BLOB-FREE

CRITICAL DESIGN REVIEW (CDR)

INTERDISCIPLINARY PROJECT A.Y. 2020/21

PROPOSED BY PROF. DOVIS, PROF. PIRAS AND PROF. DI PIETRA

BLOB-FREE

Computer vision system for reducing Coronavirus infection risk

MASK detection

ASSEMBLAGE detection

CHANGES & PERFORMANCE

NVIDIA **Quadro P1000** → NVIDIA **Jetson Nano**

Tensorflow MobileNetV2 → **Darknet** YOLOv4-tiny

- Output of object detection and tracking at **2-3 fps**
- Class “no mask”, ap = 75.31%
- Class “mask”, ap = 91.11%
- **mAP**@0.50 = **83.21** %

HIGH LEVEL DESIGN

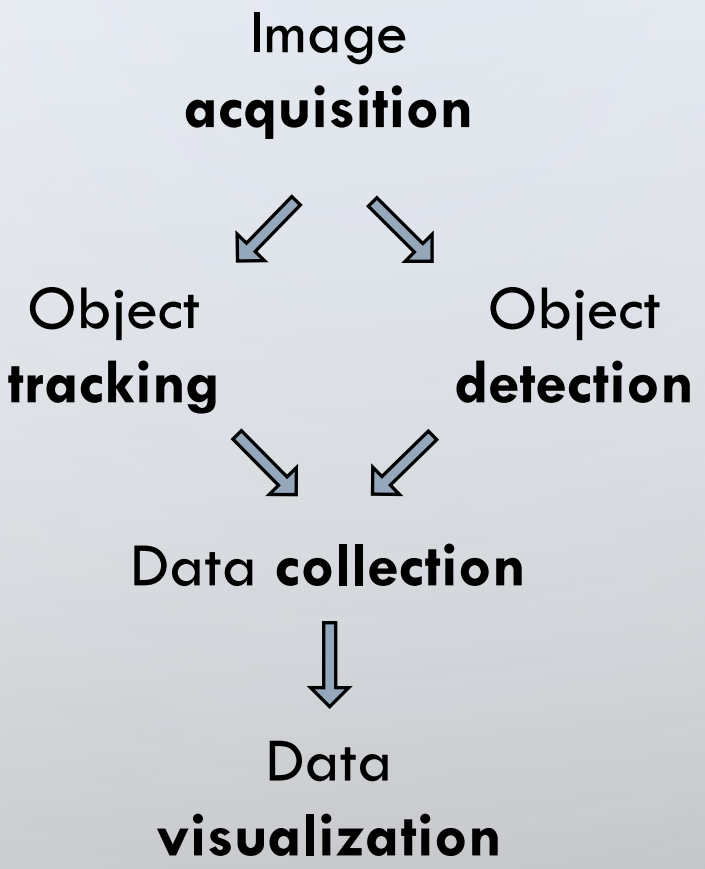
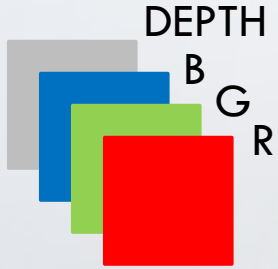


IMAGE ACQUISITION

ZED2 Stereo Camera

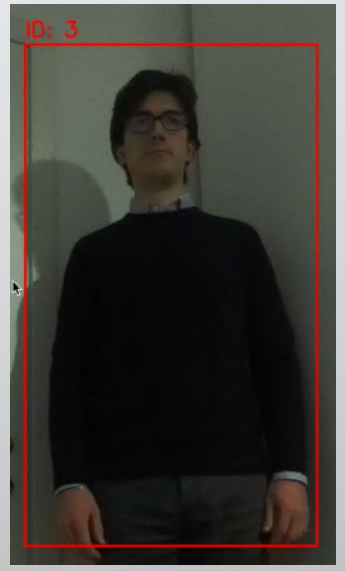


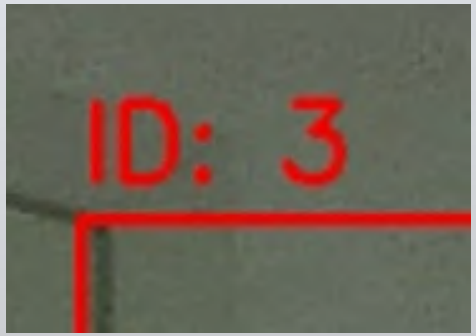
- **R-G-B-DEPTH** channels
- DEPTH channel sampled at **15 Hz**
- **1920x1080** resolution for improving face mask detection
- **15 fps** for improving brightness

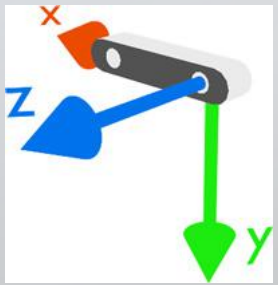
OBJECT TRACKING

ZED SDK

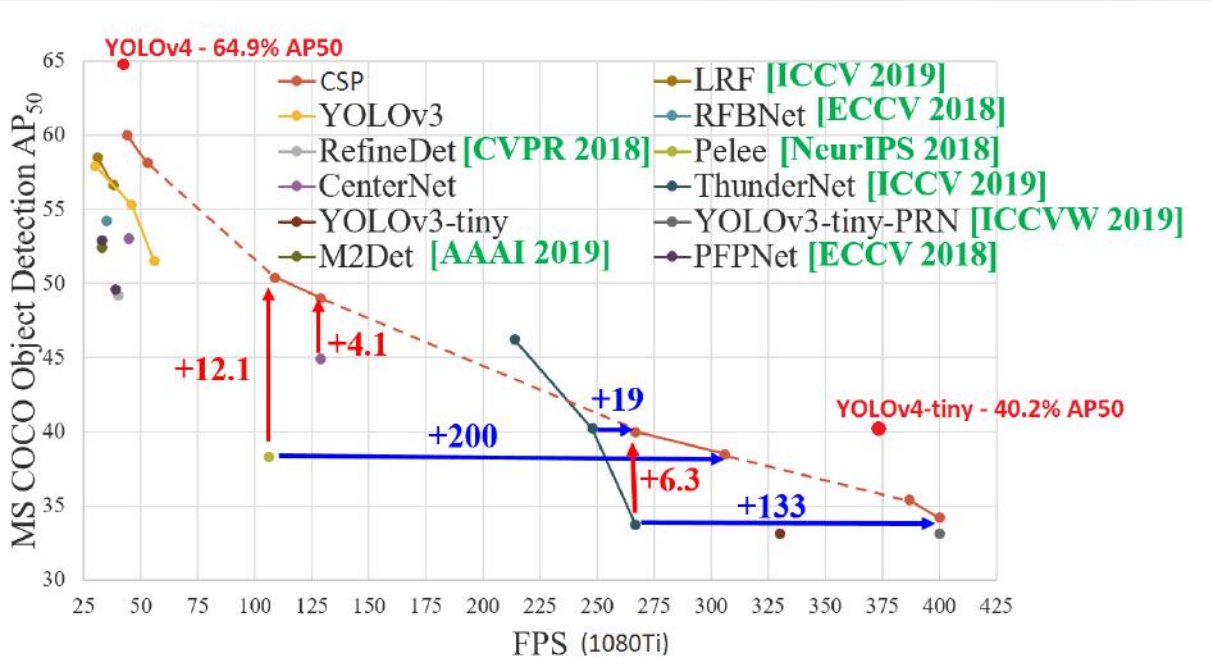
Person recognition with **CNN** → Progressive **ID** assignment → Relative **position** computation







OBJECT DETECTION



- **Darknet** framework
- Face mask dataset
- **YOLOv4-tiny** weights custom training
- 2 classes: "**mask**" and "**no mask**"
- **Single network** evaluation
- **800x800** network resolution

DATA COLLECTION

- Create 1 document for each person detected
- Random **ID**
- **Mask** detection
- **Timestamp**
- Images are not saved (data **anonymity**)

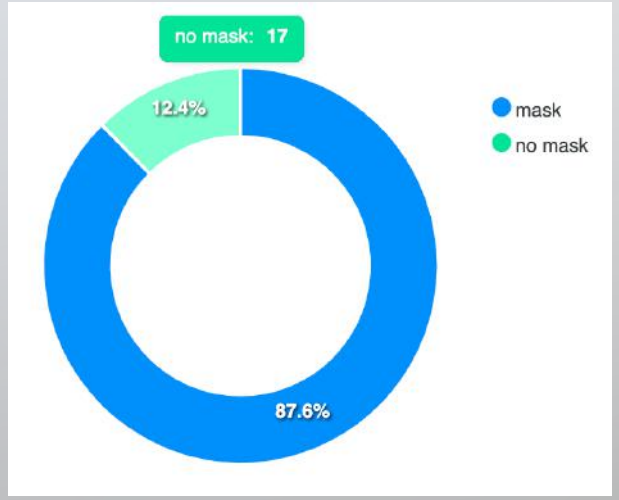
```
db={
  "detections": [
    {
      "_id": 1,
      "mask": true,
      "timestamp": 1610365775
    },
    {
      "_id": 2,
      "mask": false,
      "timestamp": 1610365775
    }
  ]
}
```

DATA VISUALIZATION

CherryPy web server for **management interface** hosting

Angular (JS framework) for frontend

APEXCHARTS for visualizing charts



DEVELOPMENT TOOLS

- **Jetson Nano** in headless mode to save RAM
- **OpenCV** real-time encoding
- **Flask** web server
- **M-JPEG** video stream on LAN visible from browser
- **Development-purposes** only

WORKPLAN


27/11 SRR
18/12 PDR
15/1 CDR
7/5 TRR
25/6 FR
16/10
10/11
5/12
30/12
24/1
18/2
15/3
9/4
4/5
29/5
23/6
18/7
Project plan definition
16/10 – 30/10
User requirements definition
23/10 – 27/11
Image recognition methodology evaluation and definition
6/11 – 27/11
Training dataset gathering
6/11 – 4/12
Cameras testing
11/11 – 4/12
Solid image composition algorithm development
4/12 – 29/1
Person recognition algorithm
4/12 – 29/1
Assamblages detection algorithm
29/1 – 9/4
Mask detection algorithm
29/1 – 9/4
Statistics visualization
9/4 – 7/5
Warning issuing management
9/4 – 7/5
Controlled-scenario testing
7/5 – 17/5
Results analysis and validation
17/5 – 27/5
Real-world scenario testing
27/5 – 3/6
Final results analysis
3/6 – 25/6

THANK YOU FOR THE ATTENTION!

Team members:

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