

OpenLABEL



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Findings and results from the Concept Project

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OpenLABEL Agenda

OpenLABEL

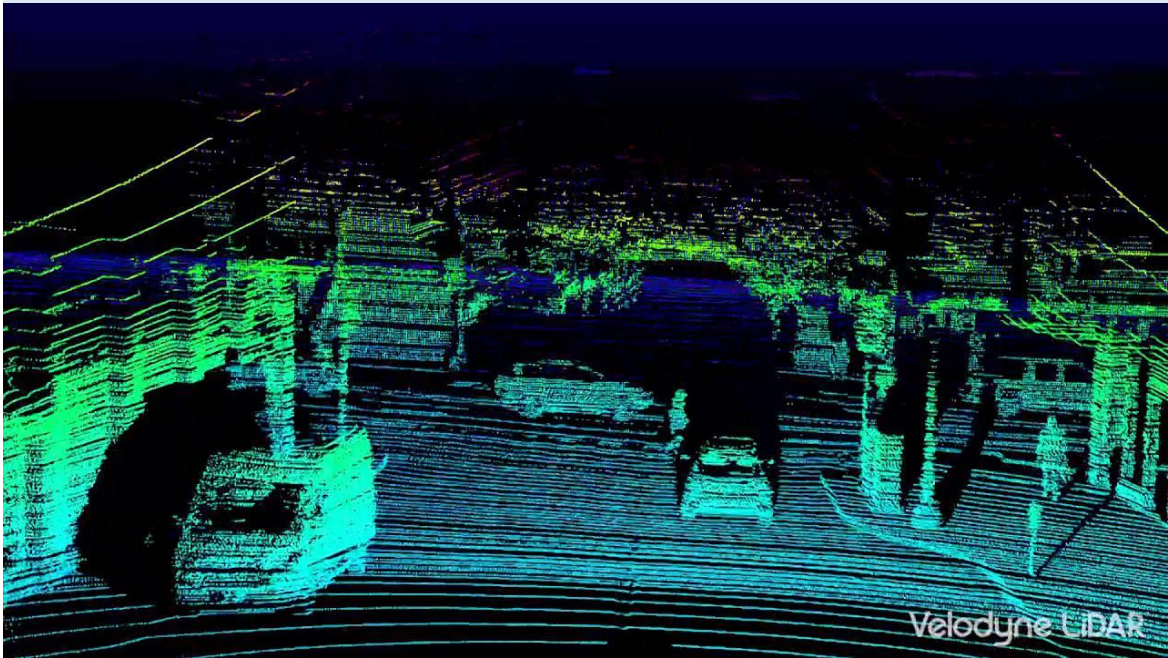
- Intro and Scope
- Annotation Format
- Spatial Constructs
- Taxonomy
- Scenario Labeling
- Open Issues



<input checked="" type="checkbox"/>	Right turn
<input checked="" type="checkbox"/>	dawn
<input checked="" type="checkbox"/>	Medium traffic
<input checked="" type="checkbox"/>	wet street

OpenLABEL - What is it?

OpenLABEL is a standard for annotation format, which can be used to label data streams (from sensors), scenarios, or other artifacts created during the development of automated driving features



OpenLABEL Format

The format is key to make OpenLABEL flexible enough to host different labeling use cases, ranging from simple object-level annotation in images (e.g. with bounding boxes), to complex multi-stream labeling of scene semantics (e.g. with actions, relations, contexts). The annotation format is then understood as the materialization of labels in files or messages, that can be stored or exchanged between machines. The format shall address a number of requirements:

- Different scene elements (objects, actions, contexts, events)
- Temporal description of elements (with frames and timestamps)
- Hierarchical structures, with nested attributes
- Semantic relations between elements (e.g. object performing an action)
- Multiple source information (i.e. multi-sensor)
- Preservation of identities of elements through time
- Encoding mechanisms to represent different geometries (e.g. bounding boxes, cuboids, pixel-level segmentation, polygons, etc.)
- Enable linkage to ontologies and knowledge repositories
- Ability to update annotations in online processes (extensible)
- Scalable and searchable (good traceability properties)

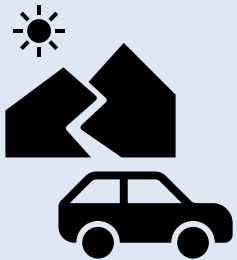
OpenLABEL Structure of the Format

JSON Schema

In OpenLABEL, a scene can be either a subset of the reality that needs to be described for further analysis, or a virtual situation that needs to be materialized. In the former case, reality is typically perceived by sensors, which get discrete measures of magnitudes from the scene at a certain frequency. In the latter, sensors can be ignored, and the scene described by its components and logical sequence. Several concepts conform the basis of the OpenLABEL format.

these pieces constitute the foundations to create rich descriptions of scenes, either as an entire block (e.g. serialized as a file), or frame-by-frame (e.g. serialized as message strings).

Elements



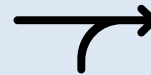
Frames



Streams



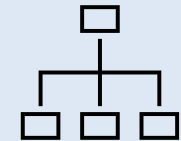
Coordinate Systems



Metadata

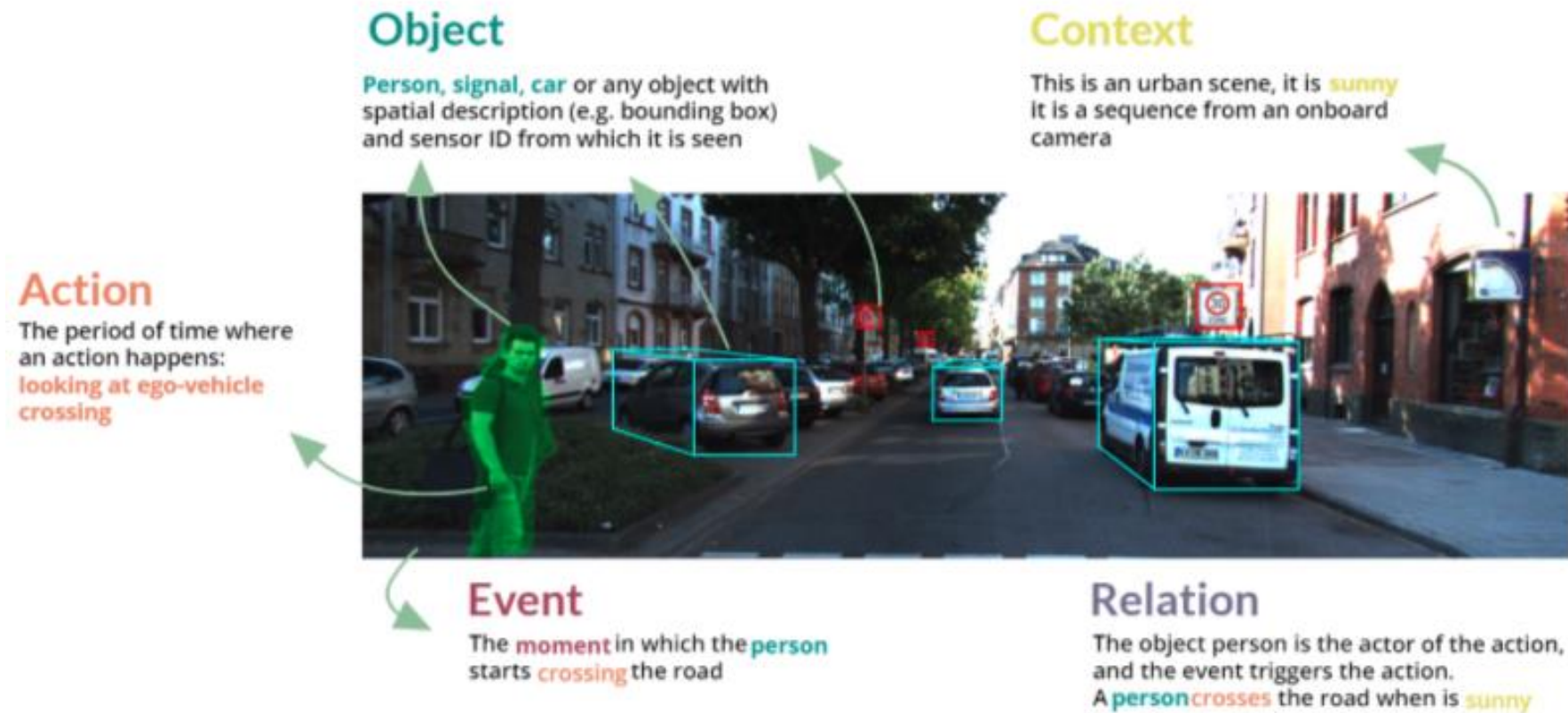


Ontologies



OpenLABEL Structure: Elements

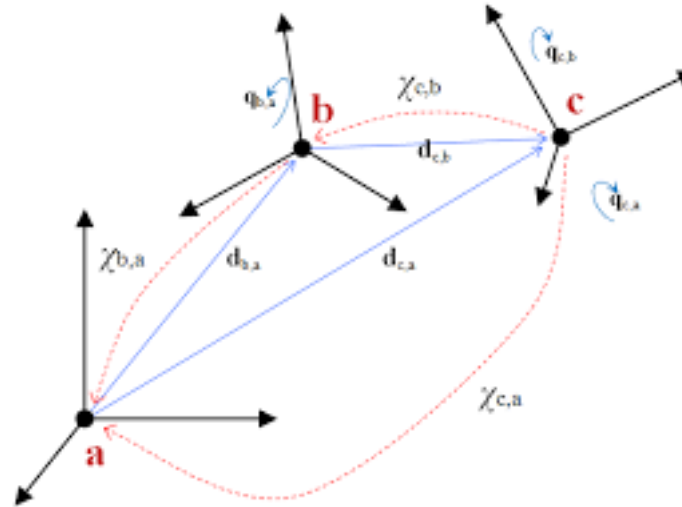
Elements is the name for Objects, Actions, Events, Contexts and Relations, which are all treated similarly within the OpenLABEL format, in terms of properties, types and hierarchies.



OpenLABEL Spatial Constructs

Spatial constructs are a key concept in OpenLABEL. Often, data recorded from sensors has specific reference systems attached to each of them that need to be aligned among each other and with the ego-vehicle or other infrastructure. Furthermore, elements of the scene are usually identified through geometric shapes such as boxes in an image or sets of points in a point cloud.

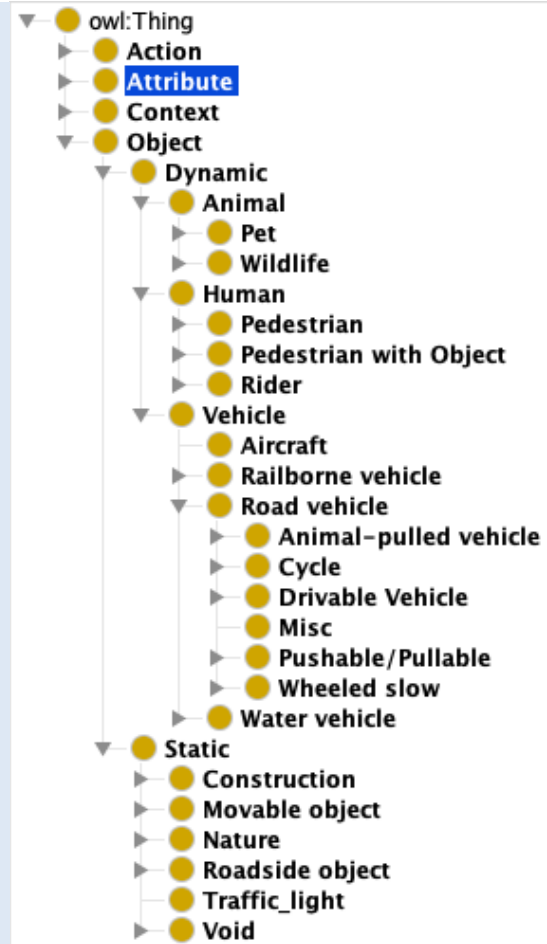
- Coordinate Systems and Transforms
- Labeling Geometries
- Bounding Boxes
- Cuboids
- Pixelwise segmentation
- Polygons
- Images



OpenLABEL subgroup withing OpenXOntology Status

To date, there exists thousands of different taxonomies or dictionaries of terms and entities of the real world that are of interest for labeling. For object detection algorithms and other applications. OpenLABEL taxonomy unifies that through a comprehensive ontology

- NuScenes
- Waymo Open Dataset
- Lyft Lvl5 dataset
- Apolloscapes
- Mapillary Vistas
- PandaSet
- AudiA2D2
- ...
- Field knowledge by Deepen AI
- Safety Pool Taxonomy



Any vehicle carried by a horse or a group of horses



Any vehicle carried by a donkey or a group of donkeys



Personal mobility devices are small vehicles, motorized or not, that are designed for agile mobility of a single person normally. They are not considered rideable or drivable vehicles due to their low weight (<15 kg) and small dimensions and due to the fact that they do not offer any structural protection to the rider, nor have any articulated systems designed to control such vehicles (steering wheels, pedals etc.). The rider is completely exposed, usually standing on the device.

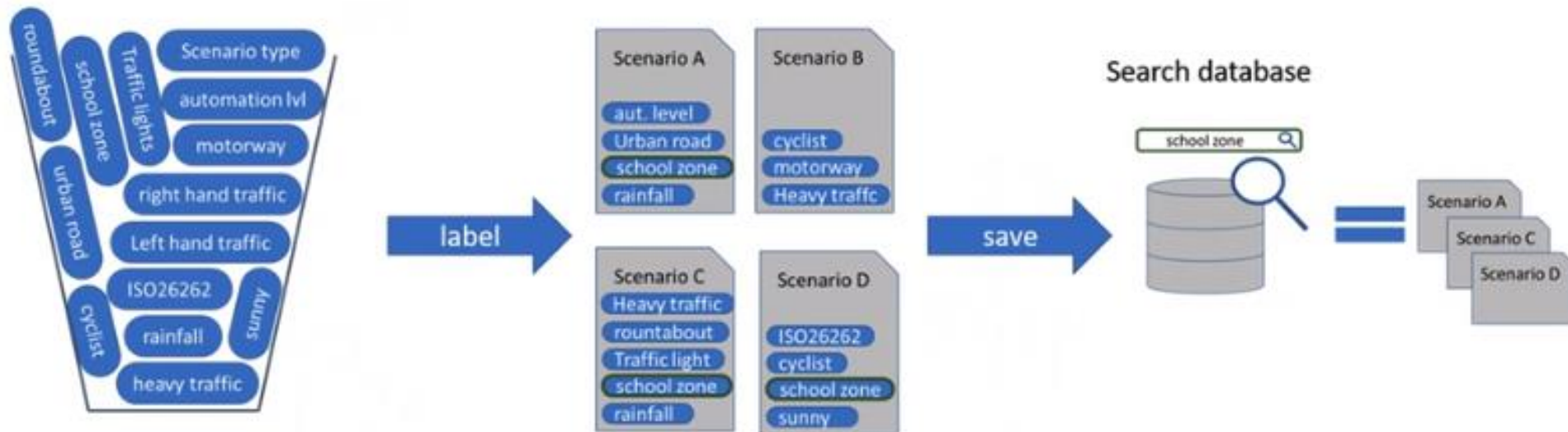


A skateboard is a short and narrow board with usually two pairs of wheels fixed at the bottom of either end, on which a person can ride in a standing or crouching position, propelling themselves by occasionally pushing one foot against the ground. Today's skateboards can have electrical actuators as propellers, usually controlled by a joystick-like device held in the hand of the rider. They also fall in this category

OpenLABEL Scenario Labels

Current methods of scenario definition focus on the representation of scenarios for the purpose of scenario execution (either in simulation or real-world) or for training Machine Learning systems.

When working with scenarios it is often found that additional data beyond that which can be represented in a scenario definition is necessary to facilitate their use, discoverability, management, and portability



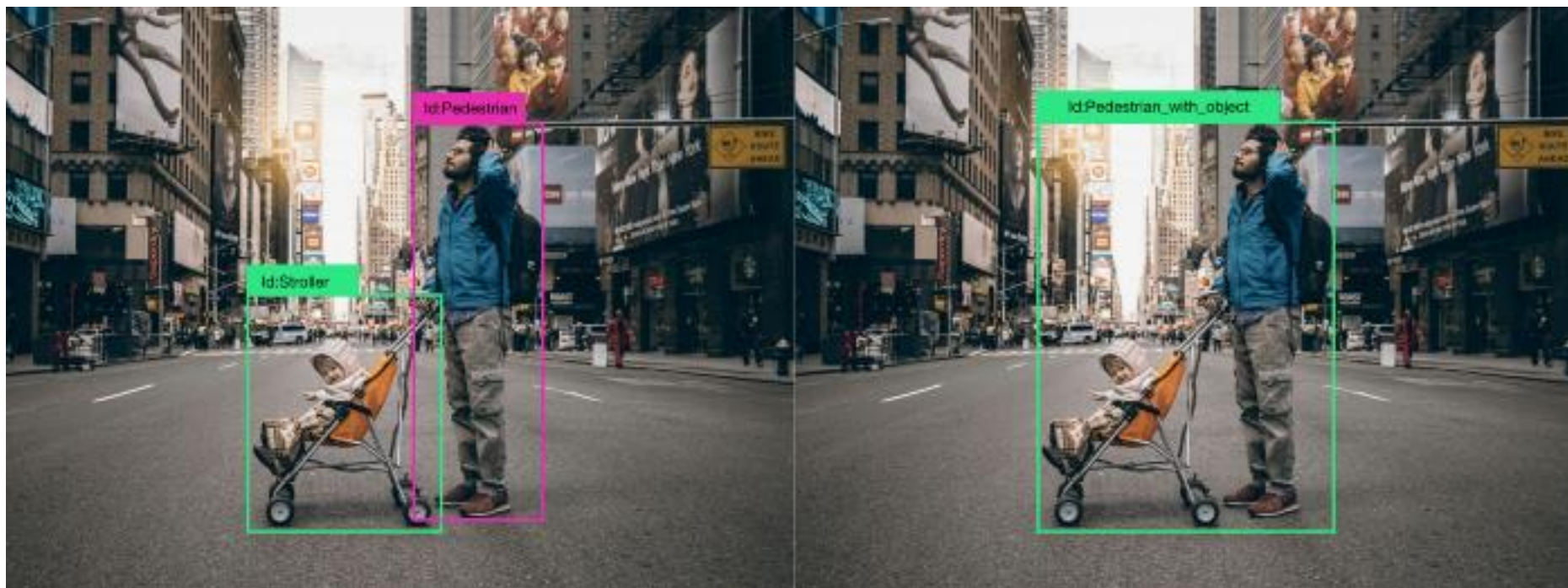
An example of using labeling to retrieve similar scenarios

OpenLABEL Open Issues

A lot of interesting problems to work on are still open, join us 😊!

- Custom labels and extensibility
- Relationship with other standards (ODD, OSI, OSC2.0, Ontology, ODRIVE)
- Logic and semantics for database scenario querying using openLABEL tags

Questions?



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