Develop Face Mask detection algorithm for COVID-19

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Abstract

Artificial Intelligence and Machine Learning can help in many ways to prevent the face mask violation in places where wearing the face mask is mandatory specially during current COVID-19 pandemic. The aim of the project is to attempt different machine learning and AI techniques to classify "person with mask properly work" and "person without mask properly worn".
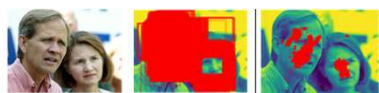
Data

A dataset including around 27000 of images with facial landmarks has been used. For the faces without mask, two sets of datasets are used: UTKFace Invalid source specified. and FDDB Invalid source specified..


Baseline Localization Model

A CNN is trained to classify faces with masks and without masks. A sliding window does a one passthrough with the goal to detect faces. At every step, the image confined in the sliding window is classified by the trained CNN model.


R-CNN Model

Selective search is used on face annotated data to generate bounding box proposals.
Intersection over union is then performed to label each proposed region as mask, no mask, or neither.

These labeled regions are used to train a MobilNetV2 CNN.
For prediction, new images passed through Selective search and each region is then fed to the trained CNN to correctly classify each proposed region in the image.
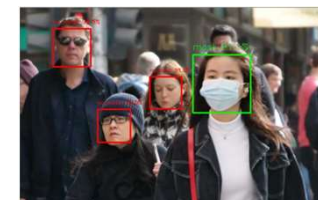

HAAR Cascade Classifier

As an alternative to Selective Search, HAAR Cascade Classifier has been used. It works by extracting and considering adjacent rectangular regions at a specific location in a detection window (HAAR features), summing up the pixel intensities in each region and calculating the difference between these sums.
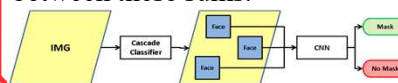
Results

The training has been accomplished processing a total of 39,077 face images. 85% of this dataset (random) was used to run MobilnetV2 for learning while the remaining 15% was then usedsss as validation data. After 10 cycles the model reached an accuracy of about 85% and less than 5% of loss.
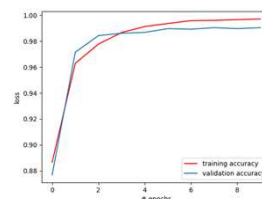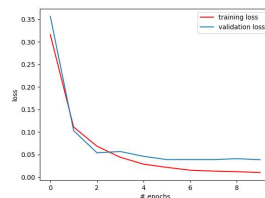
Future Works

R-CNN still takes a long time to classify each proposed region by selective search and can't really be implemented in real time.
Fast R-CNN can be implemented to reduce the time it takes to identify object in images. Instead of regions, Fast R-CNN processes the entire image.