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Face Mask Detection For ICU

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Abstract

The rapid spread of infectious diseases has highlighted the importance of strict safety protocols in healthcare environments, especially in Intensive Care Units (ICUs). Wearing face masks is one of the most effective preventive measures to reduce transmission. This project presents an automated Face Mask Detection System designed specifically for ICU environments using computer vision and deep learning techniques.The system utilizes image processing with the help of OpenCV for real-time face detection and a Convolutional Neural Network (CNN) model to classify whether a person is wearing a mask or not. The model is trained on a dataset containing images of masked and unmasked faces, enabling it to achieve high accuracy in diverse conditions. The system continuously monitors video input from surveillance cameras installed in the ICU and identifies individuals who are not complying with mask protocols.

Keywords **Face Mask Detection, Intensive Care Unit (ICU), Computer Vision, Deep Learning.**

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I. INTRODUCTION

Face mask detection is a system that detects whether a person is wearing a mask or not. It is same as an object detection system in which a system detects a particular class of objects. Through building this system we are trying to help ensure people's safety at public places. This system can be implemented in many areas such as supermarkets and shopping malls, schools, colleges, stations and so on. To accomplish this task, we'll be fine-tuning the MobileNet V2 architecture, a highly efficient architecture that can be applied to embedded devices with limited computational capacityand overall efficiency. we have used Keras/Tensorflow, MobileNetV2 and OpenCV and trained our model using a large dataset consisting of with and without mask faces. Wearing a medical mask is one of the prevention measures that can limit the spread of certain respiratory viral diseases.

II. LITERATURE REVIEW

Sethi et al. (2021) proposed a real-time face mask detection system using deep learning techniques to identify individuals without masks. Their approach focused on achieving high accuracy and efficiency in public monitoring systems, highlighting the importance of automation in enforcing safety protocols Kaur et al. (2021) developed a Convolutional Neural Network (CNN)-based model capable of detecting masked and unmasked faces in real-time. The study emphasized the effectiveness of CNN architectures in image classification tasks and demonstrated reliable performance in practical environment. Athif et al. (2023) addressed challenges in low-light environments by implementing a CNN model using TensorFlow and OpenCV. of combining object detection with classification

III. PROPOSED SYSTEM ARCHITECTURE

This layer consists of CCTV cameras or webcams installed within the ICU environment. These devices continuously capture real-time video streams of patients, healthcare staff, and visitors. The video feed serves as the primary input for the system..

ProcessingLayer:

In this stage, the captured video frames are preprocessed to enhance quality and prepare them for analysis. Techniques such as resizing, normalization.

DetectionClassificationLayer:

This is the core component of the system. Face detection algorithms identify human faces in each frame. A Convolutional Neural Network (CNN) model is then used to classify whether the detected face is wearing a mask or not.

Alert&MonitoringLayer:

Once classification is completed, the system generates alerts if a person is detected without a mask. Alerts can include visual indicators on the screen, alarm sounds.

VideoInputLayer:

This layer consists of CCTV cameras or webcams installed within the ICU environment. These devices continuously capture real-time video streams of patients, healthcare staff, and visitors

Cover Letter Generator:

The Alert Report Generator module is responsible for creating structured reports whenever a face mask violation is detected within the ICU environment. Instead of generating cover letters, this module focuses on documenting safety compliance and incidents in a clear and organized format.Uses. The system automatically records details such as date, time, location, and detection results

IV. IMPLEMENTATION DETAILS

We trained the images of people not wearing a face mask. The next step is to apply **face detection**. Here we've used a **deep learning method** to perform face detection with OpenCV. Then the next step is to extract the **face ROI** with OpenCV and NumPy slicing. And from there, we apply facial landmarks, allowing us to localize the eyes, nose, mouth, etc. Next, we need an image of a mask. If you use a set of images to create an **artificial dataset** of people wearing masks, you cannot "reuse" the images without masks in your training set

Feature Extraction:

Feature Extraction is a crucial step in the Face Mask Detection System, where important visual patterns are identified from detected face regions to enable accurate classification.

Model Training:

Here we have focused on loading our face mask detection dataset from disk, training a model (using Keras/TensorFlow) on this dataset, and then serializing the face mask detector to disk.

Interface Design:

The Interface Design of the Face Mask Detection System is developed to provide a simple, intuitive, and user-friendly experience for healthcare staff in ICU environments. The interface ensures real-time monitoring, quick understanding of system outputs, and easy interaction with minimal training requirements.

V. RESULTS AND DISCUSSION

We have successfully trained our model and tested it on a real time face using the laptop's camera. Our face mask detector correctly labeled the person's face as either 'Mask' or 'No Mask'. As you can see in this image that the face is labeled as 'Mask' when the person is wearing a mask and labeled as 'No Mask' when the person is not wearing a mask. The system performs efficiently when deployed with stable camera input and adequate lighting.

VI. CONCLUSION AND FUTURE WORK

In this paper, a face mask detection system was presented which was able to detect face masks. Keras/Tensorflow and OvenCV. A novel approach was presented which gave us high accuracy. The dataset that was used for training the model consists of more than 3800 face images. The model was tested with real-time video streams. The training accuracy of the model was around 99%. Deploying our face mask detector to embedded devices could reduce the cost of manufacturing such face mask detection systems

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