



Multisensor Large Scale Data
Management for Training Sets and
Ground Truth Automatic Generation

Virtual, 9 -10 September

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Vicotech



Outline

- **Cloud-LSVA** project
 - H2020 project
 - Large scale analytics

- **Annotation**
 - VCD – Video Content Description
 - Standardisation activities

Cloud-LSVA project



Maps

The TomTom logo is displayed within a blue-bordered box. A blue padlock icon is positioned at the top left of the box.

ADAS

The Valeo logo is displayed within a blue-bordered box. A blue padlock icon is positioned at the top left of the box.

Cloud

The IBM logo is displayed within a blue-bordered box. A blue padlock icon is positioned at the top left of the box.

Spec. HW

The Intel logo is displayed within a blue-bordered box. A blue padlock icon is positioned at the top left of the box.

Middleware

The Intempora logo is displayed within a blue-bordered box. A gear icon with a 'G' is positioned at the top left of the box.

Sim. & Val.

The tass international logo is displayed within a blue-bordered box. A gear icon with a 'G' is positioned at the top left of the box.

Research

A collection of logos for research partners, including 'ceatech list', 'DCU', 'TU/e Technische Universiteit Eindhoven University of Technology', and 'vicomtech ik4 research alliance'. A magnifying glass icon is positioned at the top left.

Security & Data Privacy

The University of Limerick logo is displayed within a blue-bordered box. A blue padlock icon is positioned at the top left of the box.

End Users & Stakeholders

The ERTICO logo is displayed within a blue-bordered box. An icon of four people is positioned at the top left.

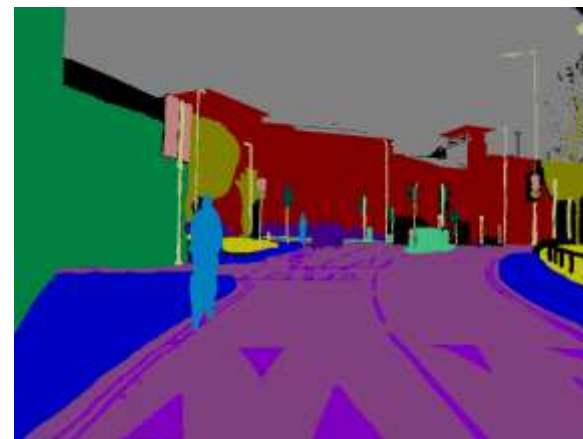
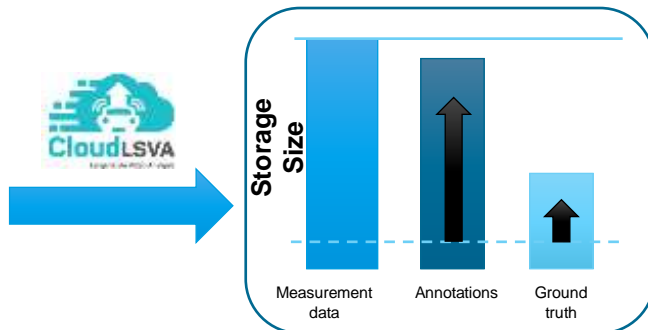
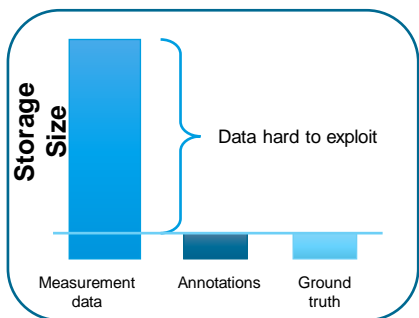
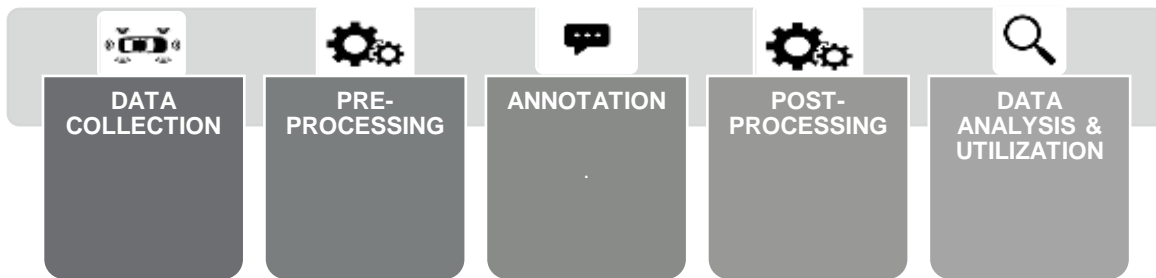
Cloud-LSVA - Cloud Large Scale Video Analysis
Co-ordinator: Vicomtech
Duration: 36M - 1.1.2016 – 31.12.2018

Research and Innovation Action
H2020-ICT16-Big Data Research
Outcome A – **Big Data technologies**

Web Page: <http://cloud-lsva.eu/>

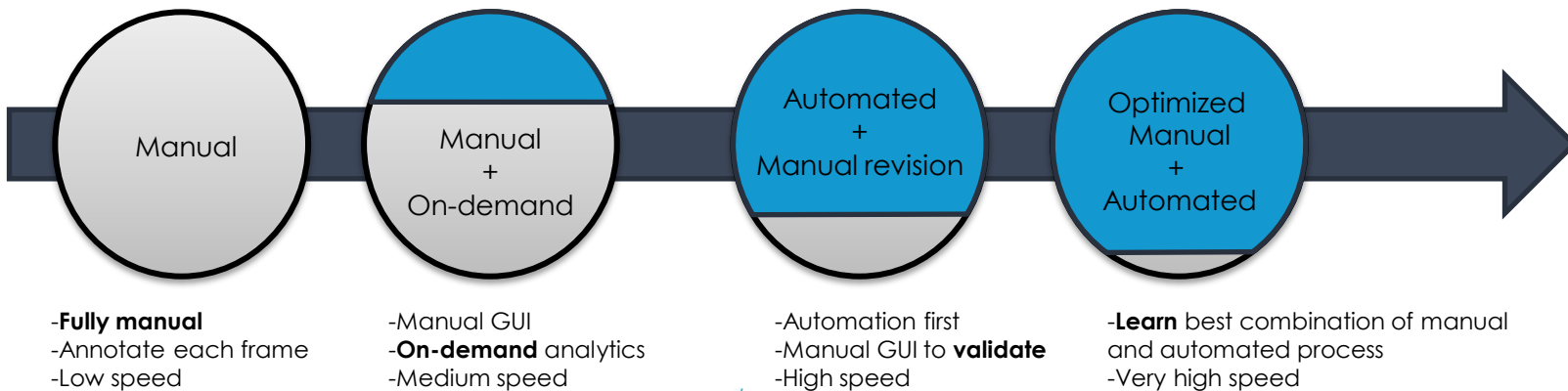
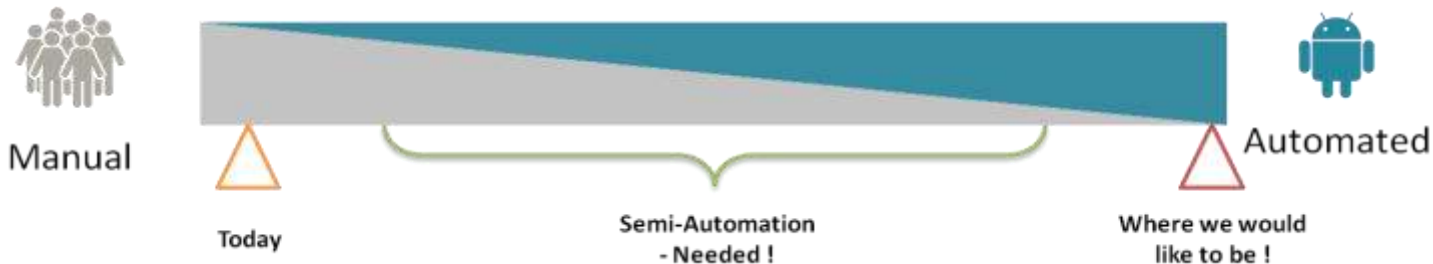
Cloud-LSVA project

- Annotation for ground truth generation

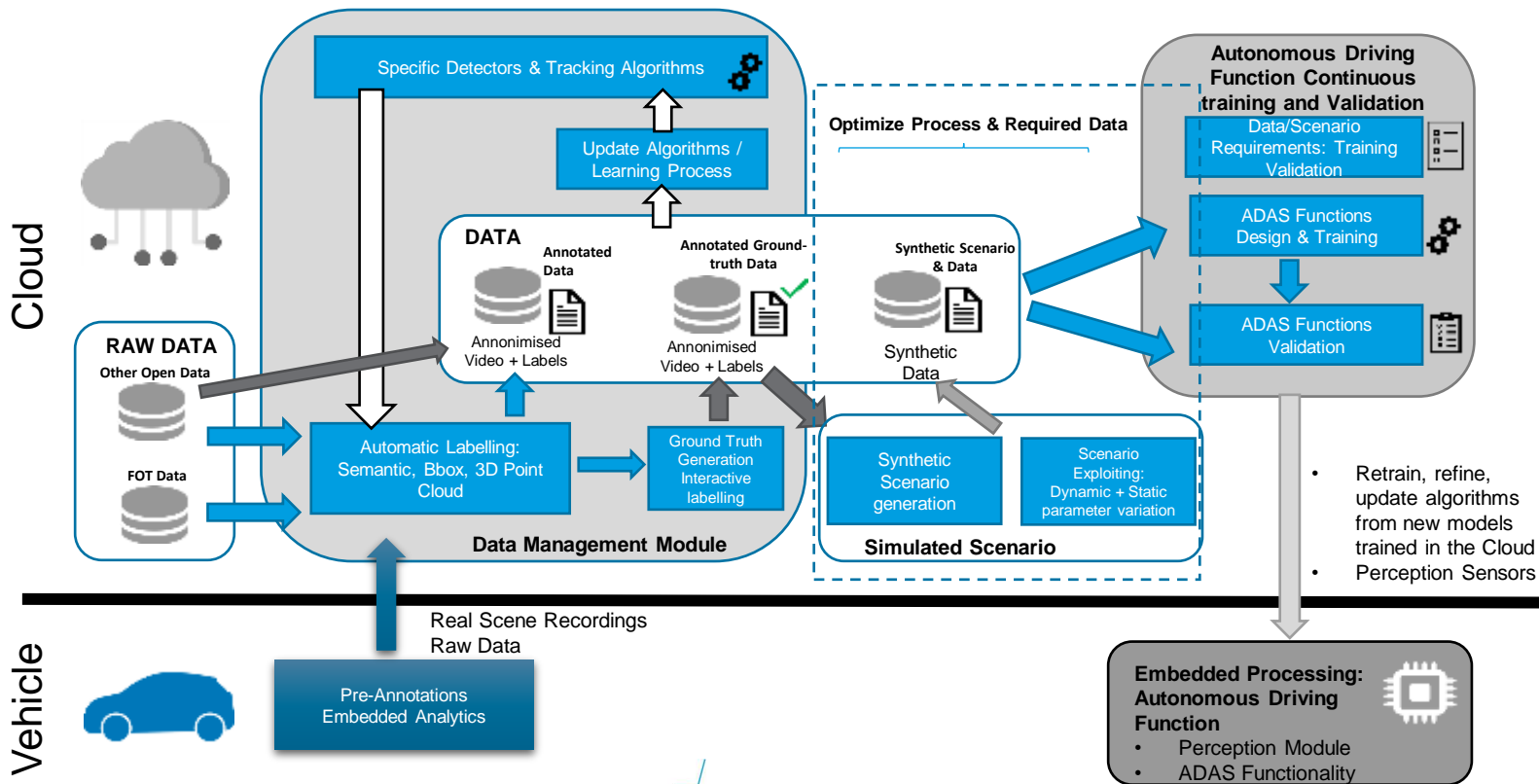


Cloud-LSVA project

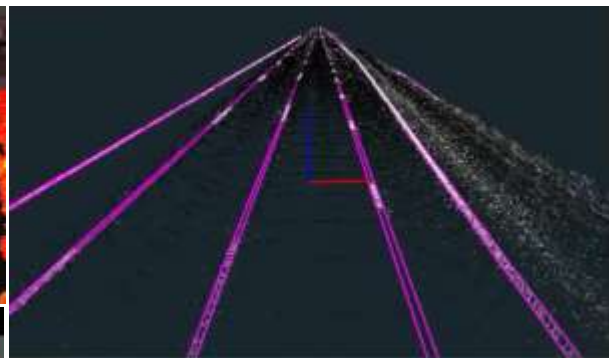
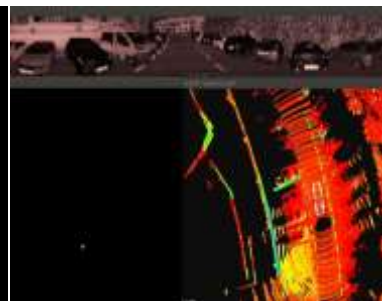
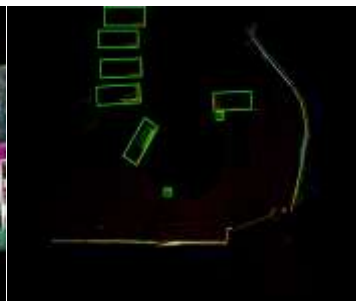
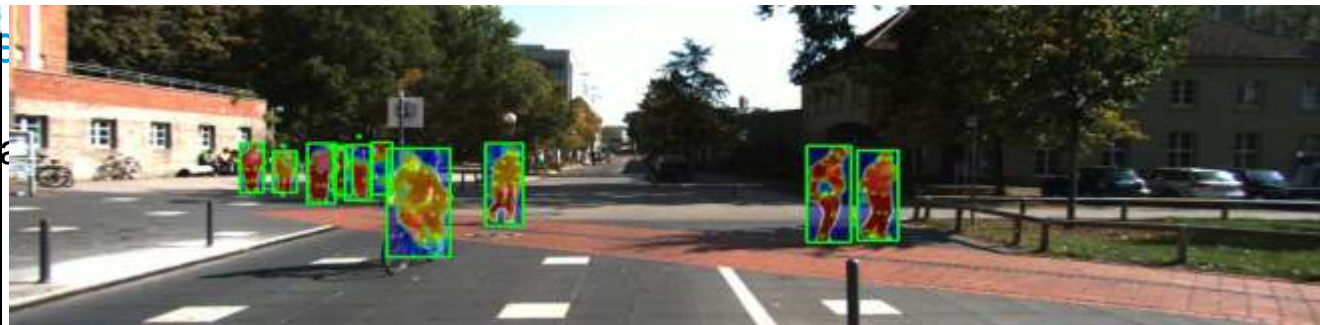
- Data labeling automation process



Cloud-LSVA project

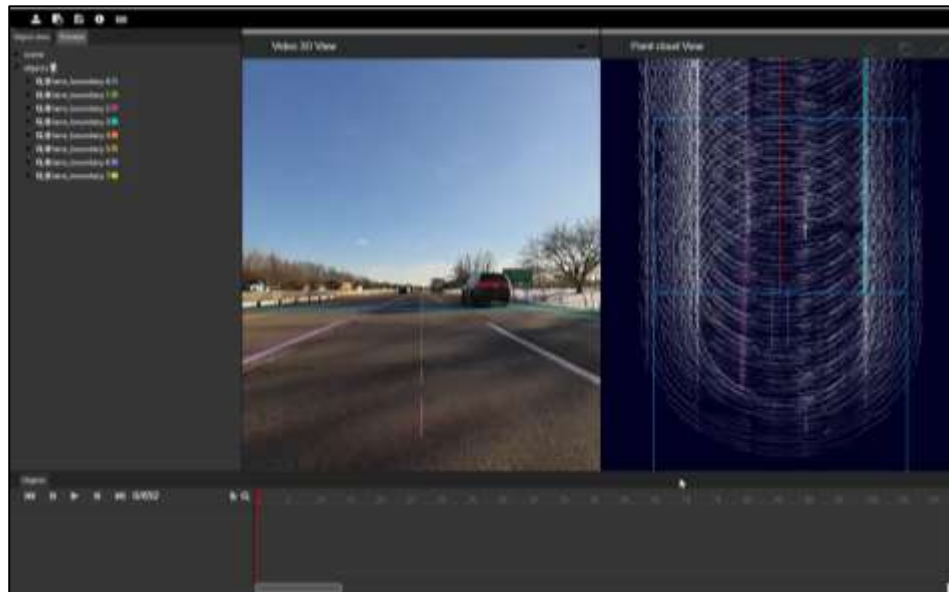


Tracking Dataset
 Run 0
 File: VCD_KIT_MITTrackingdata_tracking_Label_2traininglabel_020_0w.json
 Frequency: 15 Hz
 Original frequency: 10 Hz



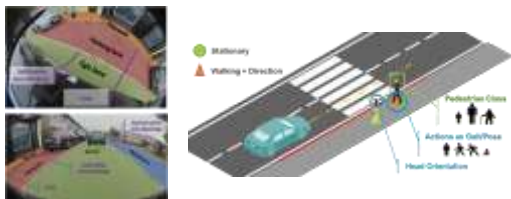
Cloud-LSVA project

- Web UI for ground truth validation

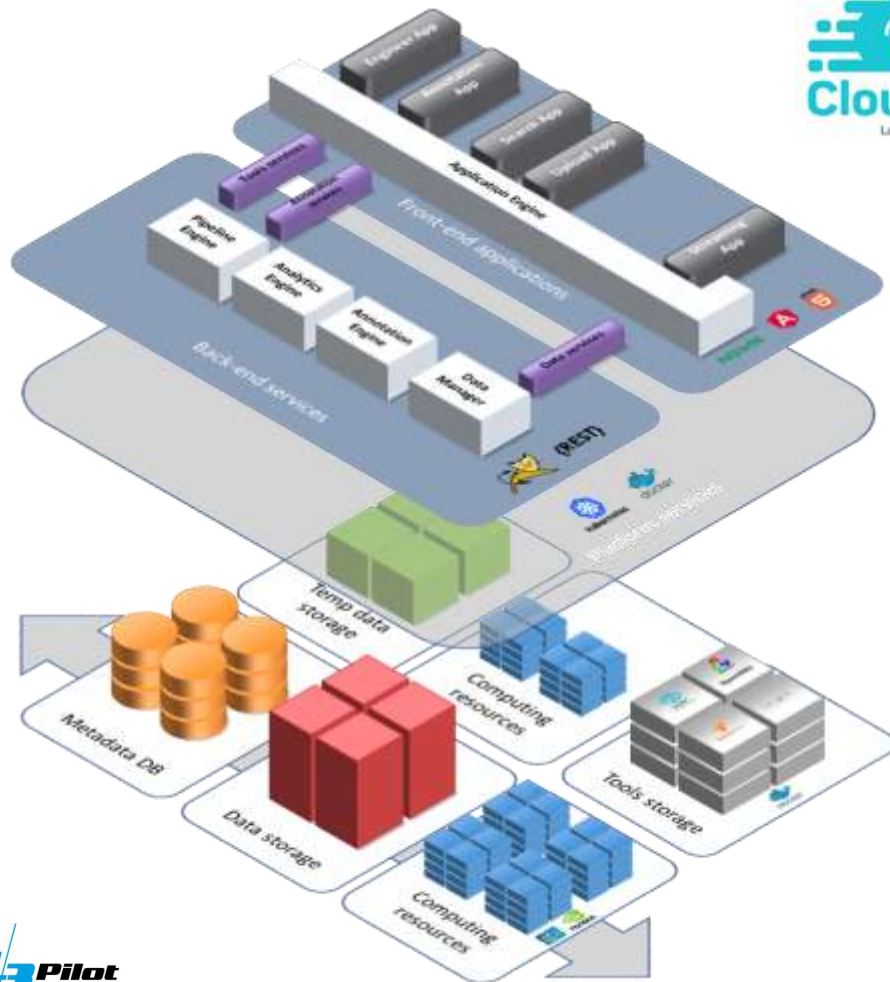


Cloud-LSVA project

- **Cloud platform for orchestration**
 - **ADAS annotation:** to create tools to enable large scale ground truth generation

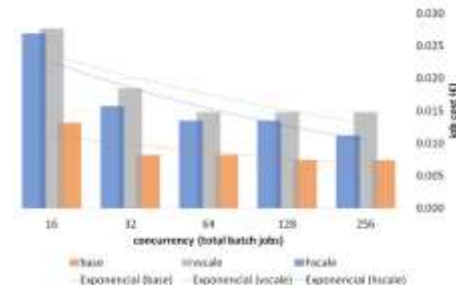
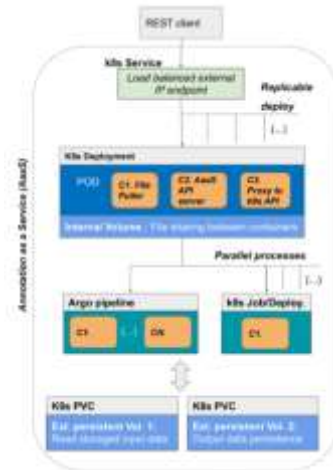


- **Cartography update:** to develop a system to create and update HD maps from crowd sourced data



Large scale analytics

- **One-day** recording labeling exercise
- Large-scale exercise
 - Cluster allocation, raw data pre-processing, CNN processing, cost analysis



Raw data
25 TB
8 hours video + lidar
4000 clips



Cloud cluster
32 worker nodes
x16 computing cores
x64 GB RAM
= 512 cores (2048 GB RAM)



Total: 1h 32'
Job: 0h 20' (parallel run)
Effective time/job: 1.39 s



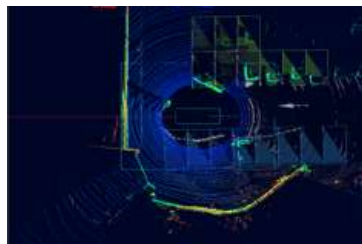
Cluster: 23.284 €/month
Cost/job: 0.012 €

Cost experiment: 48 €

S. Sánchez-Carballido, O. Senderos, M. Nieto, and O. Otaegui, "Semi-Automatic Cloud-Native Video Annotation for Autonomous Driving," Applied Sciences, 2020, 10, 4301, doi: 10.3390/app10124301

Annotation

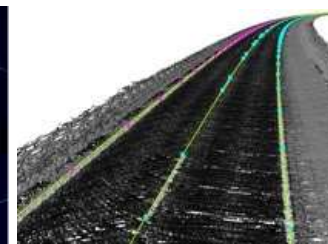
- **Metadata** which describe the content of a **scene** in an structured manner
- In many cases, **metadata needs to be attached to data series:** videos, lidar, static images, etc.
- **Annotations** need to cover:
 - Object descriptions
 - Spatio-temporal entities
 - Synchronization and timestamps
 - Sensor calibration
 - Numerical ranges
 - Actions and events
 - Time intervals
 - Relations between elements
 - Semantic concepts



3D Parking slots



3D objects



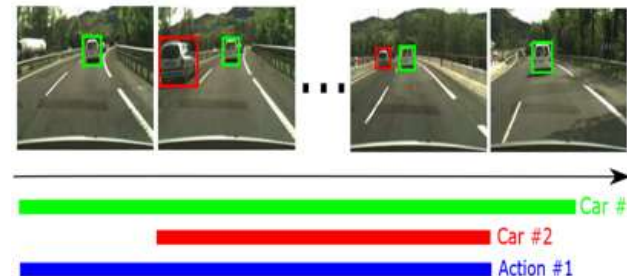
3D lane markings



2D-3D objects



2D segmentation



Maneuvres (actions)

Annotation

- **Elements** = {**Objects**, **Actions**, **Events**, **Contexts**, **Relations**}

Object

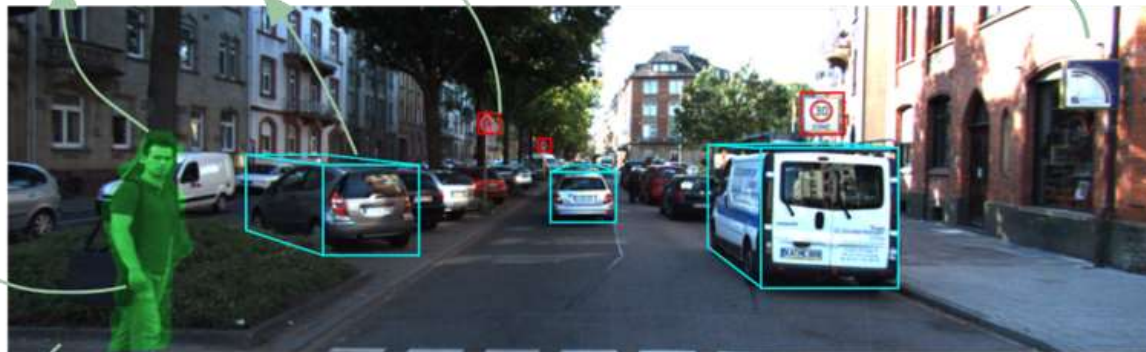
Person, signal, car or any object with spatial description (e.g. bounding box) and sensor ID from which it is seen

Context

This is an urban scene, it is **sunny** it is a sequence from an onboard camera

Action

The period of time where an action happens:
looking at ego-vehicle crossing



Event

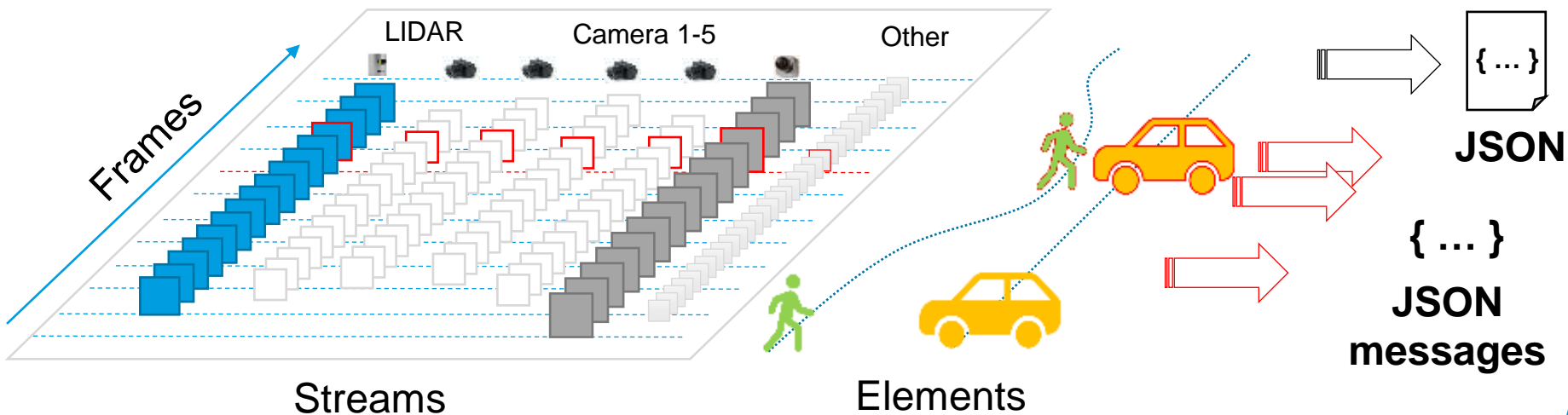
The **moment** in which the **person** starts **crossing** the road

Relation

The object person is the actor of the action, and the event triggers the action.
A **person crosses** the road when is **sunny**

Annotation / Annotation format

- Elements, Frames and Streams



Annotation / Annotation format

- **VCD (Video Content Description)**

syntax and tools for multi-purpose data labelling

- JSON schema
- Multi-sensor labels
- Objects and Scene-level
- Nested attributes
- Static and dynamic information
- Online and offline processing

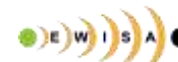
- Linkage between **L3PILOT CDF** and **VCD** to extend metadata labelling capabilities for recordings



Github (open source, MIT license)

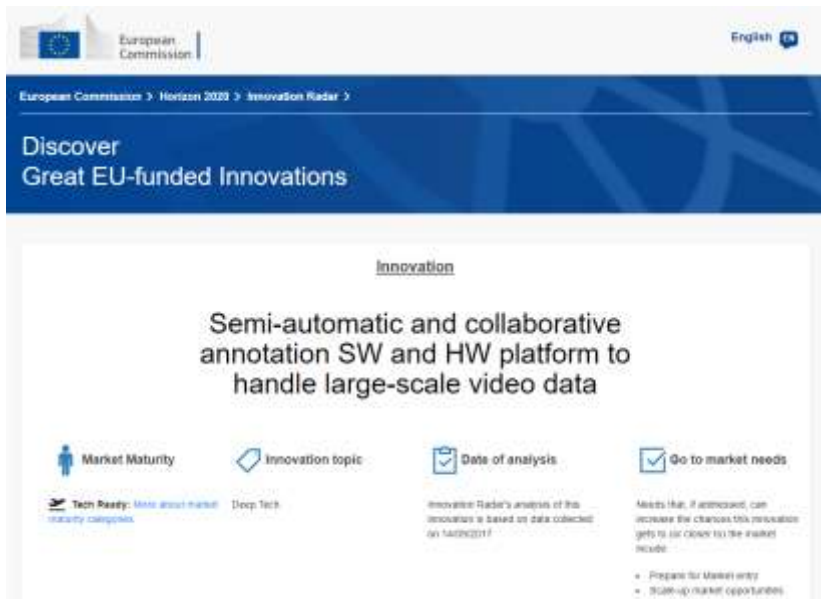
<https://github.com/Vicomtech/video-content-description-VCD>

Python and Typescript APIs



Annotation / Annotation format

- Horizon 2020 / Innovation radar



European Commission | English

European Commission > Horizon 2020 > Innovation Radar >

Discover Great EU-funded Innovations

Innovation

Semi-automatic and collaborative annotation SW and HW platform to handle large-scale video data

Market Maturity
Tech Ready: More about market maturity categories

Innovation topic
Deep Tech

Date of analysis
Innovation Radar's analysis of this innovation is based on data collected on 14/03/2017

Go to market needs
Needs that, if addressed, can increase the chances this innovation gets to go closer to the market include:

- Prepare for Market entry
- Scale-up/Market opportunities

<https://www.innoradar.eu/innovation/22423>



European Commission | English

European Commission > Horizon 2020 > Innovation Radar >

Discover Great EU-funded Innovations

Innovation

VCD/SCD (Video/Scene Content Description) data model for large scale video annotation

Market Maturity
Tech Ready: More about market maturity categories

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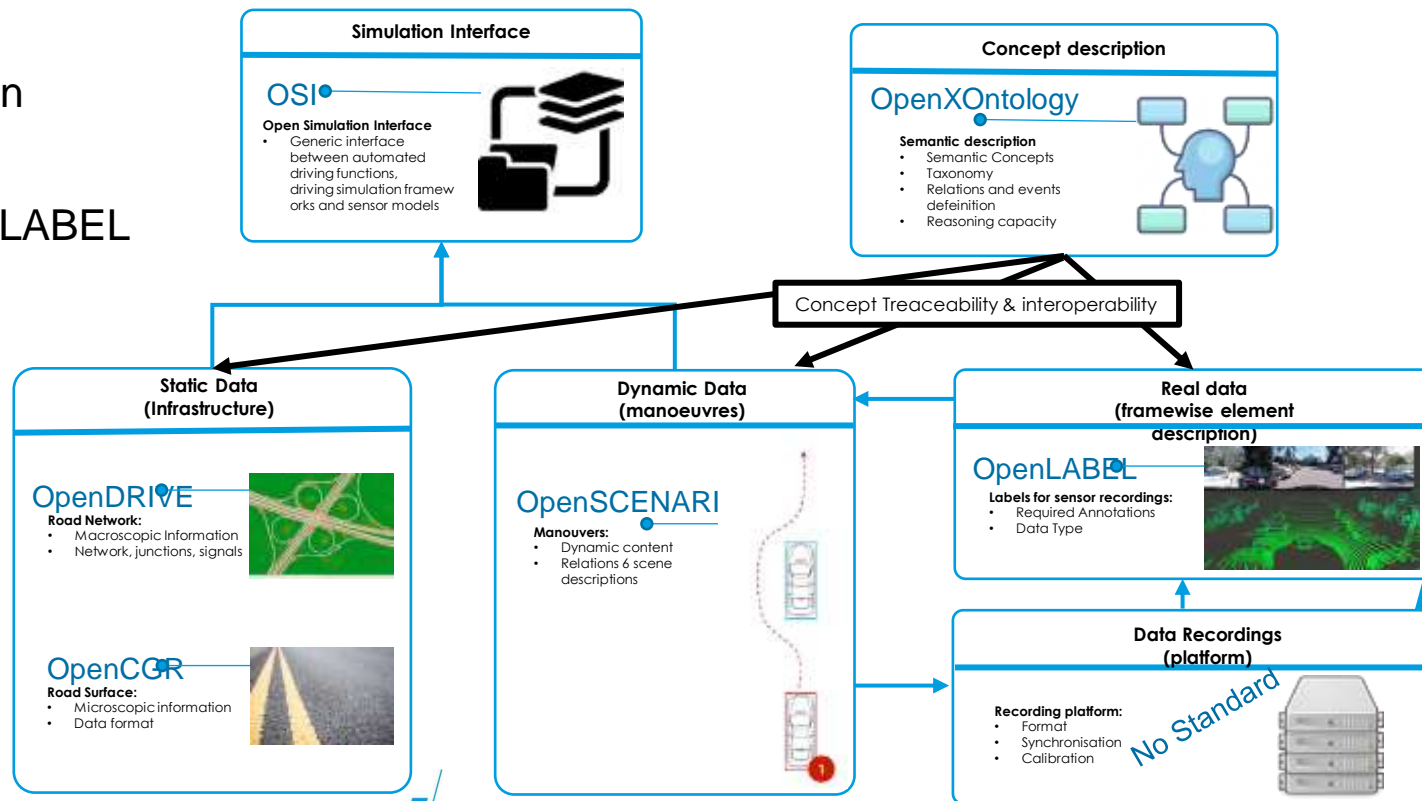
Go to market needs
Needs that, if addressed, can increase the chances this innovation gets to go closer to the market include:

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<https://www.innoradar.eu/innovation/22420>

Annotation / Annotation format

- Standardisation
- ASAM e.v.
- VCD - OpenLABEL





Thank you for your kind attention.

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