

Covid-19 Approved Mask Detection using Mathematical Morphology



Dumitru Abrudan, Ana-Maria Drăgulinescu, Radu-Ovidiu Preda, Nicolae Vizireanu
Telecommunications Department, University Politehnica of Bucharest, Bucharest, Romania



Motivation

Due to current COVID-19 pandemics, there is a need for proper identification of the way that protection mask are worn in order to insure population safety and limit virus spread and support the state authorities to take appropriate measures. Current screening systems are at a primary level and needs further developments.

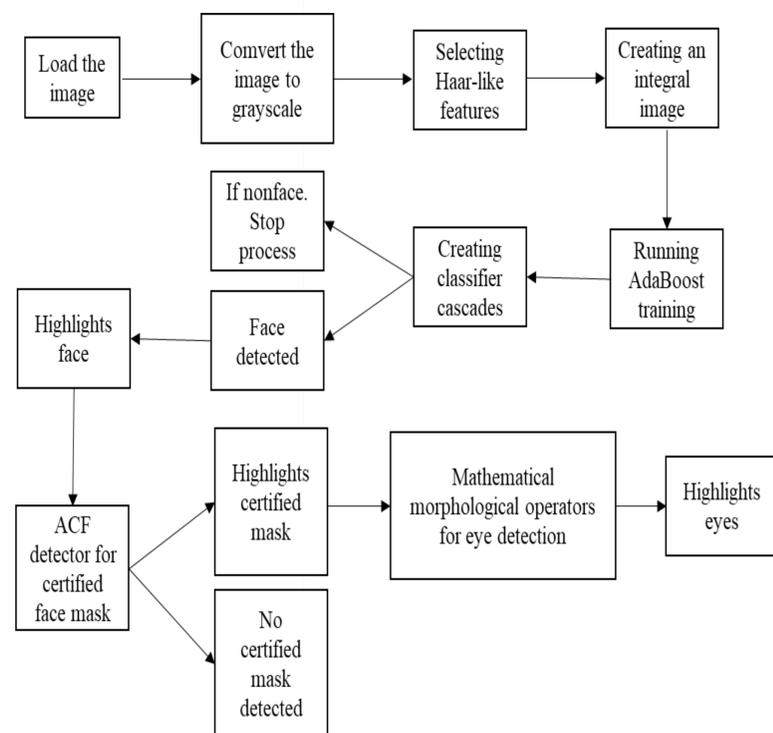


Figure 1. Flowchart of the proposed algorithm .

Main issue of current solutions

In the analyzed images, were identified issues in case of eyes covered with sunglasses or eyes covered with other objects. Also, video stream cannot be tested.

RQ: Are Viola Jones algorithm, aggregate channel features (ACF) and mathematical morphology appropriate `tools` to detect the proper wearing of a certified face mask ?

Due to robustness for detection rate, suitability for real time applications, the algorithm proposed detect has a high accuracy

Experiment and results

Viola Jones algorithm identifies the face of the human person in the images (Figure 1). If a face is detected, this will be highlighted using a rectangle box.

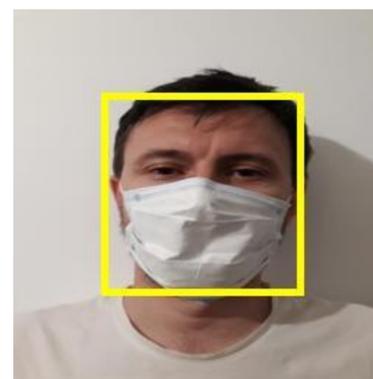


Figure 1. Viola Jones algorithm on images

ACF Detector identifies in the images if there is a mask face or not. If a mask is detected, a rectangle shape color in yellow is highlighted on the image (Figure 2).

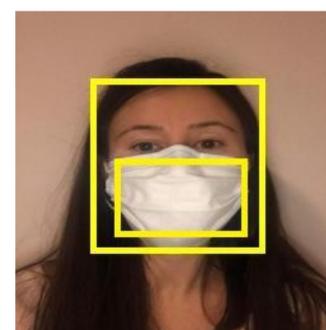


Figure 2. certified mask detection using ACF Detector

The final step of the algorithm is to use the mathematical morphology for eye detection. For positive detection of eyes, the area will be highlighted using a rectangle (Figure 3).

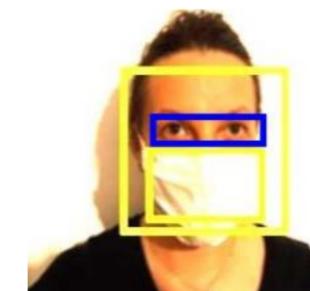


Figure 3. Eye detections using mathematical morphology

The formula of morphological transformation used for image processing is:

$$A \ominus B = \{x | B_x \subseteq A\}$$

Negative detection of eyes: the face and face mask are detected but the eyes cannot be detected due to obstructed eyes area (Figure 4).



Figure 4. Negative detection of eyes

Acknowledgement

This work was supported by a grant of the Romanian National Authority for Scientific Research and Innovation, CNCS/CCCDI - UEFISCDI, project number PN-III-P2-2.1-PED-2019-4395, 419PED/2020.

Conclusions

In this paper, using the Viola Jones algorithm, ACF detector and mathematical morphology operators we detect with high accuracy if a person is wearing a certified face mask against Covid-19. The study has some limitations in face mask detection, such as images captured from profile. The proposed method is faster than other similar methods due to the reduced amount of information necessary for the mathematical morphology.