ResNet을 사용한 전이 학습 기반 안면 마스크 감지

모하메드 마흐무드, 강현수*
충북대학교 정보통신공학부
mohamedabokhalil@chungbuk.ac.kr, *hskang@cbnu.ac.kr

Transfer Learning-Based Face Mask Detection using ResNet

Mohamed Mahmoud, Kang Hyun Soo*
Chungbuk National University.

Abstract

Recently wearing a medical mask has been important after the Coronavirus outbreak (COVID-19), and it became necessary to prevent infection. In some countries, it has become mandatory in public and more crowded areas to limit the spread of the virus. Through cameras, many institutions have resorted to a mechanism to detect those who do not wear a mask by machine learning and deep learning algorithms. in this work, we proposed a deep learning model based on transfer learning for Face mask detection to monitor who is wearing a mask or not. our proposed model is built on ResNet50 as a pre-trained model and trained on a simulated Face Mask Dataset (SMFD). It achieved high accuracy and took a few minutes.

Keywords: Transfer Learning, Face Mask Detection, Deep Learning, COVID-19, ResNet.

Ⅰ. Introduction

At the end of 2019 and the emergence of the Coronavirus (COVID-19), the world faced a rapid and frightening spread of COVID-19. The number of infections continued to increase daily, as well as deaths, and this is the last statistic of the World Health Organization [15], which shows that the number of infections is close to 529.5 million. The number of death is close to 6.3 million. So many precautionary measures have been taken, such as wearing a medical mask, effectively reducing injuries. Due to the difficulty of traditional monitoring, artificial intelligence AI monitoring system has been proposed to detect the people who are not wearing a mask through cameras using deep learning to identify who is wearing a mask and who isn't.

Deep Learning approaches have improved the results of several computer vision challenges, including medical applications such as object detection [1]-[3], classification[4], and medical question answers [6], [7], as well as applications in software engineering field like Time optimization and schedule of software projects[9], network security [10], and handwritten recognition for various languages [11]-[14].

Recently, there have been many academic researchers interested in the field of face mask detection. In this work, we proposed a deep learning (DL) model using transfer Learning (using ResNet) that determines which person is wearing a mask or not. We can divide the objects into two classes with masks and without masks. We train and test our Method on the simulated Face Mask Dataset (SFMD) [16], which achieves the best results among other models.

Ⅱ. Related Work

Jignesh Chowdary, G. et al. [17] proposed a Deep Learning model based on InceptionV3 as a pre-trained model. They test their model on the SFM dataset, and it achieves 100%. Shilpa Sethi et al. [18] proposed a model that consists of one-stage and two-stage detectors. They applied the concept of transfer learning and used ResNet50 as a pre-trained model. Their proposed model gets high accuracy (98.2 %) when using ResNet50. Roy, B., Nandy, S., Ghosh, D. et al. [5] create a monitoring task to check whether people are wearing masks. They use popular object detection algorithms like Yolo, SSD, and Faster R-CNN. They evaluate these methods on the Moxa3k dataset, which has 3K images. Zhongyuan Wang et al. [8] reviewed three masked face datasets and their applications in face mask recognition.

Ⅲ. Methodology

A. Transfer Learning: is a concept that trains a deep neural network on a huge dataset and saves this model, then uses it as a pre-trained model in another problem. It improves the new model's performance even if trained on a small dataset or with low computational power.

B. Data augmentation: Some Artificial intelligence techniques are usually used to increase dataset size by generating new data by making some changes to the original data. Fig.1 shows an example of Image augmentation. Many changes happened to the data to create new data like rotating, blurring, Contrasting, adding noise, Zooming, translation, flipping, and grayscale.

C. Dataset: In this work, we train and evaluate our model on SFMD [16]. We used 6-different colored masks and divided each class into training and testing. Fig.2 shows some samples from the dataset.

D. Results: We used 84% of the dataset to train our model, and the residual 16% of the dataset was used for model evaluation. We used ResNet as a pre-trained model and changed the final Fully connected layer to run on our problem. We train our proposed model total of 20 epochs. It achieves an accuracy of 100% and takes 4 minutes and 42 seconds to finish the training. Fig.3 and Fig.4 show the training/validation dataset's loss and accuracy.

This work aims to monitor people to detect who wore a mask and who didn't. Fig.5 shows some random output from our model, which detects whether the person is wearing a mask.

Fig 1. Examples of image augmentation.

Fig.2 Dataset samples.

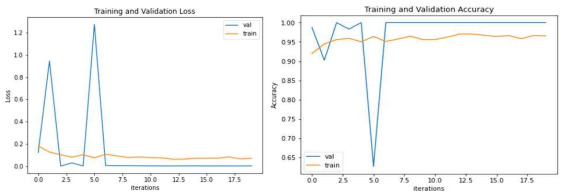

Fig 3. training&validation Loss. Fig 4. training&validation Accuracy.

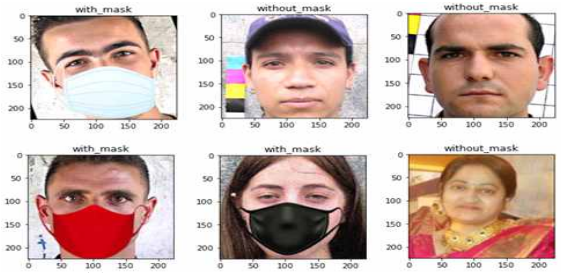

Fig 5. Model output Random samples.

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