
EMOTION3D
CREATING INTELLIGENT VISION
FOR INCREASING ROAD SAFETY

EMOTION3D

20+ PROFESSIONALS WITH INTERDISCIPLINARY CORE EXPERTISES

EXPERTISE

COMPUTER VISION

AI & MACHINE LEARNING

SIMULATION & VISUALIZATION

CUSTOMER REFERENCES

ZF

ZKW

PALFINGER

umdaschgroup

AVL

intel

ColorLink Japan, Ltd.

Melexis
INSPIRED ENGINEERING

OmniVision

NVIDIA

EMOTION3D

ADVANCES IN AUTOMOTIVE IN-CABIN MONITORING

AGENDA

MOTIVATION

IN-CABIN MONITORING OVERVIEW

IN-CABIN MONITORING MODULES

SYSTEM ASPECTS

EVALUATION & VALIDATION

SUMMARY


DRIVECAM

OVERVIEW AI BASED MONITORING

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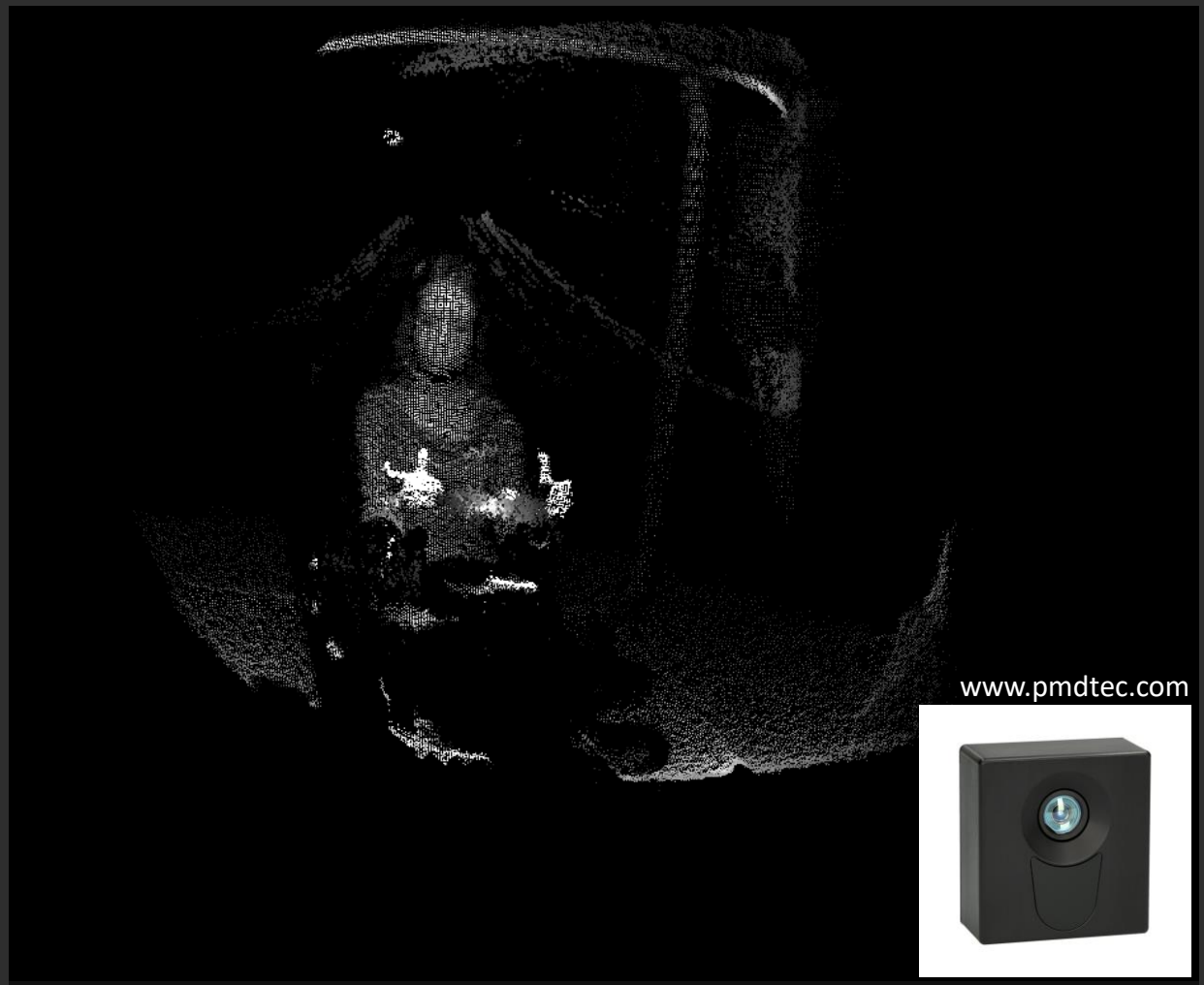
ATTENTION MONITORING	DISTRACTION DETECTION	INTELLIGENT AIRBAGS	HANDS ON WHEEL DETECTION	BEHAVIOR ANALYSIS
SEAT BELT DETECTION	GESTURE CONTROL	OBJECT ANALYSIS	CHILD SEAT DETECTION	AND MUCH MORE …

SENSOR TYPES

2D CAMERAS



3D CAMERAS

HEAD POSE ESTIMATION

RF

DL

DL

DL

FULLSCREEN MODE

EXIT DEMO

Processing Time

75 ms

50 ms

25 ms

Depth

Near Infrared

EYE ANALYSIS

EMOTION3D

BODY POSE & ANTHROPOMETRY

RF

DL

DL

DL

FULLSCREEN MODE

EXIT DEMO

Processing Time

75 ms

50 ms

25 ms

Depth

Near Infrared

OBJECT DETECTION

RF

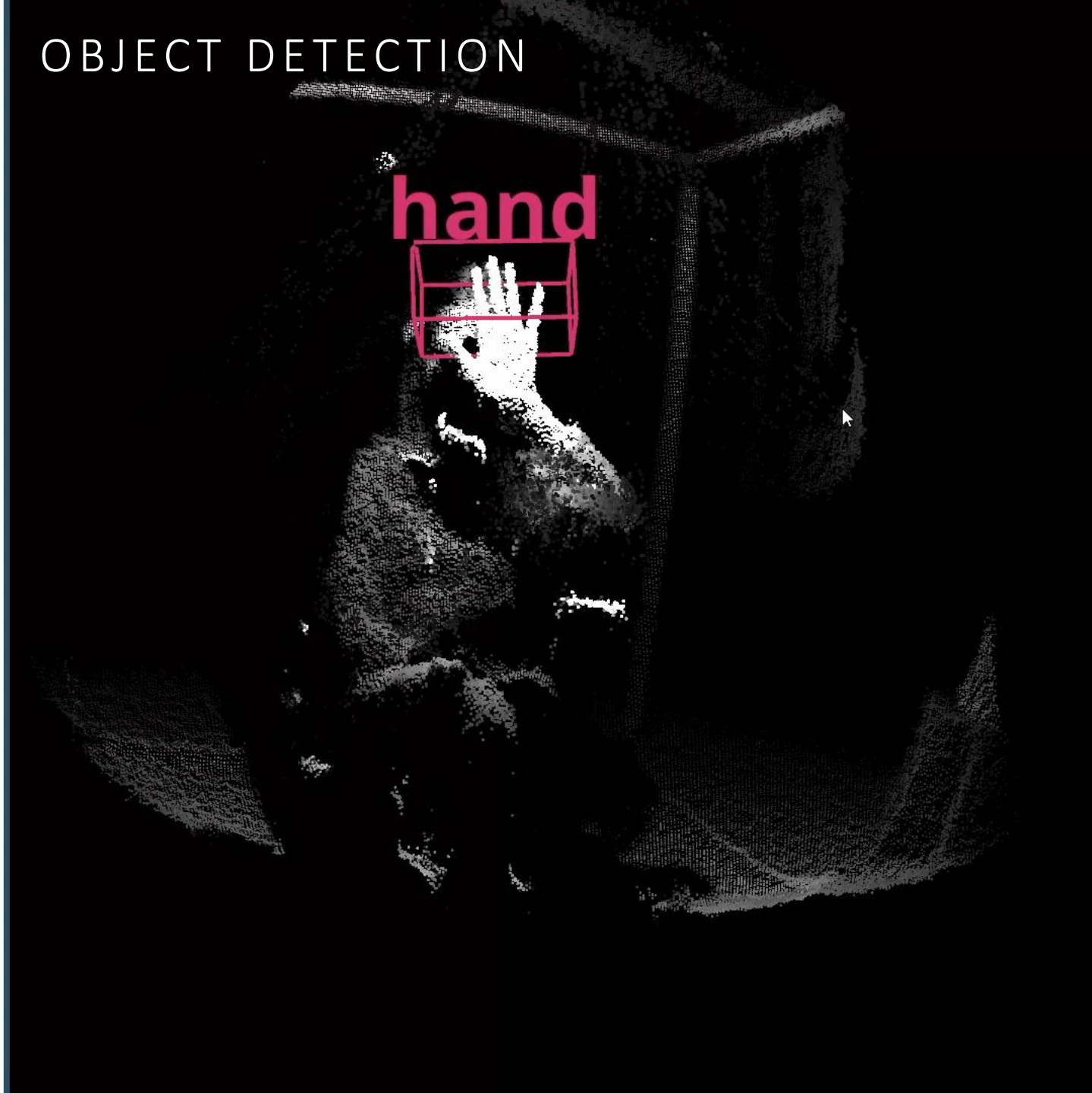
DL

DL

DL

FULLSCREEN MODE

EXIT DEMO



Processing Time

75 ms

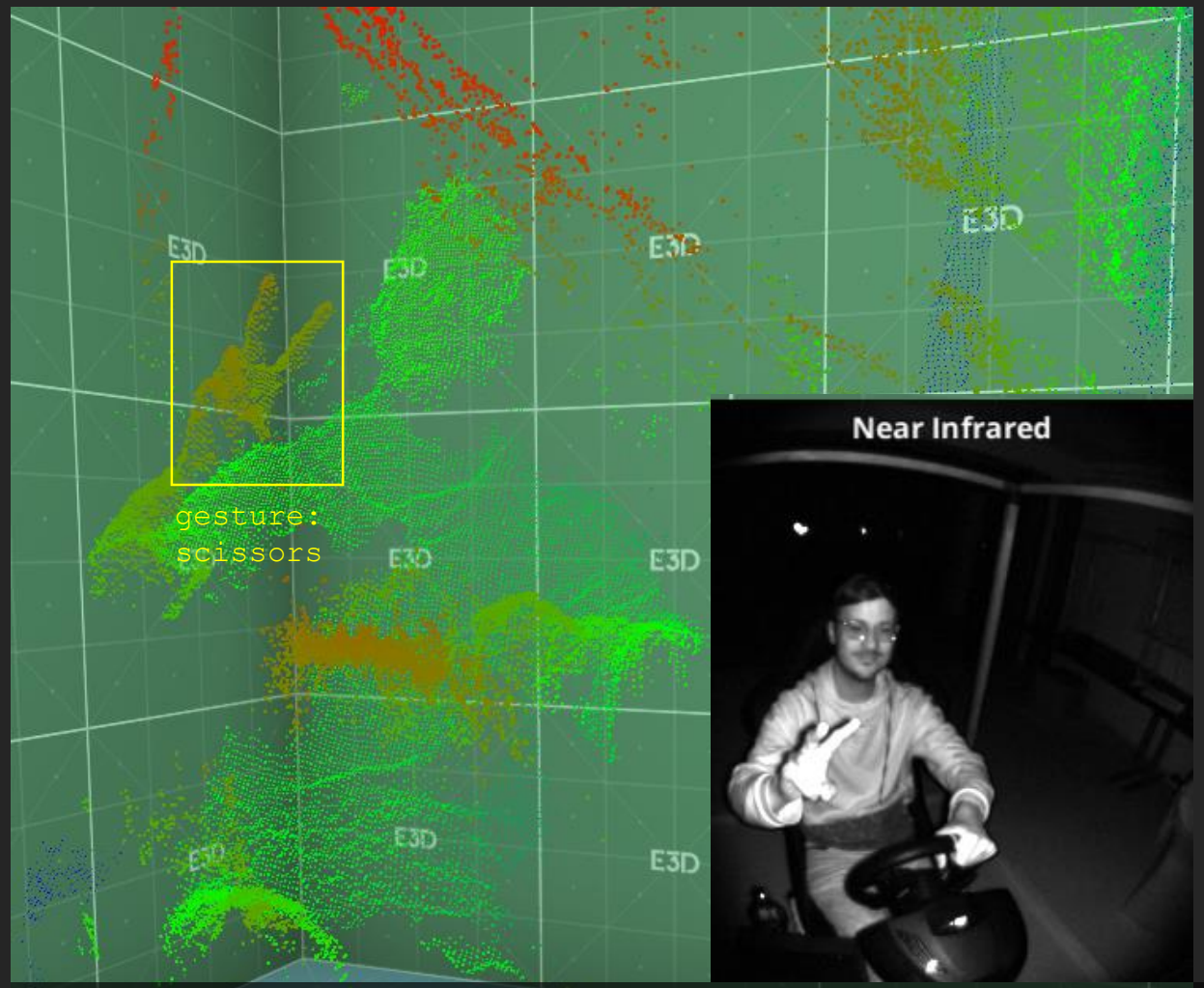
50 ms

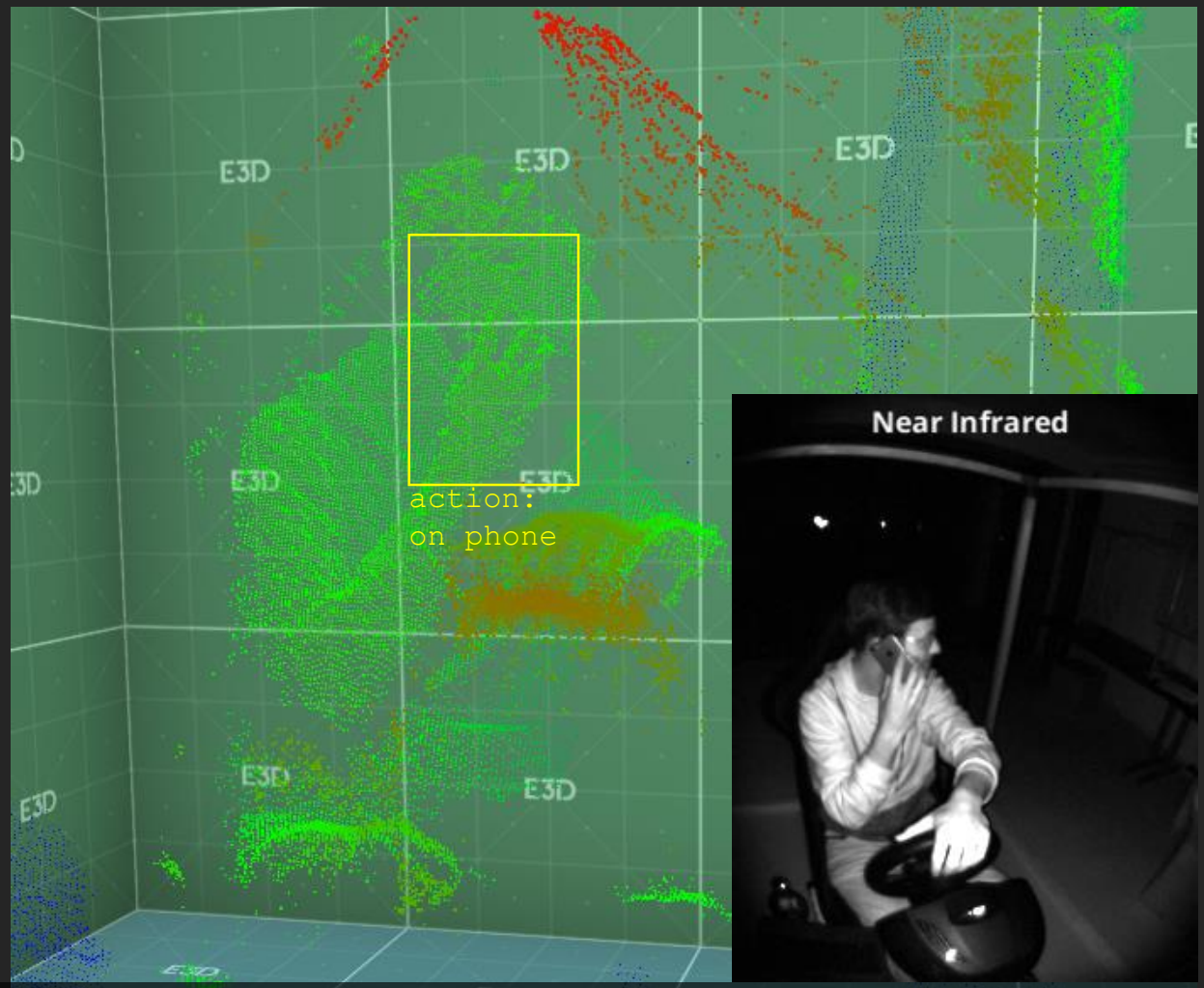
25 ms

Depth

Near Infrared

ACTION RECOGNITION





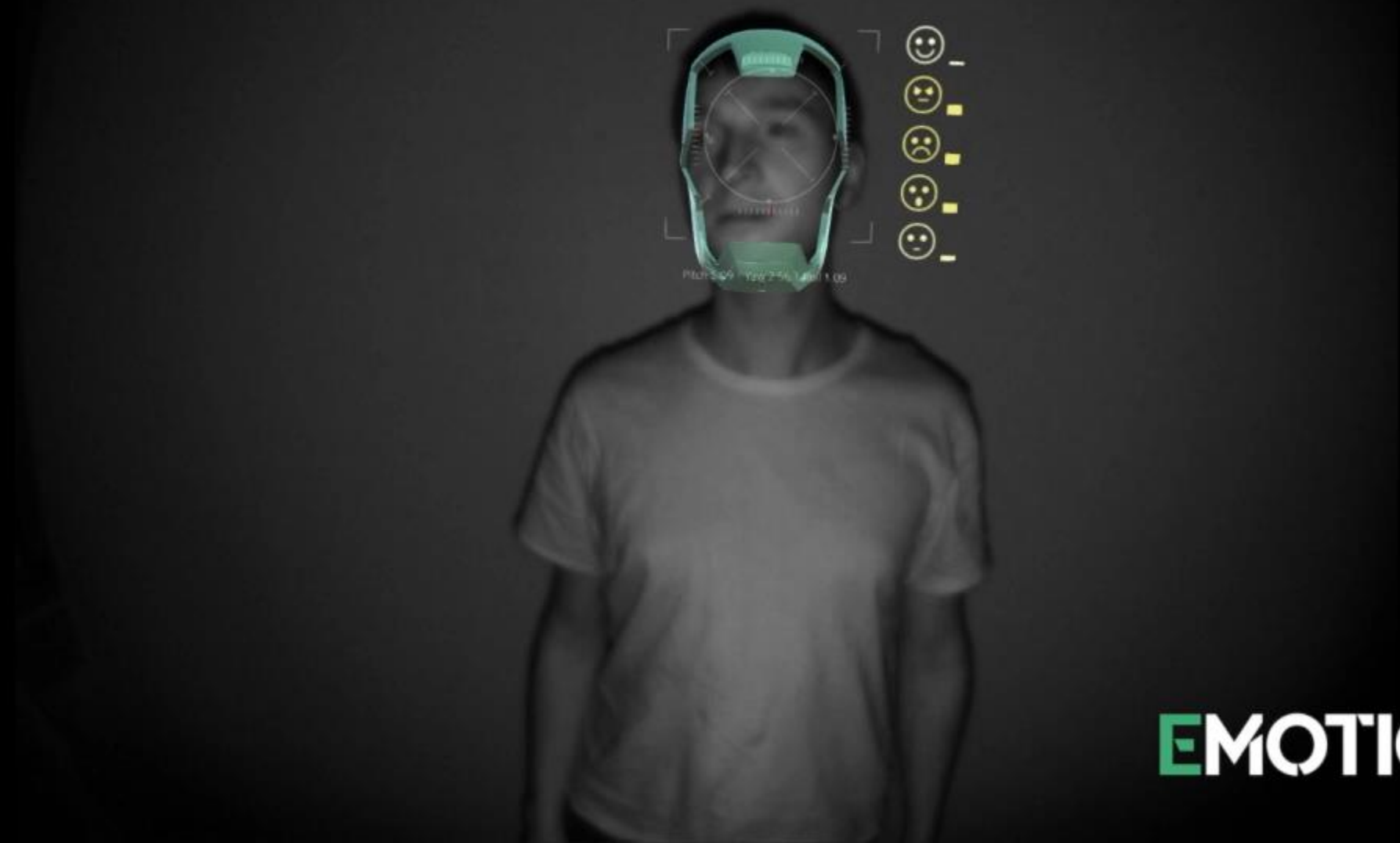
ACTION ANALYSIS

BEHAVIOR ANALYSIS, GESTURE RECOGNITION

EMOTION RECOGNITION

Visualization: 59 FPS (16.97ms)

Prediction: 32 FPS (30.92ms)



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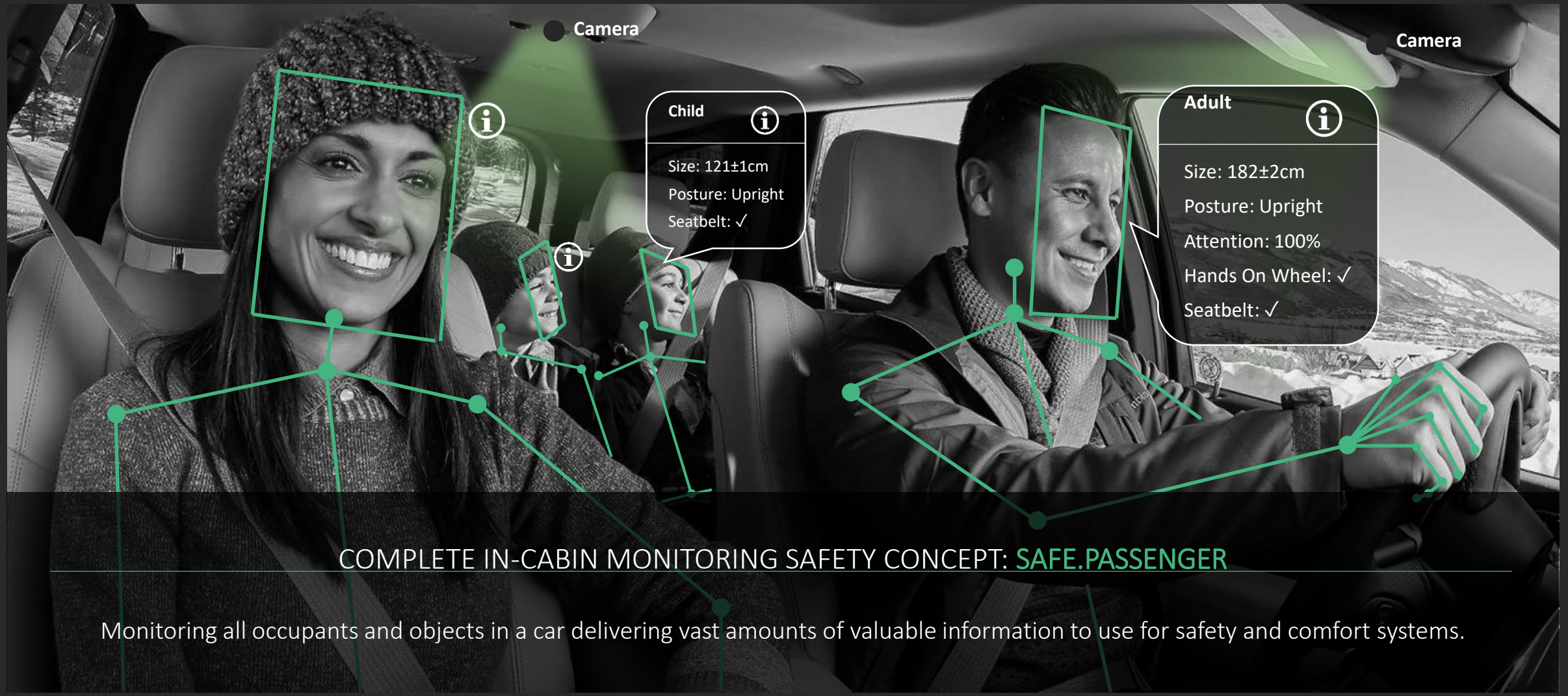
SAFE.PASSENGER

SAFE.PASSENGER

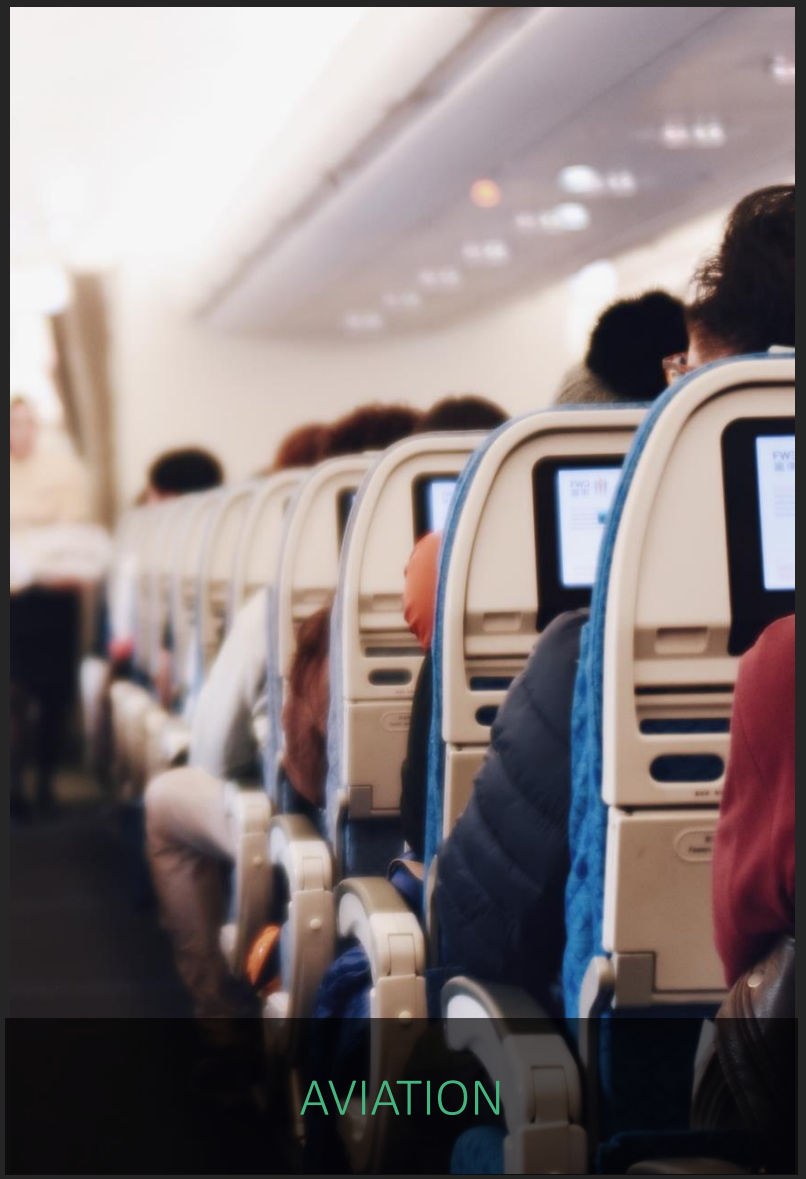


COMPLETE IN-CABIN MONITORING SAFETY CONCEPT: SAFE.PASSENGER

Monitoring all occupants and objects in a car delivering vast amounts of valuable information to use for safety and comfort systems.

ADDITIONAL APPLICATION AREAS OF SAFE.PASSENGER

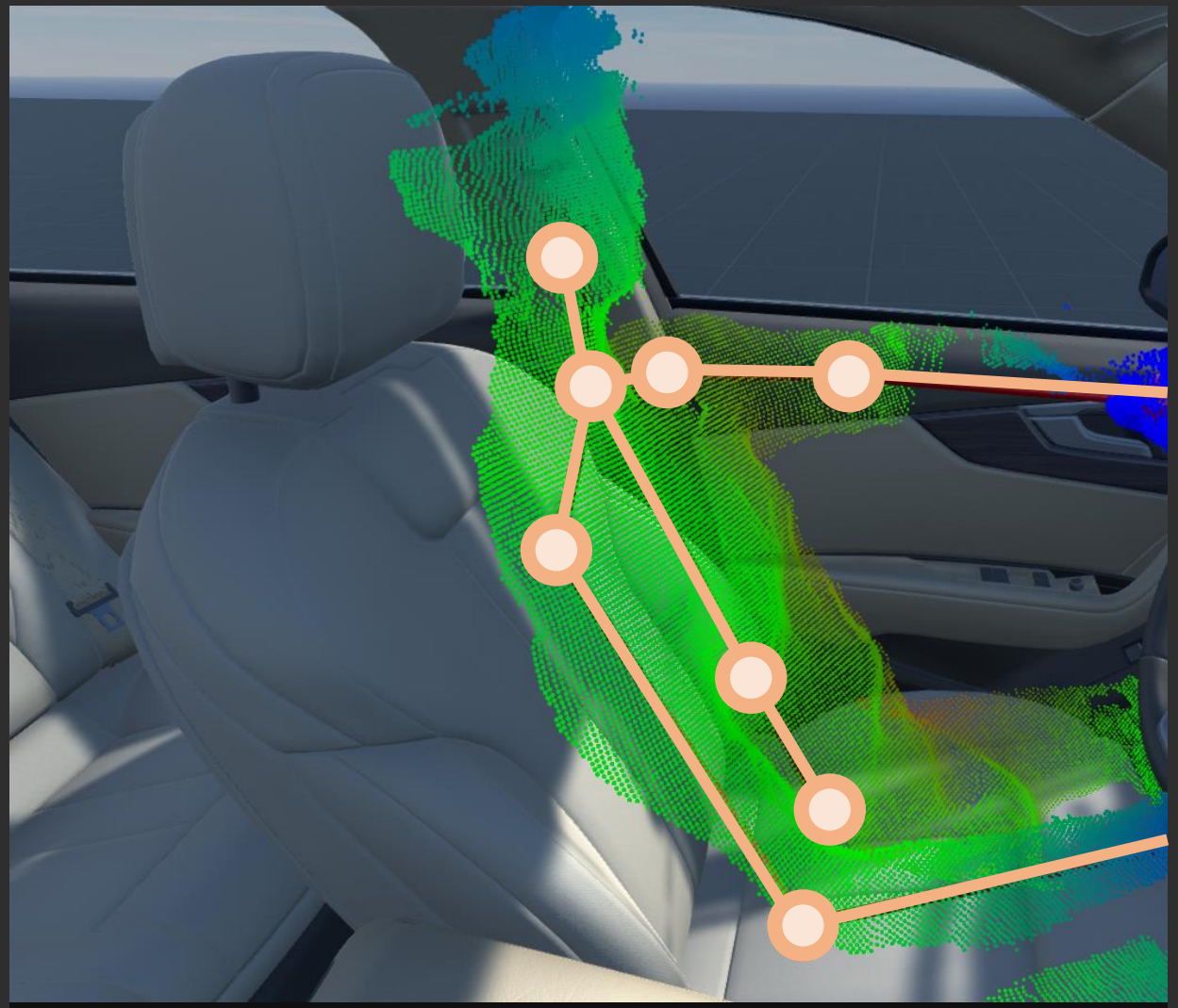
RAIL



AVIATION

OFF-HIGHWAY

SENSING & PROCESSING CHALLENGES



EXTREME CAMERA POSITIONS

LOW RESOLUTION

SENSING & PROCESSING CHALLENGES

REAL-TIME PROCESSING ON LOW COST EMBEDDED SYSTEMS

POOR ILLUMINATION

TRAINING / VALIDATION DATA GENERATION

REAL DATA GENERATION

SIMULATION & SYNTHETIC DATA GENERATION

REAL DATA GENERATION

Source: xsens.com

+Meta-Data (Weight, Emotions, etc.)

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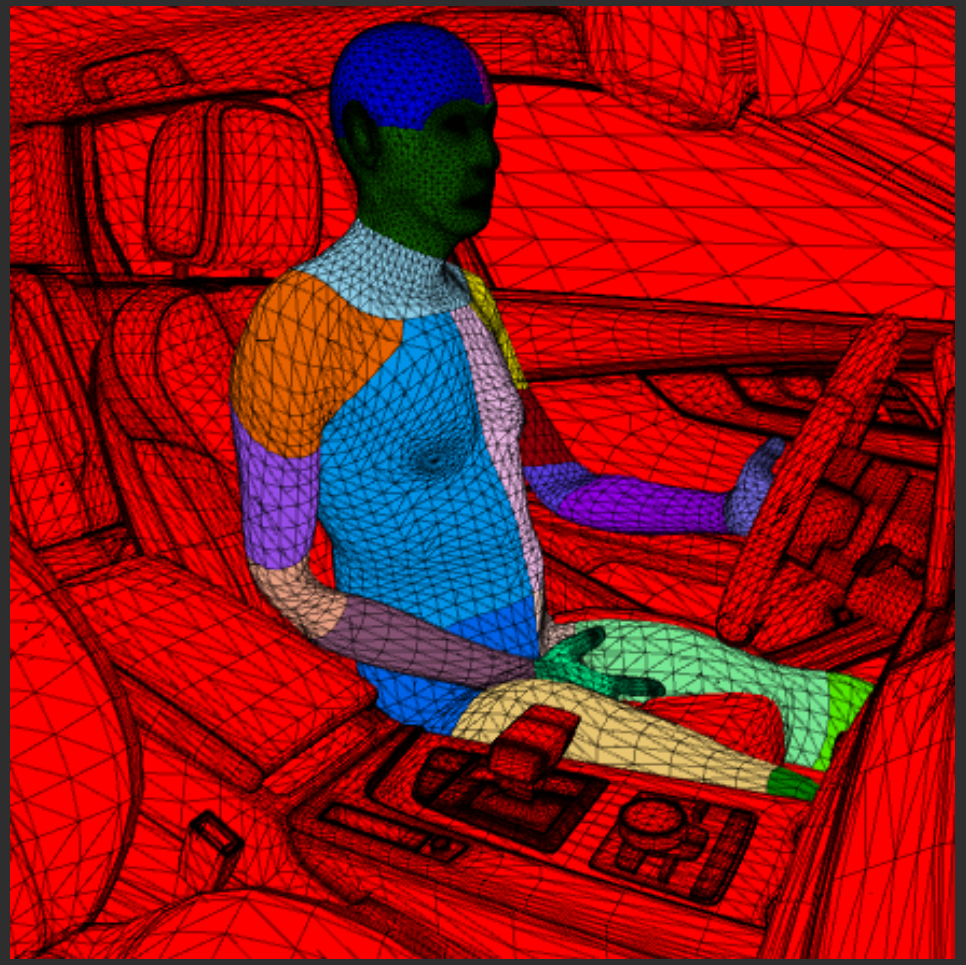
SIMULATION & SYNTHETIC DATA GENERATION

3D SCENE DESCRIPTION

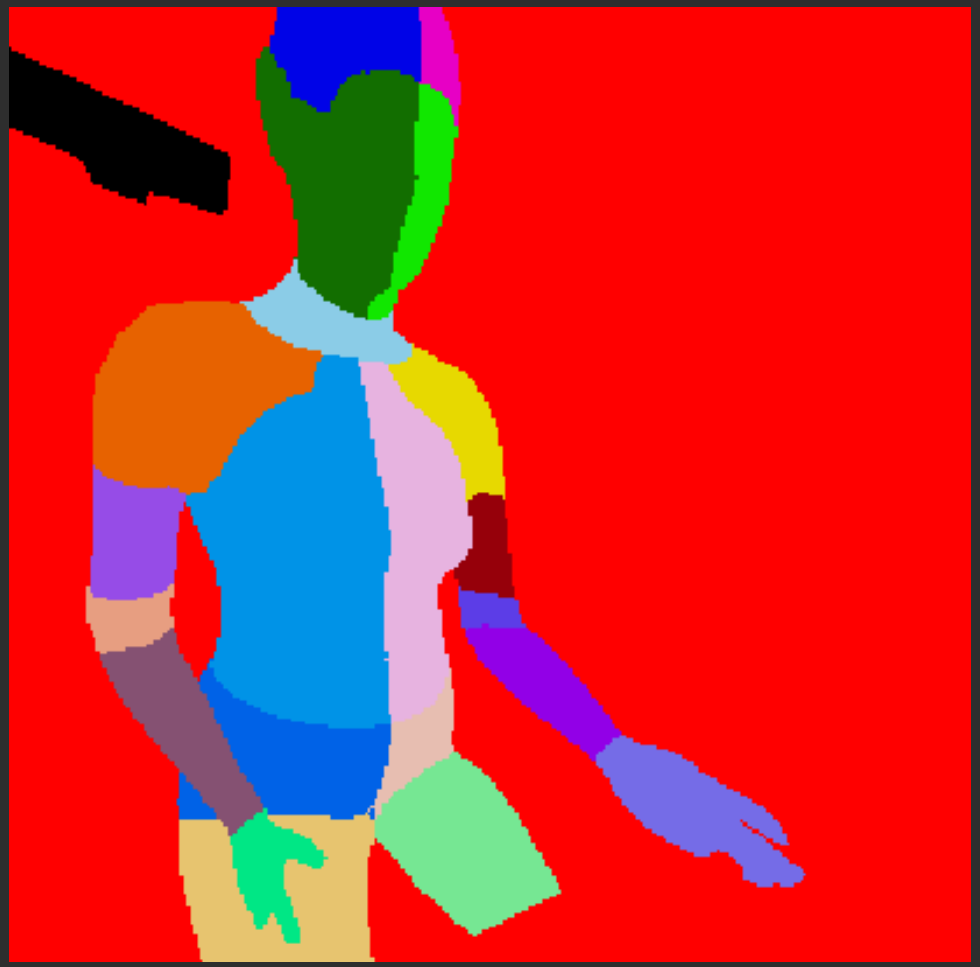


GT DEPTH SENSOR SIMULATION

SIMULATION & SYNTHETIC DATA GENERATION

DEPTH SENSOR OUTPUT SIMULATION

SEMANTIC IMAGE



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SIMULATION & SYNTHETIC DATA GENERATION





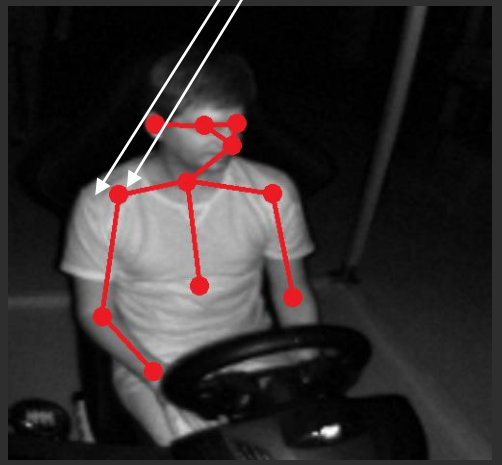

EVALUATION & VALIDATION

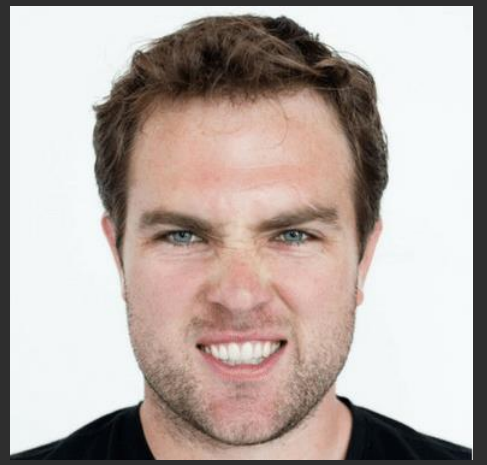
GENERATION OF QUALITY REFERENCE DATA (GROUND TRUTH)

- Time consuming
- Frequently requires special expertise & a good plan ;)
  - Visible vs. occluded
  - Anatomically correct (e.g. body joint positions)?
  - Emotions? (Correct interpretation, standardized labeling)
- …

VALIDATION CHALLENGES

- AI considered as black box
- Formal verification vs. catalogue
- No standard established so far
- Try-it-first vs. Prove-it-first approach





Source: scienceofpeople.com

CERTIFICATIONS

ISO26262

- Standard norm for automotive safety – ML components are NOT considered, therefore not applicable

AUTOMOTIVE-SPICE

- Assessment of development processes
- Required by almost all major OEMs

MISRA / AUTOSAR

- Coding / software development guidelines
- Also required by most OEMs

NEW STANDARDS & CERTIFICATIONS COMING SOON (PROBABLY)

SUMMARY

INTERIOR MONITORING IS GAINING MOMENTUM

- Many vision-based monitoring possibilities
- Driver Safety / Autonomous Driving

WIDE RANGE OF AI VISION CHALLENGES YET TO SOLVE ☺

QUALITY DATA GENERATION

VALIDATION CONCEPTS

DEVELOPMENT OF SOLUTIONS REQUIRE BROAD SKILL-SET OF TEAM

- CV
- Machine Learning
- Simulation
- …

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INTERESTED?

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