

### 3. Field of applications of Cloud LSVA

The Cloud LSVA technology turns out to be fundamental not only for the development of AV, but it can contribute and benefit many other sectors. In particular, this technology can be applied to the following fields:



ADAS (Advanced Driver Assistance Systems)



Medical imaging



Agriculture and large infrastructure surveillance



Security and CCTV systems

### 4. Project results

Key findings of the project were outlined during the event as the following:

- Online annotations can be produced in equipped vehicles, using the latest technologies such as computer vision and AI optimised for embedded platforms;
- Data and metadata produced in vehicles can be uploaded and stored to cloud platforms, where it is then processed, managed and made available to be consumed by ADAS (Advanced Driver Assistance Systems) systems (HIL and SIL) and Digital Cartography updated systems;
- Orchestration of containerised applications on cloud platforms to scale up data processing is possible;
- Web applications to efficiently stream data and metadata to front-ends for manual revision of annotations are possible;
- Metadata format can adapt to the dataflow of annotation systems: online annotation in the vehicles, offline processing at the cloud platform and flexibility and extensibility for its usage by semantic search engines.

### 5. Next steps

Cloud-LSVA has explored numerous technologies and open research lines for creating large-scale, online and offline pipelines for semi-automatic metadata generation, in the context of ADAS/AD and Digital Cartography.

These research lines will be followed by the involved partners, in order to continue investigating best trade-offs between in-vehicle and cloud computation, manual and automated components, and also adapt to the emergence of new technologies in Big Data and HPC.

Extension to other use cases is also considered to follow up the technological developments, including semi-automated annotation tools for medical imaging or surveillance applications.

### 6. Consortium



Find out more, get in touch!

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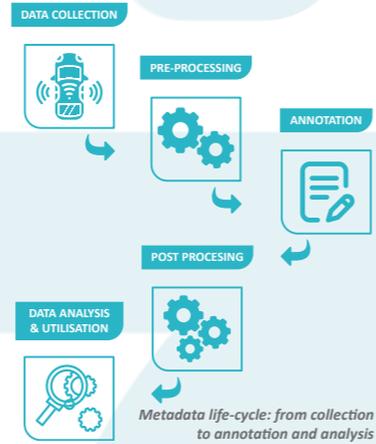


## 1. What is Cloud LSVA?

Cloud LSVA (Large Scale Video Annotation) is a EU-funded project under the H2020 initiative.

Started in 2016, Cloud-LSVA works in the framework of Autonomous Vehicles (AV) and Digital Cartography, advancing in technologies such as semi-automatic video annotation, large scale object recognition, and crowd-source web platforms. Cloud LSVA analyses and decomposes each recorded scene, in order to detect and classify relevant objects and events for specific scenarios and uses the mined and annotated video metadata to train and evaluate algorithms for real-time analysis of visual and non-visual sensors in cars.

The automotive industry needs tools that can manage the extremely large volumes of data (Big Data), especially to provide support in the annotation task (ADAS, cartography market). One of the main bottlenecks in advancing in several application domains is the lack of labelled realistic video datasets of sufficient size, complexity and coverage (comprehensiveness). For this purpose, Cloud LSVA provides two testing scenarios:



### ADAS

Analysis and annotation of petabytes of data to train and validate visual, radar and telemetry sensor data to create continuously improving ADAS algorithms for deployment in motor vehicles with possible applications in autonomous vehicles and robotics.



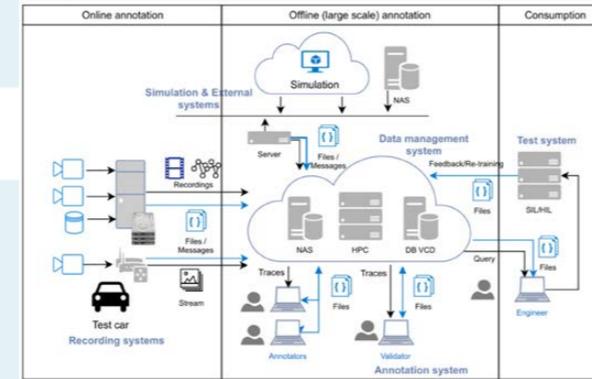
### Digital Cartography

Street and lane level analysis and interpretation of video to automatically create new digital maps for navigation applications and provide assisted positioning (i.e. in urban canyons, underground parking structures, complex flyovers, tunnels) for deployment in motor vehicles with certain application in autonomous vehicles and robotics.

## 2. How does Cloud LSVA work?

Cloud LSVA uses a set of different ways and technologies to guarantee high-quality, state of the art video annotation:

### Large-scale cloud infrastructure



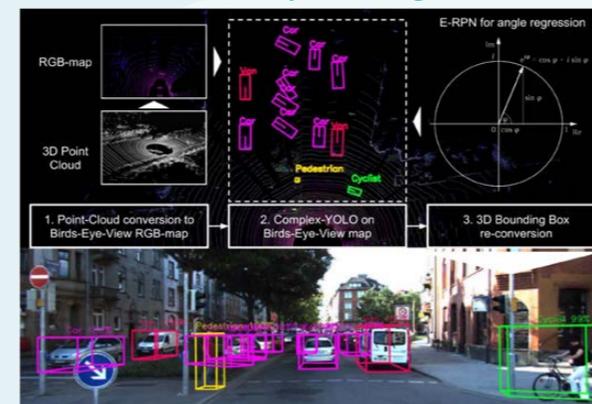
Using Big Data and High Performance Computing technologies to manage data and produce metadata.

### Sensors and in-vehicle computation



Test vehicles are equipped with latest sensor technologies (i.e. camera, laser, GPS), and recording and processing units to produce online recordings and metadata.

### Data fusion and Deep Learning



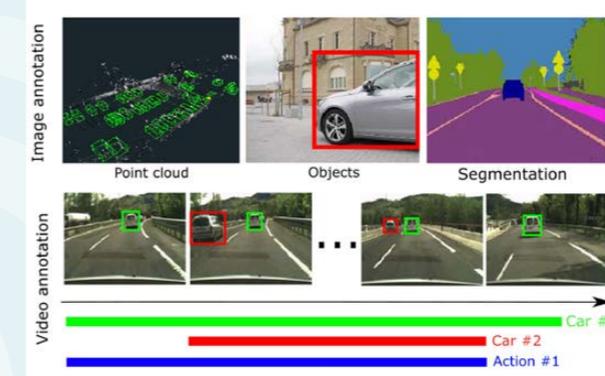
Algorithms have been created to operate on images and point clouds, to produce rich annotations both at the car and the cloud processing systems.

### Digital Cartography



Map update process for traffic sign localization layer using Autostream.

### Video annotation



Semi-automatic annotation tools have been created to produce accurate and reliable automatic annotations, and web applications for human operators to refine and validate.

### Web technologies



Web technologies for video and point cloud data streaming, and advanced user interfaces for creating, editing and validating rich and complex annotations.