Paper Review 02

Face Mask Detection using Convolutional Neural Network (CNN) to reduce the spread of Covid-19

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Purpose of This Research

The purpose of this research is to develop a deep learning-based face mask detection system to prevent the spread of COVID-19. The study used three different methods, including Max pooling, Average pooling, and MobileNetV2 architecture, to detect face masks from 1845 images from various sources, including 120 co-author pictures taken with a webcam and mobile phone camera. The results showed that MobileNetV2 architecture achieved the highest accuracy, with 99.72% for training and 99.82% for validation. The study aims to contribute to the healthcare sector's efforts to prevent the spread of COVID-19 by providing an accurate face mask detection system.

Previous Research Gap

There are several previous research mentioned here

- Jiang et al. propose a model called Retina Facemask that uses deep learning methodology to detect face masks. It combines with a bridge entity elimination algorithm and uses a single-stage detector with a feature pyramid network to achieve slightly better precision and recall than the baseline result.
- Gupta et al. propose a model that utilizes smart communities and Intelligent Transportation Systems (ITS) to implement social distance during the COVID-19 pandemic. Their model involves installing sensors in the city to monitor the movement of objects in real-time and developing a data-sharing network. The proposed system aims to help prevent the spread of COVID-19 by promoting social distancing.
- Won Sonn and Lee discuss how a smart city can aid in controlling the spread of coronavirus in South Korea. They propose using a time-space cartographer that speeds up communication monitoring, including patient movement, transaction background, mobile phone use, and cell phone position. The study suggests that CCTV cameras in residential building hallways can be monitored in real-time to help prevent COVID-19 transmission.
- M. Loey et al. compare the performance of different machine learning algorithms for detecting face masks. They used three datasets for feature extraction using ResNet50 and then used decision tree, support vector machine, and ensemble algorithms for the classification process. The study found that all three algorithms achieved high detection accuracy on each dataset.
- Another study where is to detect a person without a face mask using CCTV cameras and inform the authority to reduce the spread of COVID-19. After

preprocessing the data, feature extraction, and classification are done using CNN, and the trained model achieved an accuracy of 98.7%. The study aims to help prevent the spread of COVID-19 by detecting people not wearing face masks in public places.

- Another author designed a binary face classifier to detect faces regardless of their alignment. The study aims to improve face recognition technology by creating a classifier that can detect faces at any angle or orientation.
- M.S. Ejaz et al. implemented PCA for masked and non-masked facial image detection. They used the Viola-Jones algorithm to detect the face portion and PCA to compute Eigenface, along with the nearest neighbor (NN) classifier distance, for face recognition. The study aims to improve facial recognition technology's accuracy for detecting faces with masks.

In this paper the researcher used three deep learning methods for face mask detection, including Max pooling, Average pooling, and MobileNetV2 architecture to get best accurate result compared to previous researches.

Proposed System

The paper proposes a system for face mask detection that involves several steps. The first step is data collection, followed by data preprocessing and augmentation. Next, the system uses different CNN methods, including convolution layer with max pooling, convolution layer with average pooling, and MobileNetV2, for classification. The system then proceeds to the detection output step and performance evaluation, where precision, recall, accuracy, and F1-score are measured. The proposed system aims to detect face masks accurately using deep learning-based methods and provides a comprehensive performance evaluation of the system.

Architecture

In this research, CNN architecture is used for image processing and classification. The architecture consists of one or more convolution layers, which aim to find effective features inside an image rather than working with the entire image. Max pooling and Average pooling are used as discretization methods to reduce the complexity of input representation and enable decisions to be made on features found in binned sub-regions. The CNN model initiates with Keras.Sequential(), and the Relu activation feature is used in the first hidden layer, followed by Max pooling. The data is then passed to the second convolution layer and Max pooling is used again to obtain the most notable information. The obtained image matrix is flattened and trained using the Adam stochastic gradient descent algorithm. In addition, instead of Max pooling, Average pooling operation is used to observe the model's

performance. 80% of the dataset images were used for training. Another architecture MobileNetV2 is used which is a lightweight CNN-based deep learning model used for image classification, and TensorFlow provides the image weights for MobileNetV2.In this research the MobileNetV2 base layer is removed, and a new trainable layer is added to analyze data and extract relevant features from images. OpenCV's Caffemodel is used for detecting face and masks in images and video streams. The Dropout layer is used to prevent overfitting, and the average pooling operation with a pool size of 128 hidden layers is used in the trainable model. Relu activation function is used in the secret layer, and SoftMax activation function is used in the entire linked layer. A learning rate of 0.01 is set for better accuracy, and the Adam stochastic gradient descent algorithm aids in the model's comprehension of picture characteristics.

Experimental Procedure

Researcher used two datasets, consisting of 1845 images from various sources and 120 co-author's photos taken with a webcam and mobile phone camera, to detect face masks from images. The Deep CNN model with Max Pooling was applied, achieving a training accuracy of 96.49% and validation accuracy of 98.67%. Later, the same CNN architecture was applied with Average Pooling, which resulted in lower accuracy of 95.19% training accuracy and 96.23% validation accuracy. MobileNetV2 architecture significantly improved accuracy, achieving the highest precision of 99.72% for training and 99.82% for validation. The MobilenetV2 architecture outperformed many other models included in the study and successfully identified face masks from video streams. A confusion matrix was also measured after using MobileNetV2 architecture. Overall, the study demonstrates the effectiveness of using deep learning-based methods, to achieve the best possible accurate and efficient detection of face masks in images and videos.

Future Plan

The researcher manages to get the best possible result of The Max pooling is 96.49% training accuracy and validation accuracy is 98.67%. Besides, the Average pooling achieved 95.19% training accuracy and validation accuracy is 96.23%. MobileNetV2 architecture gained the highest accuracy 99.72% for training and 99.82% for validation. The goal was to propose a compatible model with high accuracy such that mask identification will be simple throughout the pandemic. In order to assess performance with a wider dataset, they can attempt to add further models to compare with Mobilenetv2 and try to integrate this model with IoT detect humans without masks automatically for their future work plan.

References

1. Face Mask Detection using Convolutional Neural Network (CNN) to reduce the spread of Covid-19 by FM Javed Mehedi Shamrat, Sovon Chakraborty, Md Masum Billah, Md Al Jubair, Md Saidul Islam, Rumesh Ranjan