

AUTOMATED TAILGATING DETECTION SYSTEM

**PROJECT FOR VMWARE CAMPUS AMBASSADOR PROGRAM:
VIRTUAL HACKATHON**

Done by:
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4th Semester
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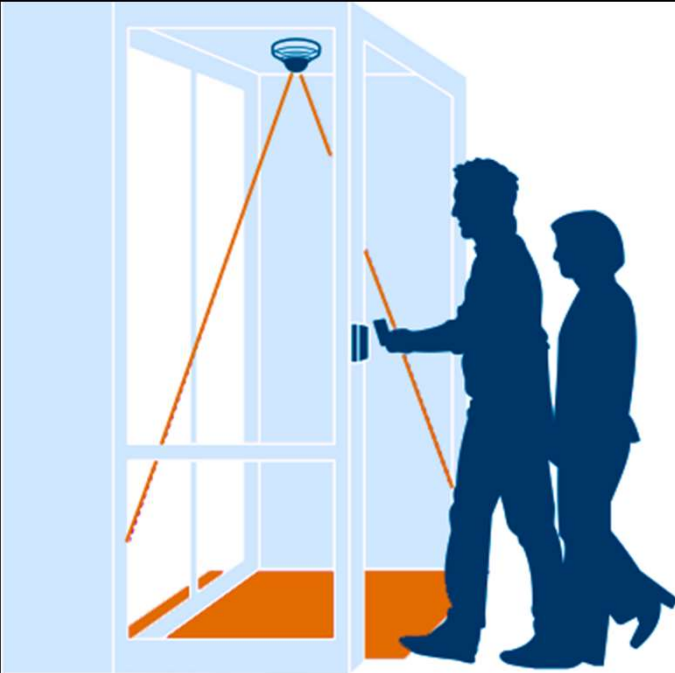
Today's Presentation

Contents:

1. Problem statement
2. Introduction
3. Proposed Solution
 - a. Object Detection
 - i. Single Shot Detectors
 - b. Object Tracking
 - c. Tailgating Detection
4. Advantages and Challenges
5. Additional Features and Future Works



1. Problem Statement

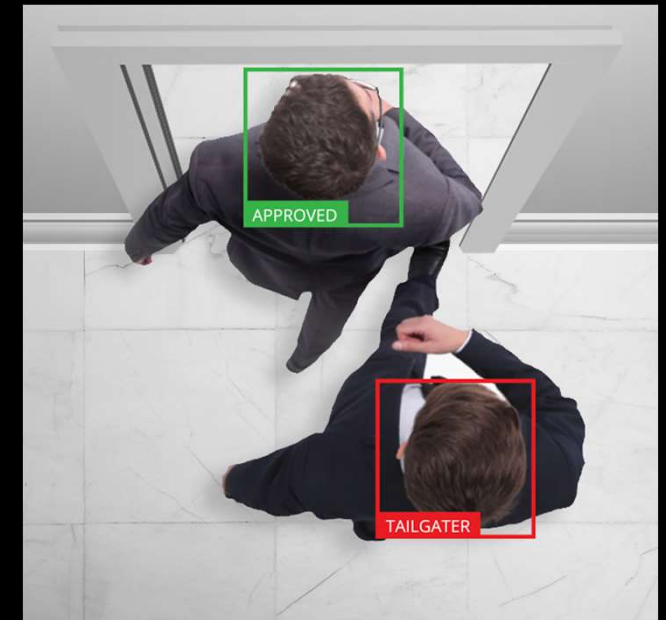


Given a CCTV camera footage of a secured door entry

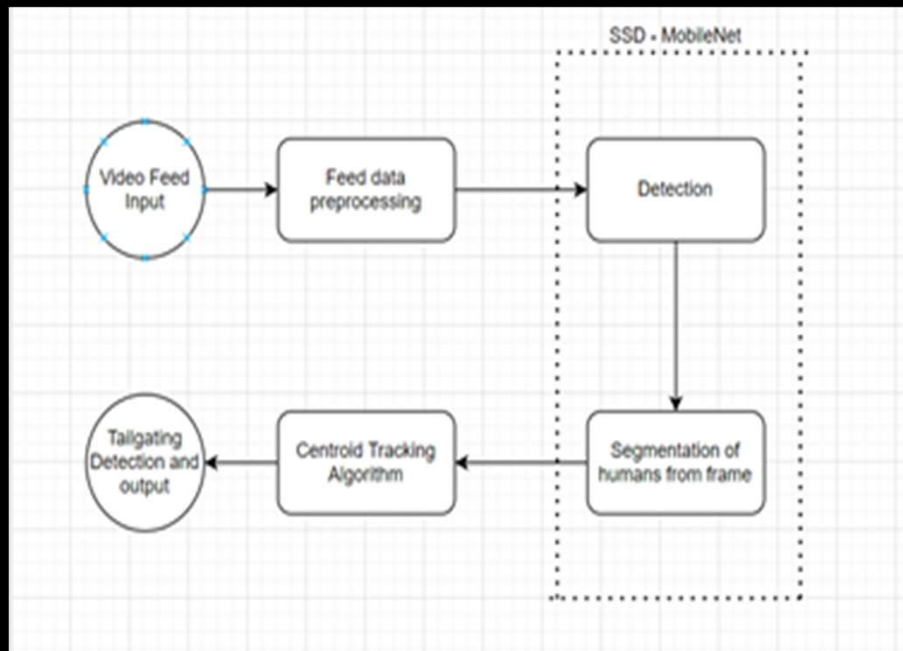
- detect anyone tailgating using an automated system.
- The system should segment individuals from the video and detect whether they are tailgating or not

2. Introduction

- Security breaches known as tailgating
- also referred to as piggybacking.
- unauthorized person follows an authorized individual to enter a secured area.
- Results in
 - huge revenue loss
 - threats to privacy and safety.
- Cause:
 - common courtesy
 - simply following a person through doors
- Present Solutions:
 - Simple Motion Detection Video Approach
 - Cameras and mirror method
- Proposed Solution
 - Computer Vision based Approach
 - Object Detection: Single Shot Detector
 - Object Tracking: Centroid Tracking Algorithm
 - Tailgating Detection

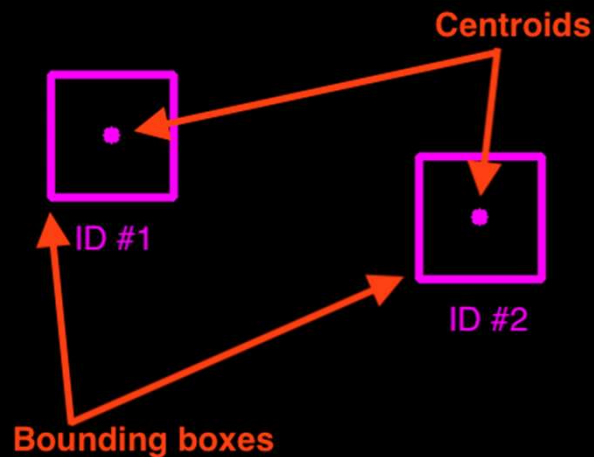


3. Proposed Solution



- **Computer Vision Based Solution**
- 3 phases implementation:
 - Object Detection
 - Object Tracking
 - Tailgating Detection

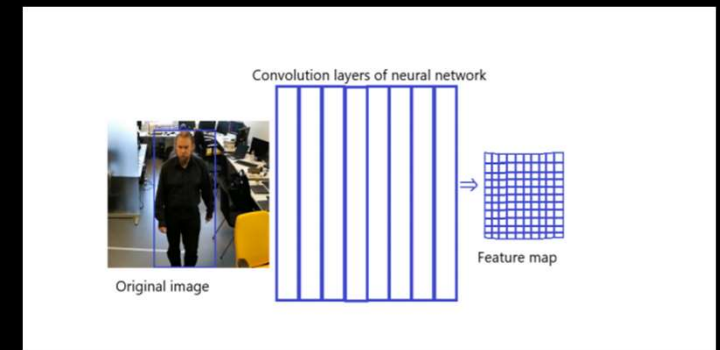
3a. Object Detection



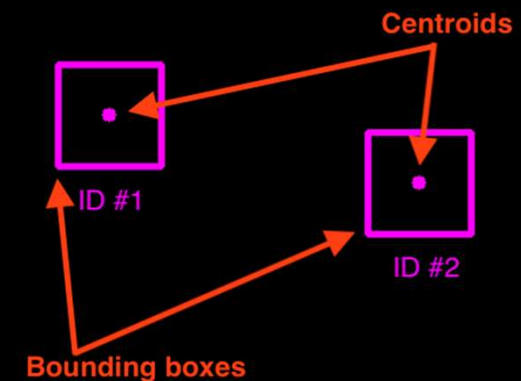
- Multiple objects detected using single shot
- For each object detected
 - create an object tracker with the bounding box coordinates
 - then find the centroid of each object detected
- Above steps are done using Single Shot Detector (SSD)

3ai. Single Shot Detector

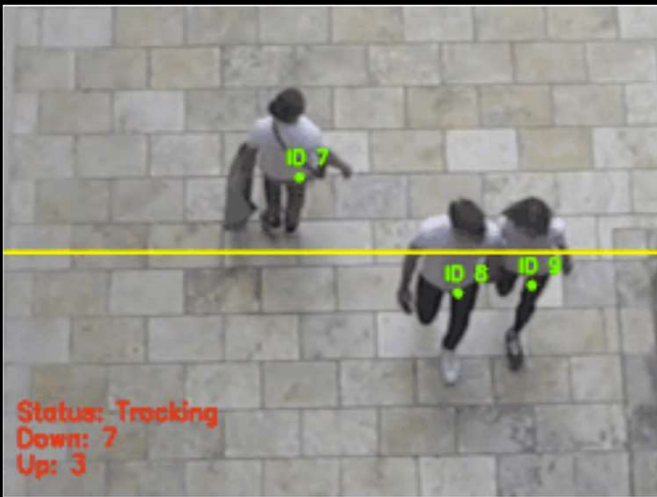
- Object Detection: Single Shot Detector (SSD)
- What is SSD
 - used in object detection and classification on images.
 - running the convolutional network once on the input image
 - This forms a feature map.
 - Formation of bounding boxes for the recognized objects
 - These bounding boxes have different sizes and aspect ratios.
 - Each bounding box represents a detected human.



SSD Working Principle

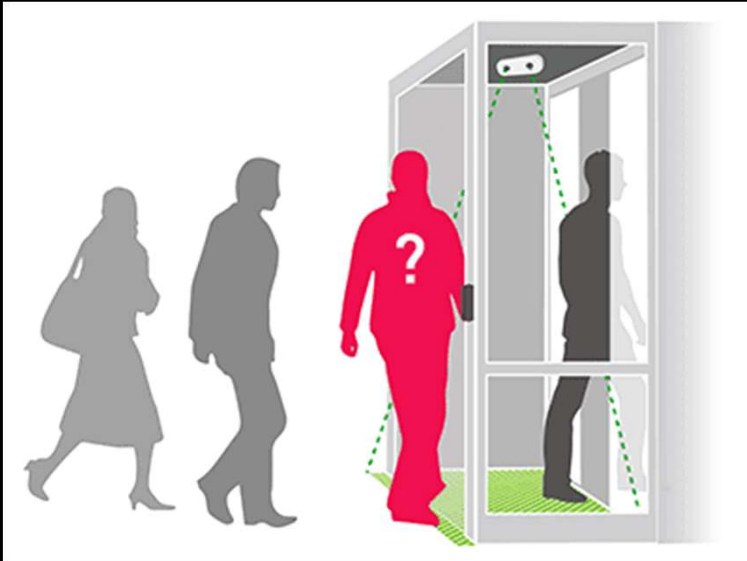


3b. Object Tracking



- Object tracking is done using the centroid associated with each objects.
- Tracking algorithm relies on the Euclidean distance
- Euclidean distance between centroids in subsequent frames is calculated
- The primary assumption of the centroid tracking algorithm is that centroids must lie close together between subsequent frames.

3c. Tailgating Tracking



- An imaginary line would be used to mark the gate region
- The line coordinates will be sent to the backend of the app where the live feed is being processed
- The line will be used as a line of reference across which tailgating can be detected.
- The number of people passing through the gate in the frame is compared with the number of authorized entries
- Mismatch in number raises an alert
- The number of authorized entries is equal to the number of card entries at any particular time

4. Advantages and Challenges

- Advantages:

- Our software would be easily configurable by anybody
- Can be used for any video feed in general
- User friendly
- Can detect with high accuracy and speed

- Challenges:

- Identifying humans even if they have some accessory(such as a person wearing a helmet or a cap)
- This approach cannot detect cases where a person carrying another person on their shoulders or in some other way.

5. Additional Features and Future Works

- Facial Recognition: We can also add facial recognition as a feature if the employee database consists of pictures of each employee and these pictures can be provided to us in order to not only detect the person who is tailgating but also release the picture of the intruder detected to the necessary authorities and also to verify (if possible) whether the intruder is someone in the database or not.

Thank you
Any
Queries?