deti universidade de aveiro
departamento de electrónica, telecomunicações e informática

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Tracking

Milestone 4

Supervisors:
Professor Osvaldo Pacheco
Professor Gonçalo Carnaz

Tracking

OUR TEAM

DAVID AMORIM

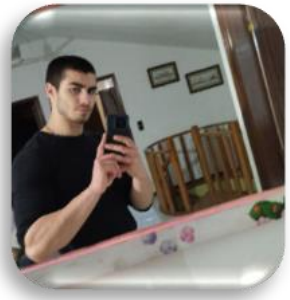
DevOps

FRANCISCO ALBERGARIA

Product Owner

FRANCISCA SILVA

Project Manager



GABRIEL SANTOS

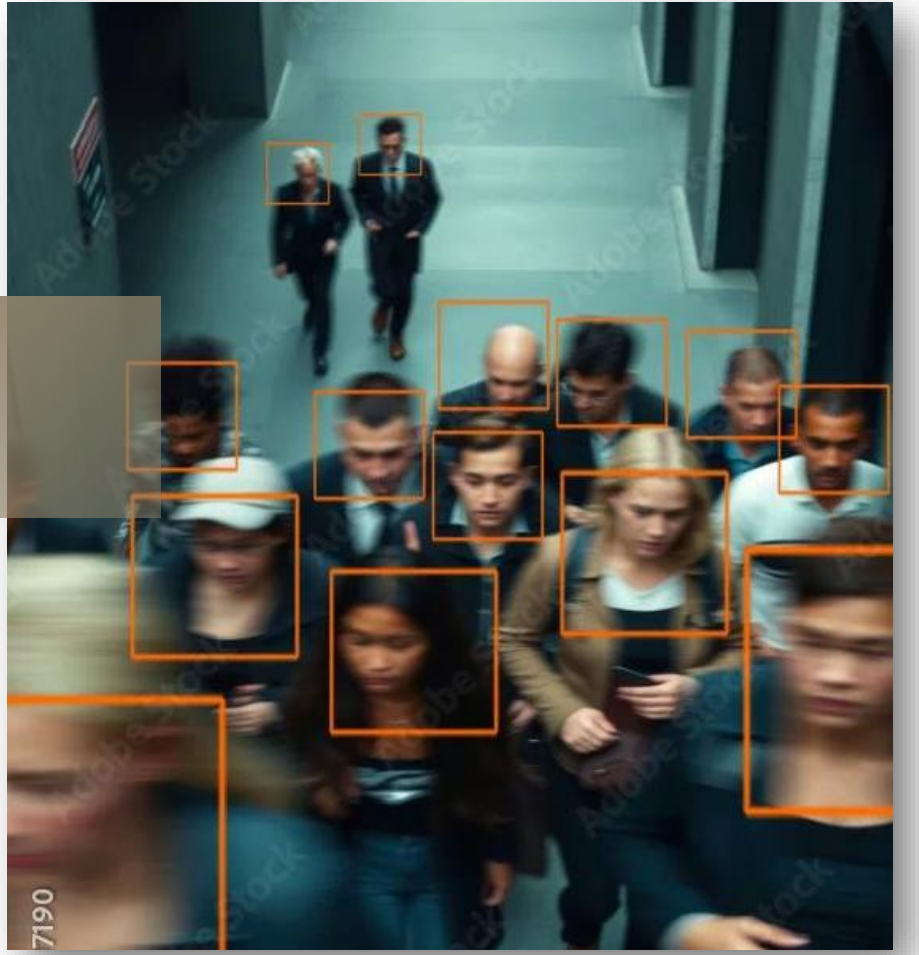
Quality Assurance
(Product Tester)

GUILHERME AMARAL

DBA

JOÃO GASPAR

Architect



ABOUT TRACKING

Software designed to assist police agents in investigations. Using AI, the system can analyze multiple cameras in real time, detecting individuals based on specific characteristics, such as carrying a weapon, and logging their movements. The goal is to significantly reduce the time required to locate suspects, enabling a faster and more effective response in critical situations.

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TABLE OF CONTENTS

USE CASES

01

USE CASES

REGISTER AND UNREGISTER USER

Priority: 4

Difficulty: 2

Priority: 3

Difficulty: 2

DETECTION OF WEAPONS & SUSPECTS IN LIVE CAMERAS

Priority: 5

Difficulty: 5

UPLOADING VIDEO

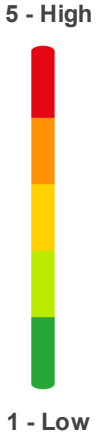
Priority: 5

Difficulty: 3

REGISTER AND UNREGISTER CAMERA

Priority: 4

Difficulty: 3



USE CASES

VIDEO SUSPECT SELECTION FOR TRACKING

Priority: 5

Difficulty: 5

DETECTION OF WEAPONS & SUSPECTS UPLOADED VIDEOS

Priority: 4

Difficulty: 4

SUSPECT PATH DISPLAY IN MAP

Priority: 3

Difficulty: 3

RETRIEVING TRACKING LOGS FOR A SPECIFIC SUSPECT

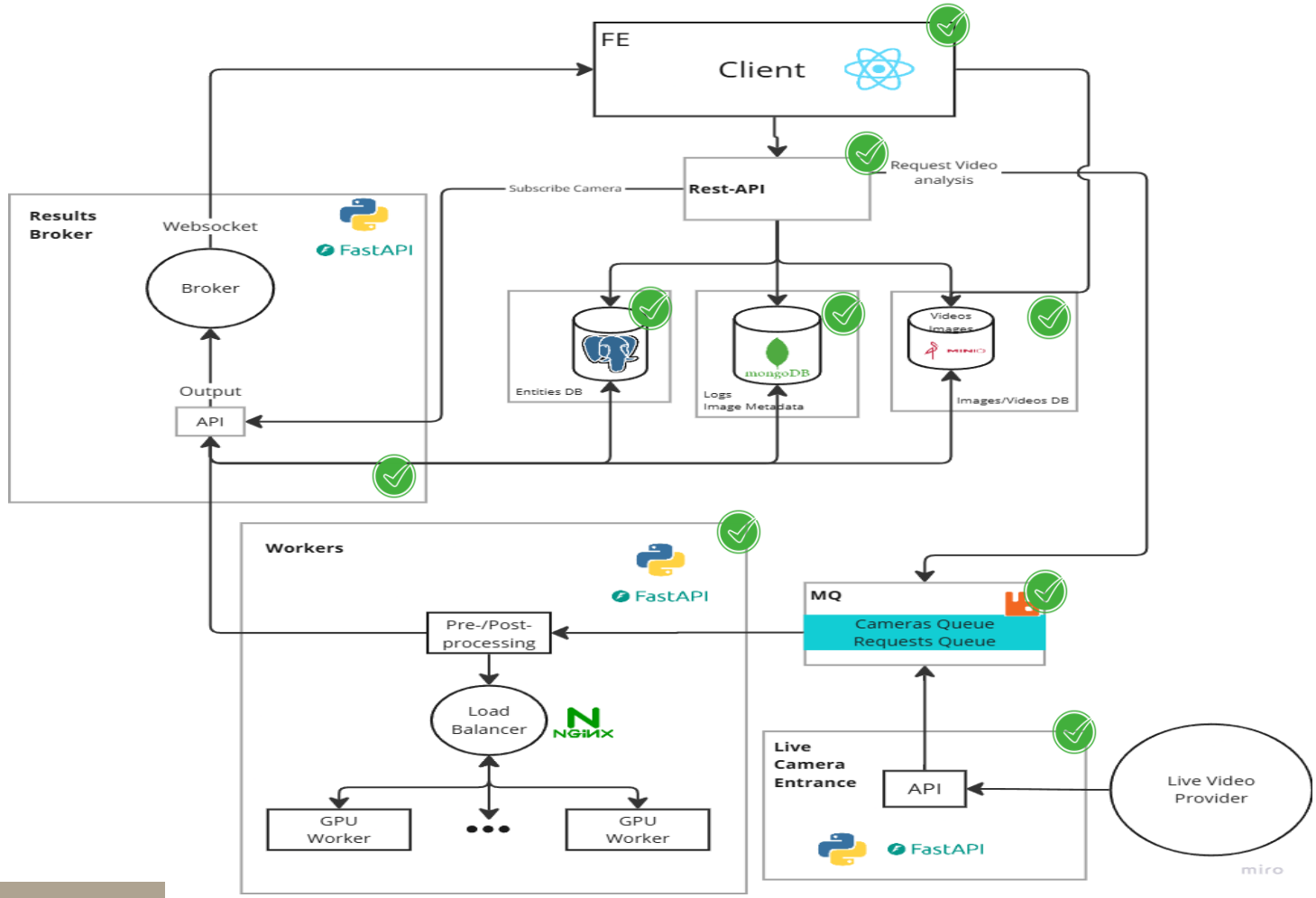
Priority: 4

Difficulty: 3

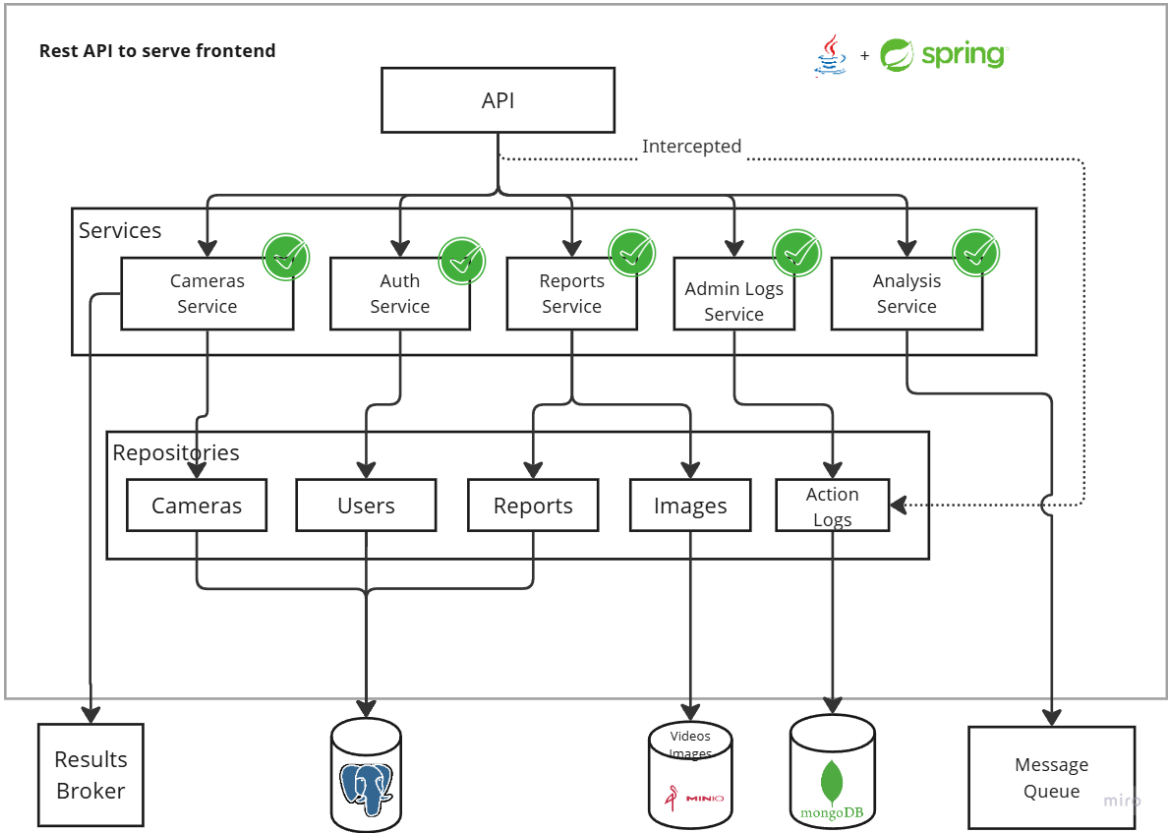
SYSTEM ARCHITECTURE

02

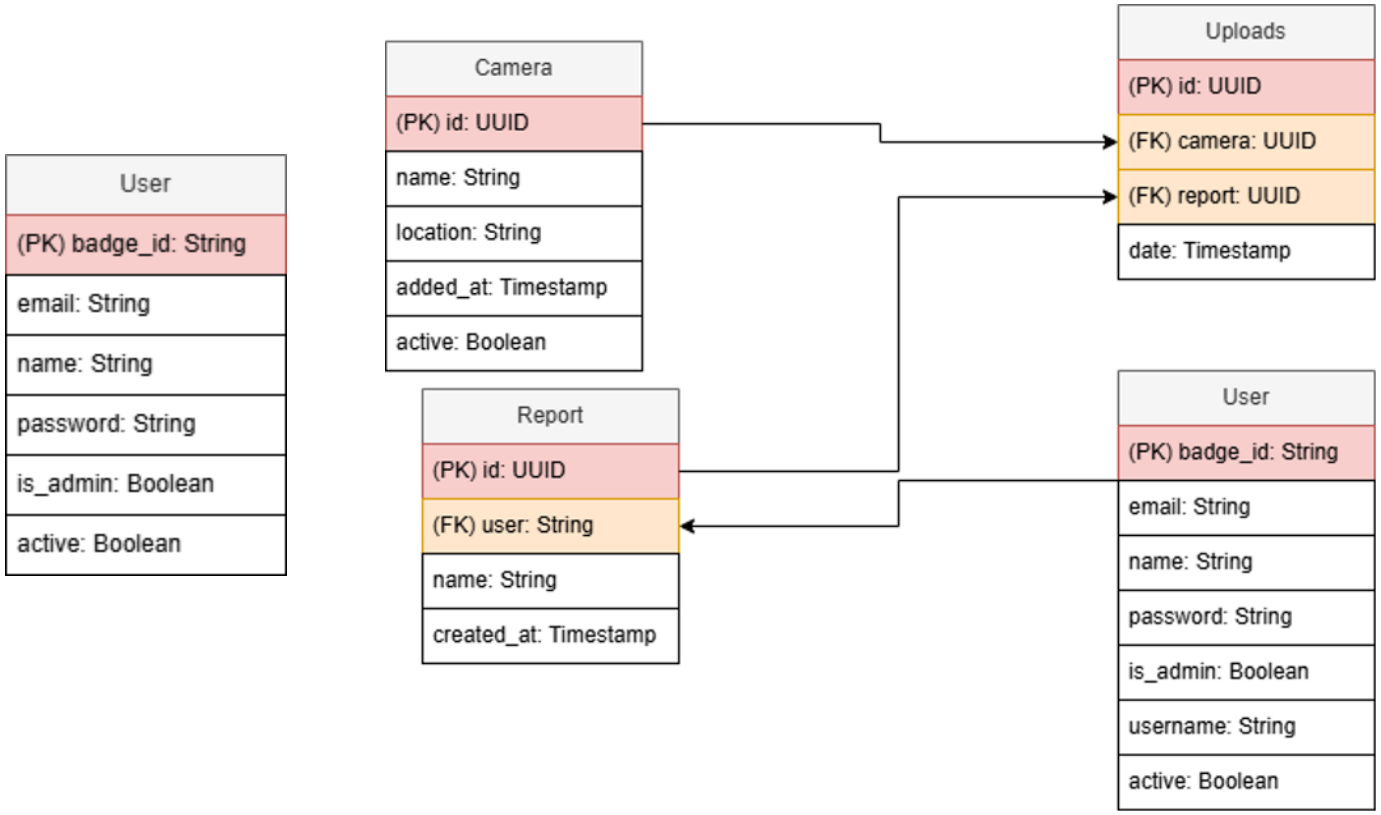
SYSTEM ARCHITECTURE



SYSTEM ARCHITECTURE



DATABASES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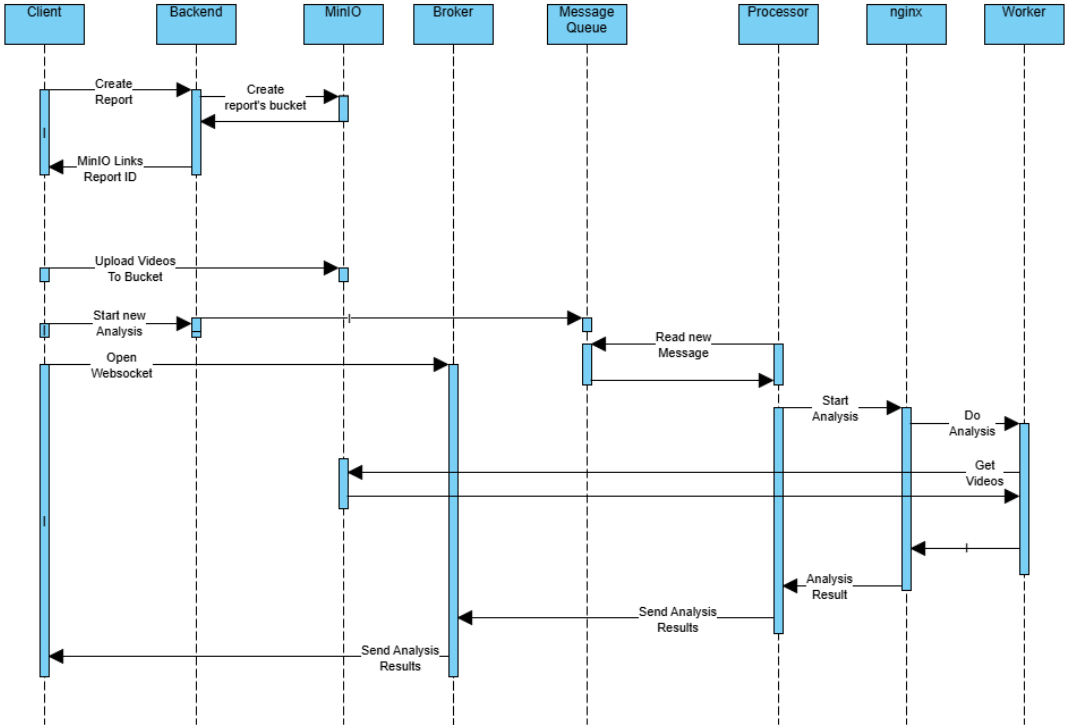
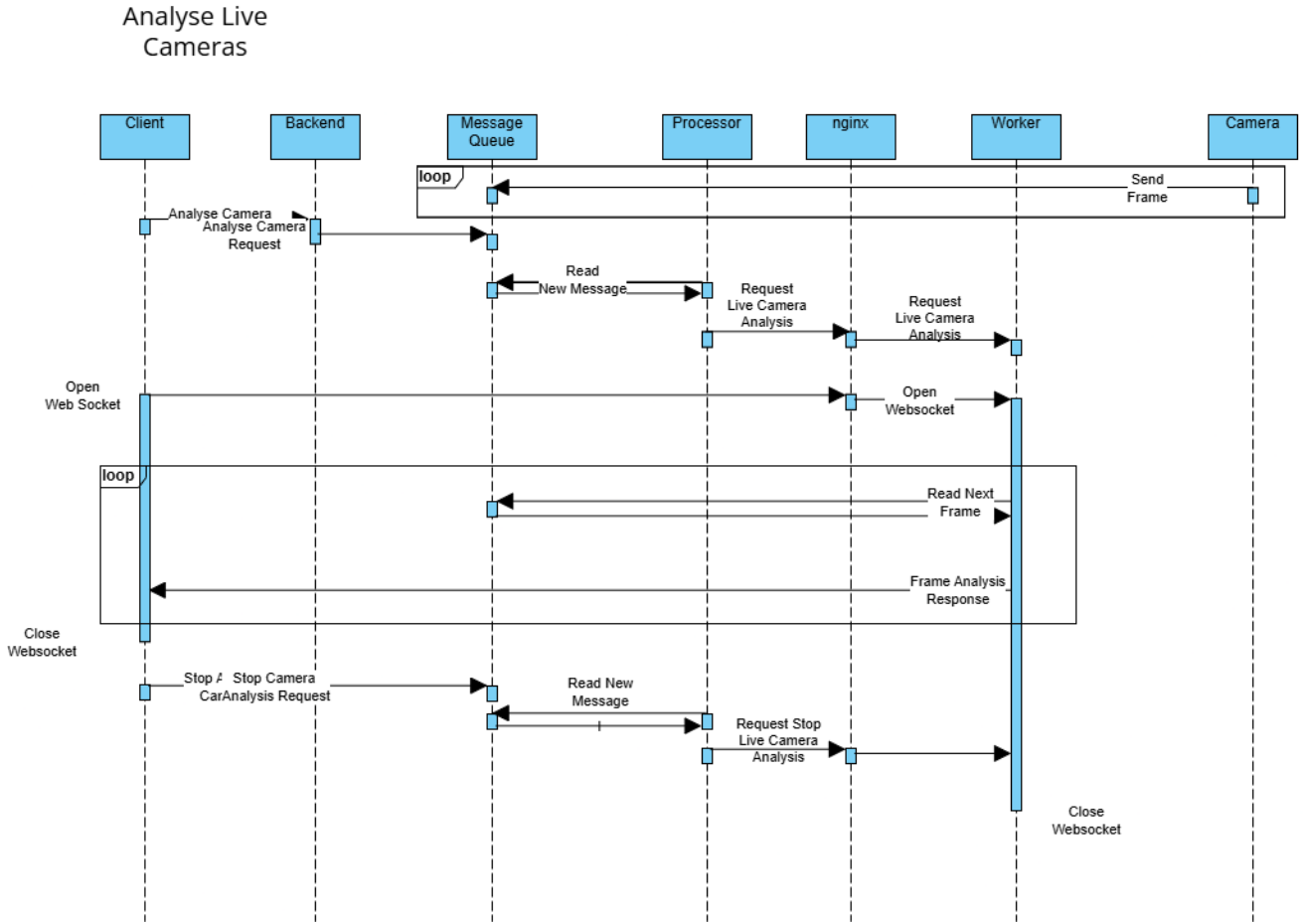
email: String
name: String
password: String
is_admin: Boolean
active: Boolean
Camera
(PK) id: UUID
name: String
location: String
added_at: Timestamp
active: Boolean
Report
(PK) id: UUID
(FK) user: String
name: String
created_at: Timestamp
Uploads
(PK) id: UUID
(FK) camera: UUID
(FK) report: UUID
date: Timestamp
User
(PK) badge_id: String
email: String
name: String
password: String
is_admin: Boolean
username: String
active: Boolean

SEQUENCE DIAGRAM

Analyse
Uploaded Videos



SEQUENCE DIAGRAM



WEAPON DETECTION MODEL

03

RESULTS

Old Dataset

	True Weapon	True Knife
Predicted Weapon	0.72	0.01
Predicted Knife	0.02	0.56

New Dataset

	True Weapon	True Knife
Predicted Weapon	0.86 (**+0.14**)	0.01
Predicted Knife	0.02	0.90 (**+0.34**)

SEGMENTATION POSE MODELS BIOMETRICS

04

POSE, SEGMENTATION, PERSON DETECTATION

Detect weapon

First we use the same algorithm to detect a weapon on screen

Person detection

After detecting a weapon it detects the people on screen

Pose skeleton

Now we point out the skeleton and important joints in those people, focusing on the wrist

Calculate distances

Then we calculate the distance from the gun to the closest wrist in order to detect who's holding the weapon

Segment person

The closest person will be associated to the suspect and will be segmented for feature extraction

Person tracking

Then we proceed to track the person detected with the weapon

BIOMETRICS

Upload picture of suspect

First we start by uploading the picture of the face of a suspect

Detect face

Use python library “face recognition” to detect and locate the face that matches the uploaded one

TRACKING ALGORITHM

05

TRACKING ALGORITHM

YOLO

Yolo offers a baseline model to segment all people inside a frame.

Bot-SORT

Allows us to keep segmentations ids between frames through a persist method.

Tracking

We can keep track of a suspect through consecutive frames in the same scenario

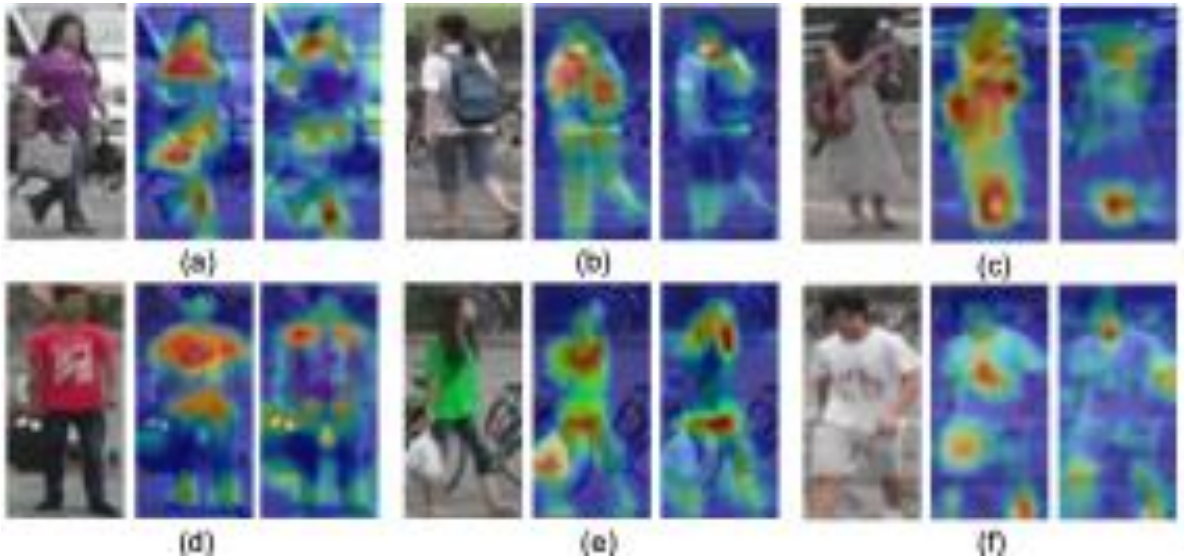
Limitations

Skipping too many frames, changing cameras or suspects going past obstacles makes the algorithm lose its track.

RE-IDENTIFICATION ALGORITHM

Model used: OSNet

Activation maps of OSNet vs other models



NEXT STEPS

07

NEXT STEPS

MODEL

Train the model with other types of weapon classes

OPTIMIZE

Optimizations on re-id and tracking logic.

MODEL SWAP

Choose different models to execute, for model testing

BIOMETRICS

Use face recognition as fallback to the re-id model

CONCLUSION

THANK YOU!

Does anyone have any questions?