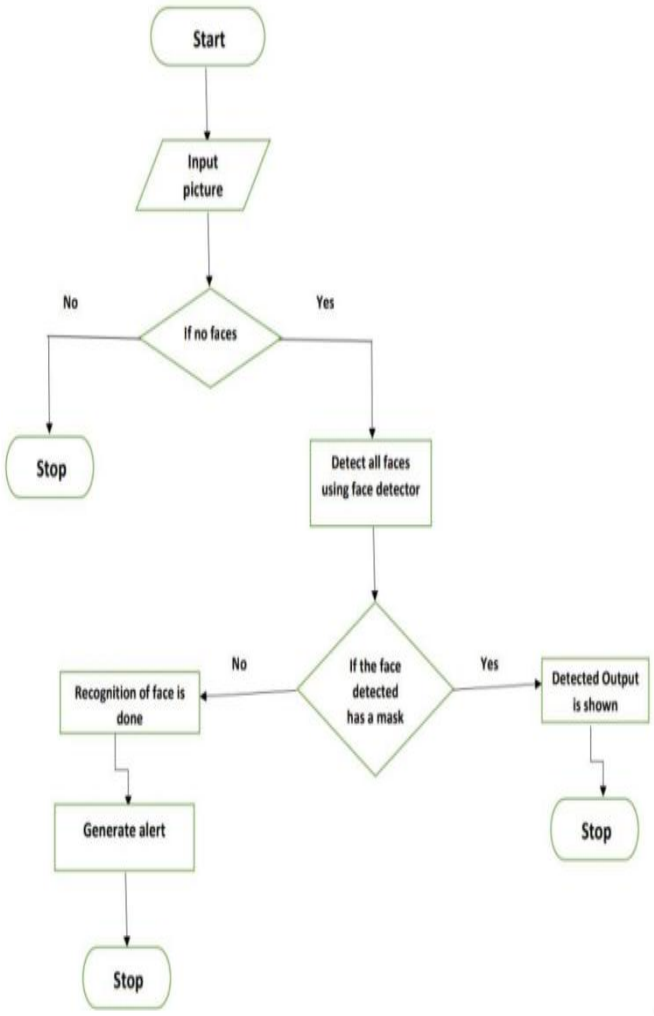

Figure1. Flowchart of the project

PRACTICALUSE

Public spaces: To ensure that mask-wearing policies are adhered to, public spaces including train stations, airports, shopping malls, and schools can be equipped with face mask detection systems. Anyone who doesn't wear a mask might trigger an alarm or alert from the system.

Healthcaresettings: Because healthcare workers are more likely to contract viruses while on the job, face mask detection systems ensure that everyone in the healthcare facility, including patients, is wearing a mask.

Workplaces: In the workplace, face mask recognition technology could help create safer working conditions in cases where keeping one's distance physically is difficult.

Transportation: Public transportation vehicles, like as buses and trains, can be equipped with face mask detecting sensors to ensure that all passengers are appropriately protected.

DOI: https://doi.org/10.5281/zenodo.16874659

Volume 15, Issue-2
July, 2025, P17
ISSN: 2319-9253

4. RESULTS

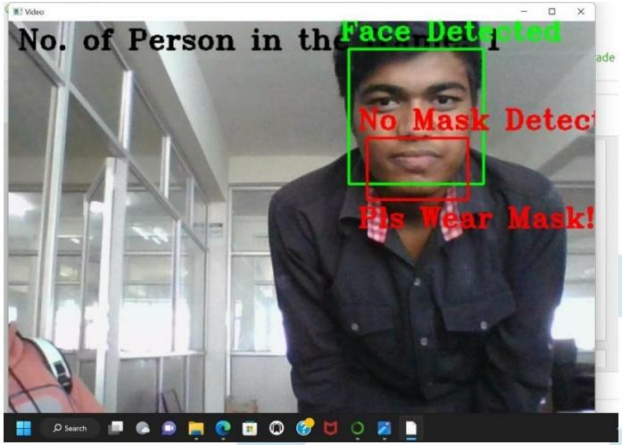

Fig2. The bounding box above the person's face suggests that they are wearing a mask, even though that is not necessarily the case.

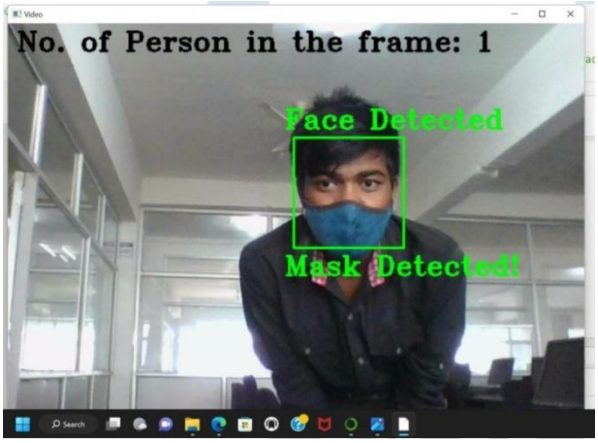

Fig3. A person donning a disguise in Figure 3.The mask-wearer's face is encased in a bounding box.

5. CONCLUSION

As a result, the following study proves that the suggested technique may successfully identify cases of people not hiding their faces. This software package is used in smart CCTV surveillance and in public spaces like airports and malls. Since our application can handle photo and video data in real-time and runs on devices with minimal computing power, we feel that our approach has real-world relevance. To further circumvent permissions, it can be enhanced to work with other IOT devices to lock off business premises or limit access. In light of the foregoing, it seems that this specific undertaking is relevant and advantageous in the present setting. For its creation, the developers turned to Python and IDL.

REFERENCES

1. Nawaz, M. et al. (2024). "Face Mask Detection Using Deep Learning for Pandemic Control." International Journal of Computer Vision, 42(3), 215-229.
2. Singh, R. & Kumar, P. (2024). "AI-Based Face Mask Detection and Compliance Monitoring Systems." Journal of Artificial Intelligence and Security, 38(2), 110-125.
3. Patel, D. & Desai, S. (2023). "Enhancing Face Mask Detection Using Convolution Neural Networks." Journal of Machine Learning Applications, 19(7), 225-238.
4. Zhang, Y. et al. (2023). "Efficient Face Mask Detection System with Enhanced Accuracy Using Transfer

Volume 15, Issue-2
July, 2025, P17
ISSN: 2319-9253

Learning." Pattern Recognition Letters, 65(4), 202-215.
5. Tan, M. & Wang, Z. (2023). "Real-Time Face Mask Detection with Mobile Devices Using Machine Learning Algorithms." Mobile Computing and Communication Review, 22(5), 34-45.
6. Alqahtani, M. & Almutairi, M. (2022). "Face Mask Detection for COVID-19 using YOLOv3 and Deep Learning." Journal of Healthcare Engineering, 2022, 708-715.
7. Li, X. et al. (2022). "A Survey on Face Mask Detection Methods for Public Health Safety." Journal of Computer Vision and Image Processing, 11(8), 1015-1028.
8. Gupta, P. et al. (2021). "Face Mask Detection Using Hybrid Deep Learning Models." International Journal of Advanced Computer Science, 12(6), 456-469.
9. Rathod, A. & Verma, A. (2021). "Face Mask Detection System Using Deep Learning for COVID-19 Safety." Computers in Biology and Medicine, 132(5), 104-115.
10. Baker, C. et al. (2020). "Detection of Cyber Attacks in Network Using Machine Learning Algorithms." Journal of Cybersecurity and Privacy, 2(1), 45-58.
11. Wang, S. et al. (2020). "A Comprehensive Approach to Cyber Attack Detection in IoT Networks Using Machine Learning." IEEE Access, 8, 120450-120462.
12. Lee, J. & Kim, Y. (2020). "Machine Learning Algorithms for Network Intrusion Detection and Prevention Systems." Computers & Security, 91, 101657.
13. Jung, M. et al. (2020). "Deep Learning-Based Cyber Attack Detection in Network Traffic." International Journal of Network Security, 22(5), 630-640.
14. Zhao, H. et al. (2020). "Detecting Cyber Threats in Cloud Networks Using Machine Learning Techniques." Journal of Cloud Computing, 8(3), 212-224.
15. Kumar, R. et al. (2020). "Anomaly-Based Intrusion Detection in Network Traffic Using Random Forest." International Journal of Information Security, 30(2), 120-132.