Chapter 9
Face Mask Classification Based on Deep Learning Framework

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ABSTRACT

Since the infectious coronavirus disease (COVID-19) was first reported in Wuhan, it has become a public health problem around the world. This pandemic is having devastating effects on societies and economies. Due to the lack of health resources in a short period, all countries and continents are likely to face particularly severe damage that could lead to a large epidemic. Wearing a face mask that stops the transmission of droplets in the air can still be helpful in combating this pandemic. Therefore, this chapter focuses on implementing a face mask detection model as an embedded vision system. The six pre-trained models, which are MobileNet, ResNet-50, MobileNet-V2, VGG-19, VGG-16, and DenseNet, are used in this context. People wearing or not wearing masks were detected. After implementing and deploying the models, the selected models achieved a confidence score. Therefore, this study concludes that wearing face masks helps reduce the virus spread and fight this pandemic.

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INTRODUCTION

Coronavirus disease (COVID-19) is an emerging respiratory infectious disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV2) (Qin & Li, 2020). All over the world, especially in the third wave, COVID-19 has been an important health care challenge (Wang et al.,). Many shutdowns in different industries have been caused by this pandemic. Moreover, many sectors like maintenance projects and infrastructure construction have not been suspended owing to their serious effect on people's routine life (Zhang et al., 2020) (Razavi et al.,). By now, the virus has speedily spread to the majority of the countries worldwide (Qin & Li, 2020). According to the centers for Disease Control and Prevention (CDC), coronavirus infection is transmitted predominantly by respiratory droplets produced when people breathe, talk, cough or sneeze (Wang et al.,) with common droplet size 5-10 μm but aerosol emission increases when humans speak and shout loudly (Dey & Howlader, 2021). No one can deny that COVID-19 is a global pandemic and affects several domains. Nonetheless, it created a path for researchers in computer science. We have seen numerous research topics, like creating new automatic detection methods of COVID-19, detecting people with or without masks, etc. (Echtioui et al., 2020). Before coronavirus, some people put masks to protect themselves from air pollution. While other people put face masks to hide their faces and their emotions from others. Protection against coronavirus is a mandatory counter measure, according to the World Health Organization (WHO) (Loey et al., 2021). In reality, wearing a mask is an effective method of blocking 80% of all respiratory infections (Wang et al.,). All over the world, governments are struggling against this type of virus and many organizations enforce face mask rules for the personal protection. Checking manually if individuals entering an organization are wearing masks is cumbersome and possibly conflicting (Loey et al., 2021). This chapter is organized as follow: the proposed face mask detection framework based on deep learning models is firstly discussed. Then, the data collection and the evaluation metrics are presented. After that, the numerical results of six models and of the implementation in the Raspberry Pi are discussed. And finally, the chapter is ended with a conclusion.

PROPOSED FACE MASK DETECTION FRAMEWORK BASED ON DEEP LEARNING MODELS

The proposed framework consists into two principal blocks. For the first block, our labeled dataset was divided into three classes. The first class is focused on the training and represents 70% of the dataset images. However, the validation step required only 10% to validate the performance for the trained models. 20% of the