# Real-time Face Mask Detection

Problem Definition

- Necessity of wearing masks to hold virus under control
- Developers motivated to monitor the process of wearing masks in public areas
- This process is divided in two main tasks; face detection and mask detection
- Detection task is done using supervised learning and transfer learning

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System Specifications

What our system is able to do

# " Pipeline
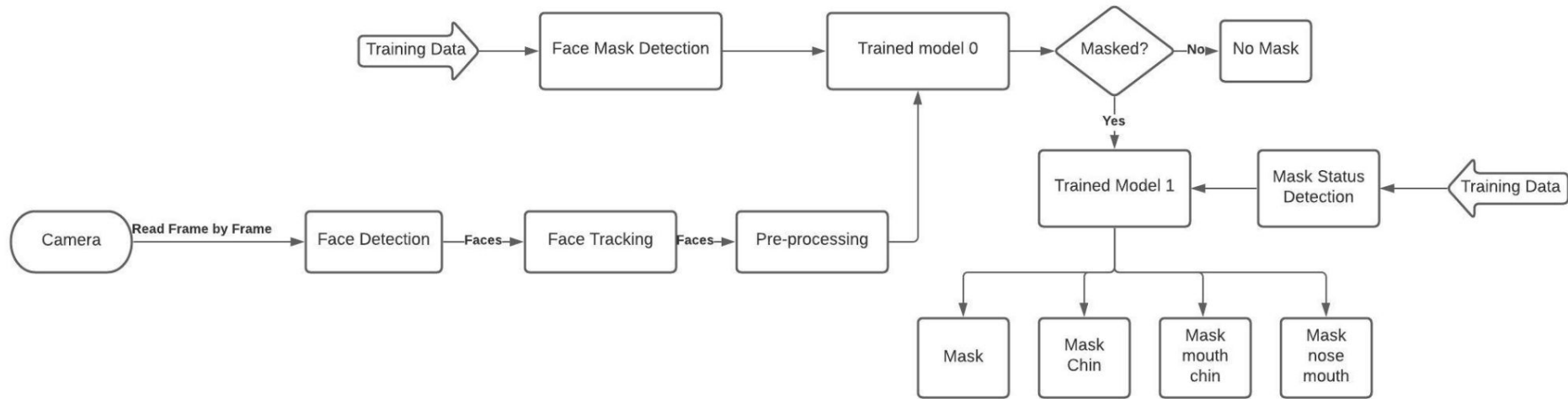
# System Specifications

- System reads a frame by frame from a video stream
- Apply Face detection to get ROI (faces)
- Track each face to enhance processing rate
- Predict whether the face id face masked or not
- If detected as face masked, predict if it covers chin only, mouth and chin only, nose and mouth only or correctly masked
- Flag each face according to prediction, so action can be taken

System Specifications

- Processing rate of 9 fps using Webcam

- Achieving 7 successive correctly predicted frames in noisy environment

- Achieving 139 successive correctly predicted frames in normal environment

- Prediction accuracy of 99%

" Application Demo
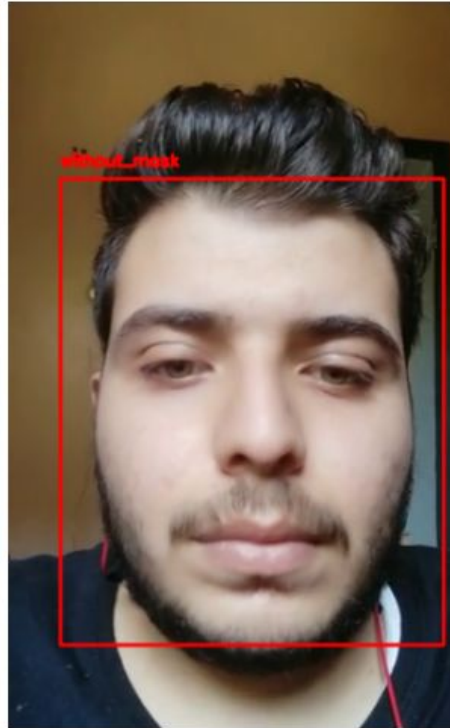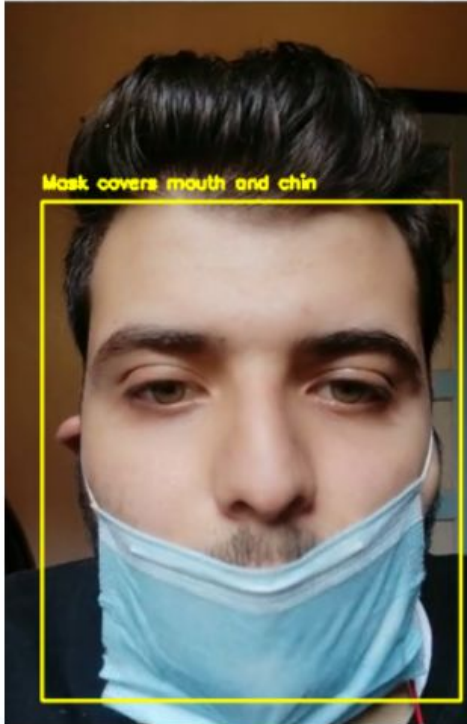
Face Detection

- Haar Cascade detection algorithm
- 21 fps face detection rate
- Detects far away faces effectively
- Fails when a frame is very dim
- Detects second faces in a noisy edge background
- Detects parts of the face (ear only)

Face Tracking

- MIL: could run at about 15 fps
- KCF: could run at 27 fps. The fastest one with pretty acceptable accuracy but it fails when occlusion happens
- CSRT: could run at 21 fps
- Trackers (KCF, CSRT) performs well in normal moving environment.
- Fails when sudden movements towards out of the frame
- If failed, we re-detect faces in following frame

Deep Learning Models

Face Mask Detection

- Test accuracy of 98%
- Detect wrongly masked that covers mouth as a masked face
- Detect masked face that covers chin only as not masked face

Mask Status Detection

- Test AUC score of 99%
- Achieved very good results of not missing any wrongly masked face
- Low precision for class "Mask_Nose_Mouth"
- False positives can be tolerated

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System Limitations

What can be considered for further improvements

Machine Specification

- HP probook 450 G4

- Processor i7-7500U

- 8 GB RAM.

- No GPUs are used.

Limitations

- Bottlenecked processing rate of 9 fps due to heavy model prediction done at each frame.
- Model prediction fails in partially dimmer environments, models needs to be trained using scale and intensity invariant local features.
- Incorrectly detected faces lowers measured system performance.
- Any covered face is detected as correctly masked.