Next Generation Face Mask Detection Using Real-Time Deep Neural Network

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***Abstract*—The COVID 19 pandemic increased the need for automated monitoring systems to ensure that people follow safety regulations such as wearing face masks in public places. Manual monitoring is inefficient and difficult in crowded environments. This paper presents a next generation face mask detection system using a real time deep neural network. The proposed system uses computer vision techniques to detect human faces and classify whether a mask is present or not. A Convolutional Neural Network model is trained on a dataset containing masked and unmasked faces. Real time video frames are captured through a camera and processed using Open CV. The system automatically detects faces and predicts mask usage with high accuracy. The proposed solution can be deployed in public areas such as hospitals, airports, and workplaces to improve safety monitoring and reduce the spread of infectious diseases.**

***Index Terms*—deep learning, face mask detection, neural network, real time monitoring.**

I. INTRODUCTION

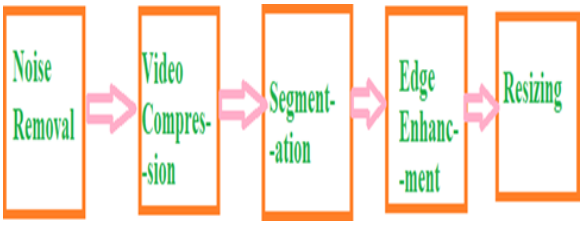
Face mask detection is an important application of computer vision that helps ensure public health safety. During the COVID19 pandemic, wearing masks became mandatory in many public areas. Monitoring compliance manually is difficult in crowded locations. Therefore, automated systems based on artificial intelligence can help detect whether individuals are wearing masks. Deep learning techniques have significantly improved the performance of image recognition systems. Convolutional Neural Networks (CNNs) are widely used for image classification tasks due to their ability to automatically extract features from images. This project proposes a real time mask detection system that uses deep neural networks and computer vision techniques.

II. LITERATURE REVIEW

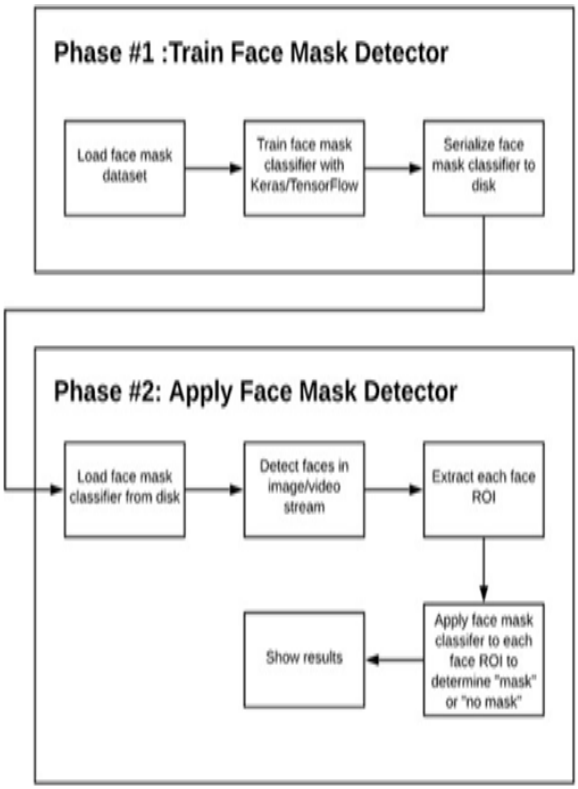
Many researchers have developed systems for face mask detection using machine learning and deep learning approaches. Earlier methods relied on traditional image processing algorithms such as Haar cascade classifiers for face detection. Although these methods worked for simple cases, they often failed in complex environments. Recent research focuses on deep learning architectures such as CNN, Mobile Net, and YOLO. These models provide higher accuracy and faster detection performance. Researchers have also applied transfer learning techniques to train models using large datasets of masked and unmasked faces.

III. SYSTEM ARCHITECTURE

The proposed system consists of several modules including image acquisition, face detection, feature extraction, and mask classification. A webcam captures real time video frames which are processed by the detection algorithm. First, the system identifies faces within the video frame. The detected faces are then passed to a trained deep neural network model which determines whether the person is wearing a mask or not. The result is displayed on the screen with bounding boxes indicating mask or no mask status.



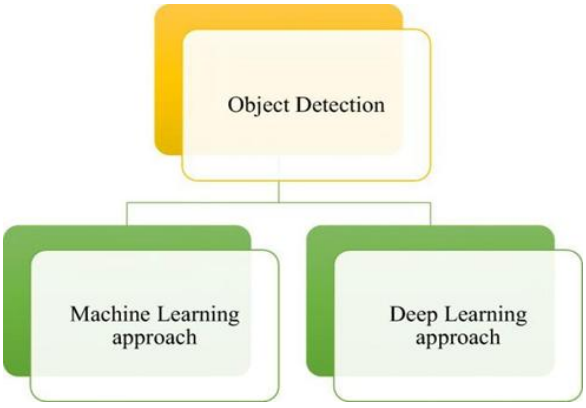
Video pre-processing techniques



IV. METHODOLOGY

The methodology of the proposed system includes dataset collection, data preprocessing, model training, and real-time detection. Images of people with and without masks are collected from publicly available datasets such as Kaggle.

During preprocessing, images are resized and normalized. The CNN model is trained using these images to learn distinguishing features. During testing, the trained model processes real-time video frames and classifies detected faces into mask and no mask categories.



V. DATASET

The dataset used for training contains images of faces with masks and without masks. These images include different angles, lighting conditions, and backgrounds to improve the model's robustness. The dataset is divided into training and testing sets to evaluate model performance.

VI. RESULTS AND DISCUSSION

I expect results show that the proposed system achieves high accuracy in detecting face masks in real time. The model performs well under different lighting conditions and facial orientations. The detection speed is also suitable for real-time applications such as surveillance systems.

VII. APPLICATIONS

The system can be deployed in many public places such as airports, hospitals, railway stations, shopping malls, and educational institutions. It helps authorities automatically monitor mask compliance and maintain public health safety.

VIII. CONCLUSION

This paper presented a real time face mask detection system using deep neural networks. The proposed approach uses computer vision techniques and CNN models to detect mask usage accurately. Future improvements may include integrating the system with IoT devices and smart surveillance systems for large scale deployment.

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