DETECT TAILGATING AND ALERT SECURITY STAFF

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Problem Statement

The Problem statement chosen by the group is **‘Detect Tailgating and Alert Security Staff’**.

Expected Results

- Detecting and segmenting humans in video
- Detect Tailgating

Given Inputs

- CCTV Footage
- A spreadsheet with access-card swipe information

Idea abstract

The challenge is to present a comprehensive Computer Vision model in order to prevent any event of **tailgating**.

We have come up with a prototype which utilises **Image segmentation** and **Tracking** in order to effectively ensure only an authorised person is allowed to enter the premises.

We have created different areas namely the **Authorised Perimeter(Red)** and the **Waiting Area(Green)**, any person entering these areas will be detected through the CCTV cameras present.

Based on where the person is situated in the given frame we shall consider him if he's willing to enter if not consider him as waiting.

Solutions

We have divided our solution into various segments in order to cater to different camera angles present at the entrance of the building:-

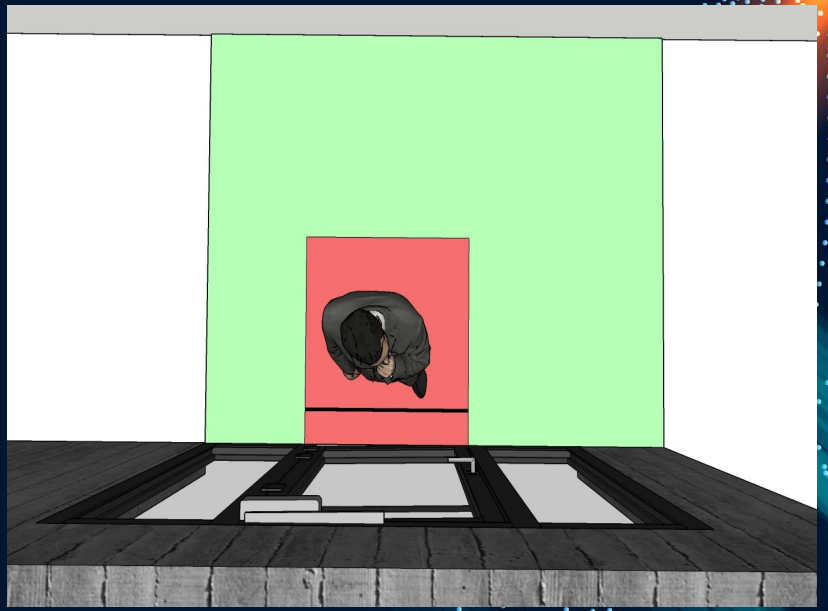
1. When the Single Camera is present directly overhead
2. When the Single Camera is present opposite to the entrance
3. When the Single Camera is present at the side of the entrance
4. When the Single Camera is present inside the building facing entrance

Keeping these conditions in mind would ensure that any company using the software could use the same throughout their different locations/buildings.

Solution -1 (OVERHEAD)

- In the first solution the camera is present directly on top of the door/entrance.

- As seen, once the person is stepping into the Authorized Perimeter, expected Headcount value increases. Then once the person swipes their card, the sheet is updated, and the expected entry value rises, expected headcount decreases. Once the person crosses the specified line, expected entry value decrements. If the counter is negative, Alarm sounds. Data logged into security database.



ALL IMAGES ARE CREATED BY US

Solution -2(BACK)

- The second solution is an instance of when the camera is placed directly opposite to the entrance at a certain height.
- The view would be of the back of the individuals entering. There are chances of overlap, which is why the team has chosen Mask R-CNN instance segmentation, which is able to detect overlap.

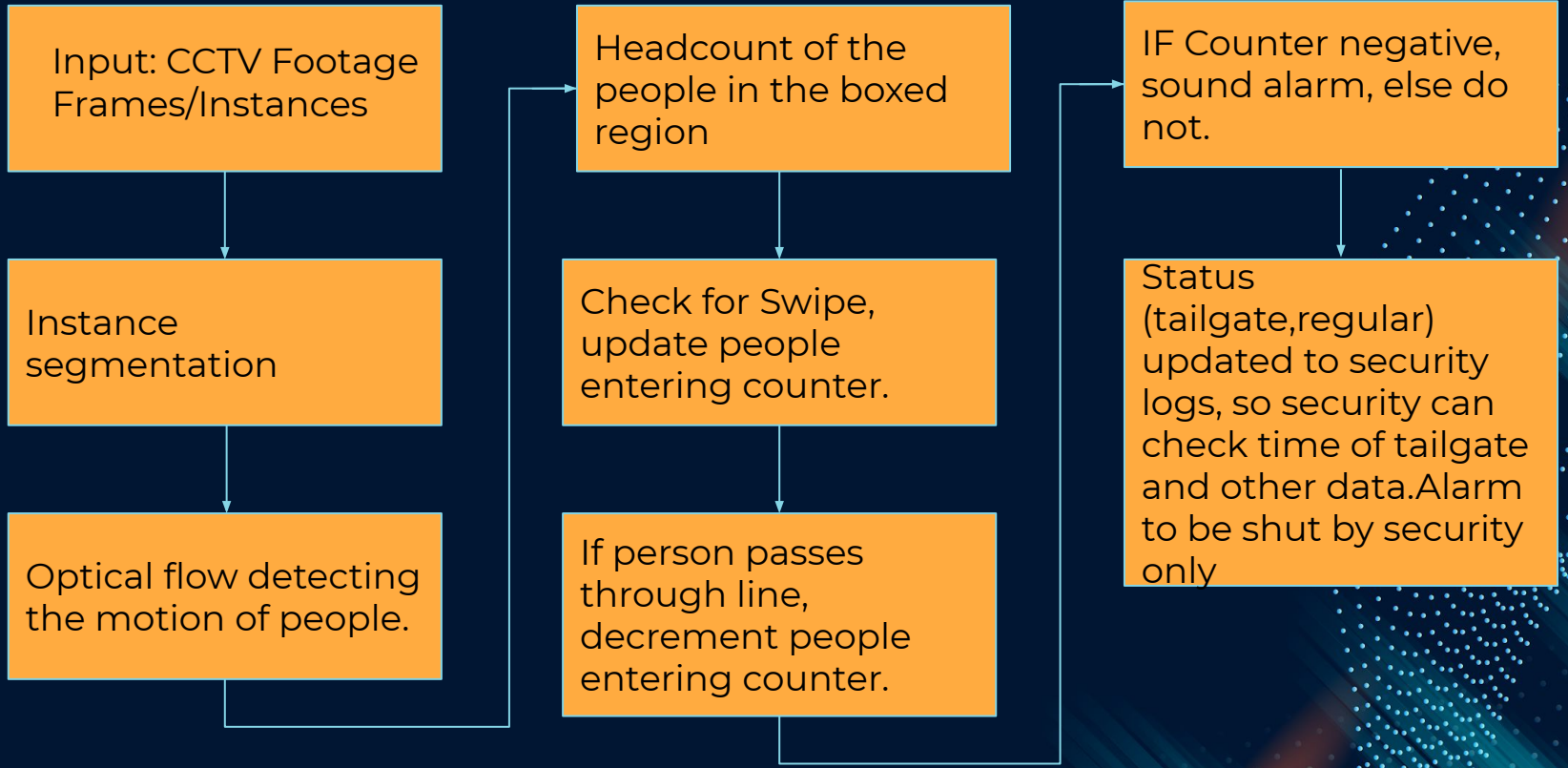
Solution -3(Side)

- The solution three is where the camera is placed on the side , at an angle facing the waiting area(green).
- The authorised perimeter(red) is drawn close to the door as seen in the image.
- The working of the solution would be similar as explained in Solution-1.

Solution -4 (From Inside)

- The camera is on the interior of the entrance, placed on the opposite wall of the room.
- The camera views the people entering the room from the outside.
- The Red Box marking the Authorised Parameter and the Green Box marking the Waiting Area are both reflected even in the interior of the room.
- The Number of Persons entering the room(Red Box) should be equal to distinct number of ID Card Swipes.
- If the number of persons entered is greater than the number of ID Card swipes, the Security is Alerted.

System Design



Technology Stack

1. Python

2. OpenCV-Python:It is a library of Python Bindings to solve Computer Vision Problems.
- People Counter
- Optical Flow to detect the motion of objects (people).

3. Mask R-CNN: Instance segmentation and Object (person) tracking.

4. NumPy:It is used for working with arrays.

5. Dlib:It is used to estimate the location of 68 coordinates(x,y) that map the facial points on a person's face.

6. Imutils: Series of convenience functions to make basic image processing functions such as resizing,rotation,etc.

Feasibility

- This solution would be extremely feasible in terms of cost, as it does not require any extra hardware sensors. Perhaps the only minimal cost that would be there would be for the storage of the data for security. However, this is something that is already available in most MNC's or Medium/Small scale enterprises.

- Technical Feasibility would be high as the program pieces together existing computer vision software to detect, and additional counting methods and regions will be added by us.

THANK YOU