Face Mask Detection Using Computer Vision

Karan Sonkar B210464CS

Kumar Gaurav B210452CS

Ranjeet Kumar B210450CS

Vipin Sunilkumar Gautam B210075CS

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Introduction

In a world deeply impacted by the global COVID-19 pandemic and recent concerns like the outbreak of the Nipah virus, public health safety has become more critical than ever. Technology has emerged as a potentially in addressing these challenges, and at the forefront of this innovation stands the project '**Facemask Detection Using Computer Vision**'. The COVID-19 pandemic, designated as a Public Health Emergency of International Concern by the **World Health Organization (WHO)**, has reshaped our society, highlighting the pivotal role of wearing facemasks in controlling infectious disease spread. Wearing masks has proven to significantly reduce the risk of infection, and it, along with the use of hand sanitizers, has been effective in curbing disease transmission. Therefore, the need for a real-time face mask detection system that alerts people and helps prevent pandemics is evident. This project aims to achieve just that by exploring real-time face mask detection through deep learning and OpenCV.

Objective

In response to the significant impact of the global COVID-19 pandemic and the recent Nipah virus outbreak, our project, 'Facemask Detection Using Computer Vision,' aims to leverage advanced technology to create an efficient, real-time system for accurately identifying whether individuals are wearing facemasks. Our primary objective is to enhance public health safety, particularly during infectious disease outbreaks, by minimizing the risk of disease transmission. Additionally, we aim to reduce the need for human intervention by automating mask-wearing compliance monitoring in public spaces, thus alleviating the workload of health officials and law enforcement.

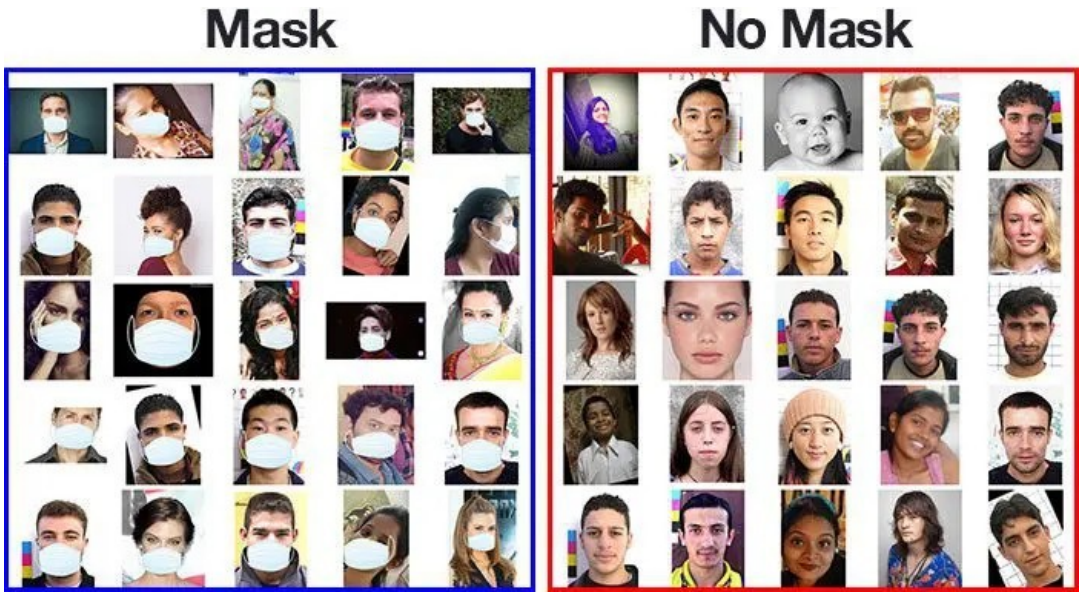

Figure 1: Sample images of people with and without mask.

Methodology

Data Collection

The first step in detecting face masks is to collect data to train the model for real-time face mask detection. For this, images of people wearing masks and people not wearing masks were required. Images were acquired from various sources like Google and **Kaggle** datasets.

Data Augmentation

In the next step, we augmented our dataset to include more images for training. Data augmentation involved rotating and flipping the images. After augmentation, the dataset contained a **7553** total of images, with **3725** images in the 'yes' class (with mask) and **3828** images in the 'no' class (without mask).

Splitting the Data

The dataset was split into training and test sets with a split ratio of **80:20.** 80% of the total images were used for training, and the remaining 20% were used for testing the model.

Building the Model

The face mask detection model was built in two phases:

1. Training: We trained the model using a dataset loaded from disk, employing Keras/TensorFlow to create a Sequential CNN model. Layers such as Conv2D, MaxPooling2D, Flatten, Dropout, and Dense were used. The 'adam' optimizer and 'binary classification' loss function were applied. Additionally, MobileNetV2 was used for better accuracy.

2. Deployment: After training, the mask detector was loaded and deployed to perform face detection and classify each face as 'with mask' or 'without mask'. Face detection was performed using a deep learning framework called FaceNet, and OpenCV was used for real-time detection.

Results

Python programming language was used for implementing the real-time face mask detection using **OpenCV.** The model achieved **97.26%** validation accuracy after training with a **batch size of 82** and **25 epochs.**

a. without mask

b. with mask

Conclusion

In conclusion, this project successfully implemented real-time face mask detection using OpenCV and deep learning techniques. The results demonstrate the effectiveness of this method for efficient detection of face masks. While the method shows great promise, it also has limitations that can be addressed in future work. The project holds significant value for real-time applications in densely populated areas, contributing to public health by encouraging mask compliance.