OpenLABEL 1.0

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Webinar

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OpenLABEL Agenda

OpenLABEL

- Intro and Scope
- Annotation Format
- Spatial Constructs
- Taxonomy
- Scenario Tagging

✓	Right turn
✓	dawn
✓	Medium traffic
✓	wet street

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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
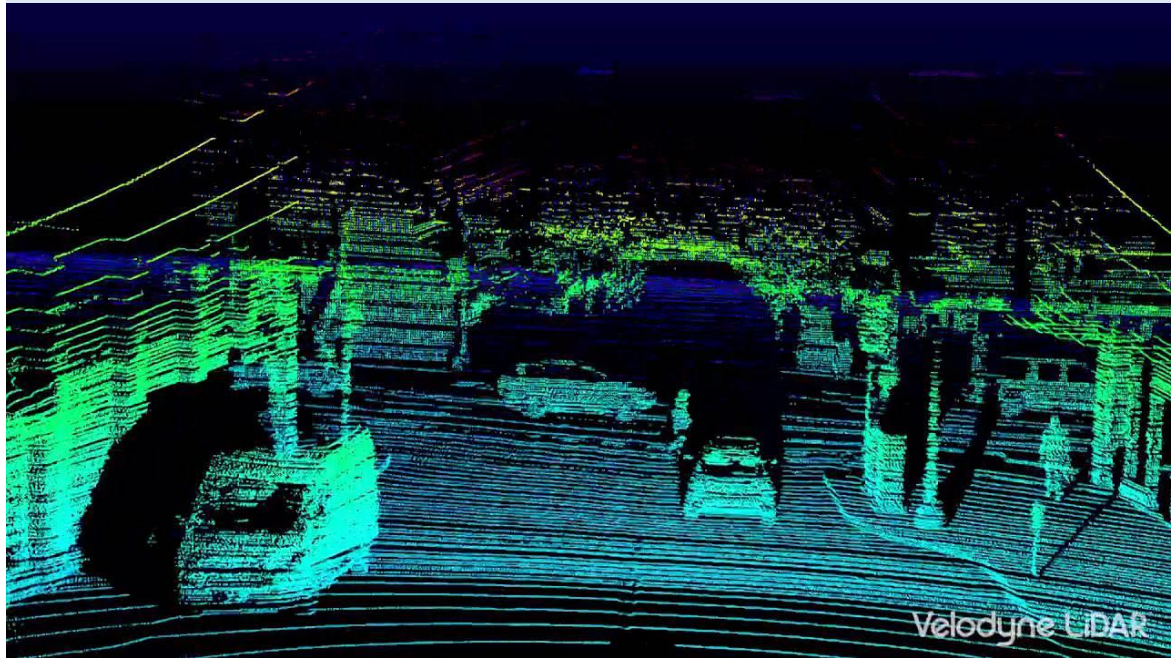
OpenLABEL Format

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, knowledge repositories, and external resources (such as elements within .Xodr files)
- Ability to update annotations in online processes (extensible)
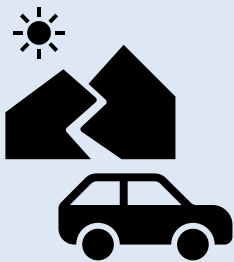- Scalable and searchable (good traceability properties)

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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).
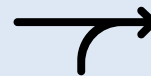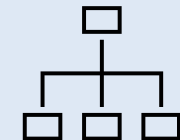
| Elements | Frames | Streams | Coordinate Systems | Metadata | Ontologies |

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OpenLABEL Structure of the Format

JSON Schema and Format Structure

Elements: objects, actions, events, contexts and relations that compose the scene, each of them with an integer unique identifier for the entire scene.

Frames: discrete containers of information of Elements and Streams for a specific time instant.

Streams: information about the discrete data sources (e.g. coming from sensors), to describe how reality is perceived at each stream (e.g. with intrinsics/extrinsics of cameras, timestamps from sensors, etc.).

Coordinate Systems: the spatial information that defines the labeled geometries refer to specific coordinate systems, which can be defined and labeled themselves within OpenLABEL. Transforms between coordinate systems determine how geometries can be projected from one reference to another (e.g. from one sensor to a static reference, or because of odometry entries.)
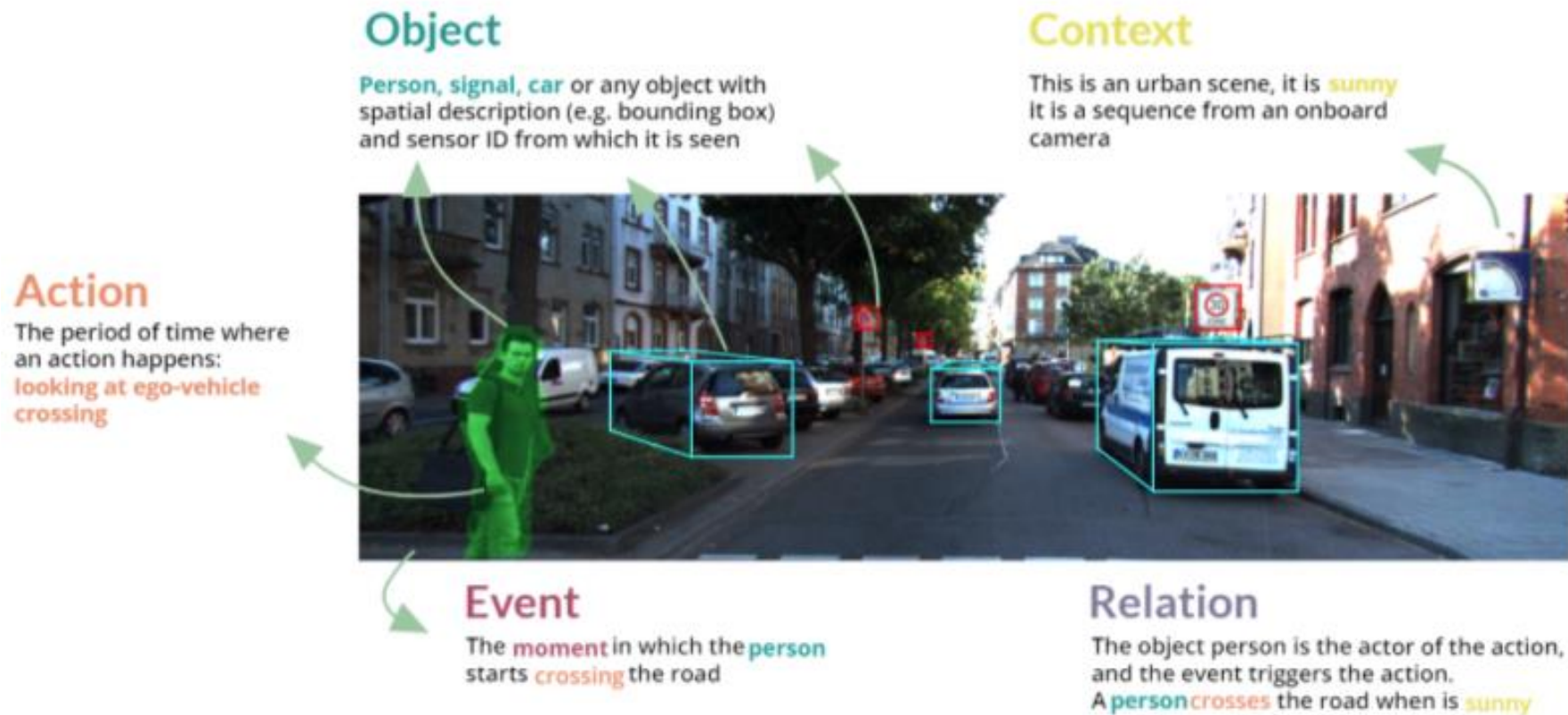
Metadata: descriptive information about the format version, file version, annotator, name of the file, and any other administrative information about the annotation file.
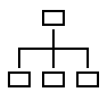
Ontologies: pointers to knowledge repositories (URLs of ontologies) that are used in the annotation file. Elements labeled can point to concepts at these ontologies, so a consuming application can consult the element meaning or investigate additional properties.

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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.

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

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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

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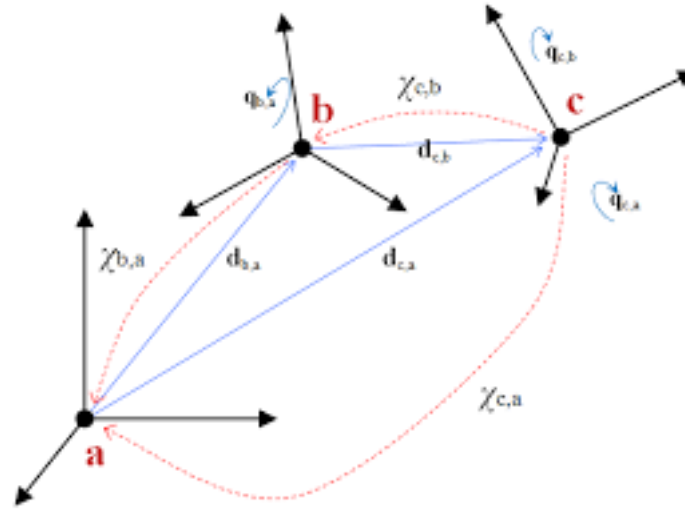
OpenLABEL subgroup withing OpenXOntology Status

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
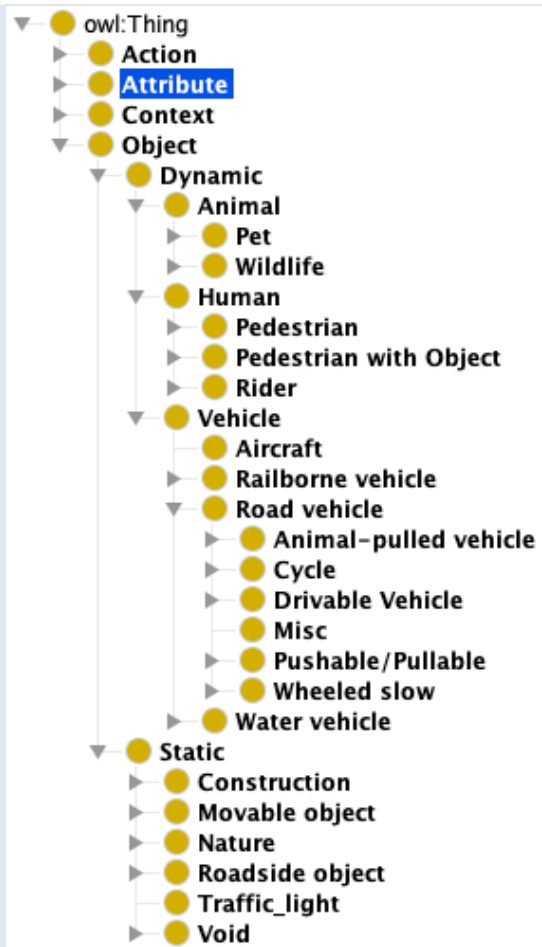
Any vehicle carried by a horse or a group of horses

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 ridable 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 skatboards is a short and narrow boards 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 hold in the hand of the rider. They also fall in this cathegory

OpenLABEL Scenario Tags

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
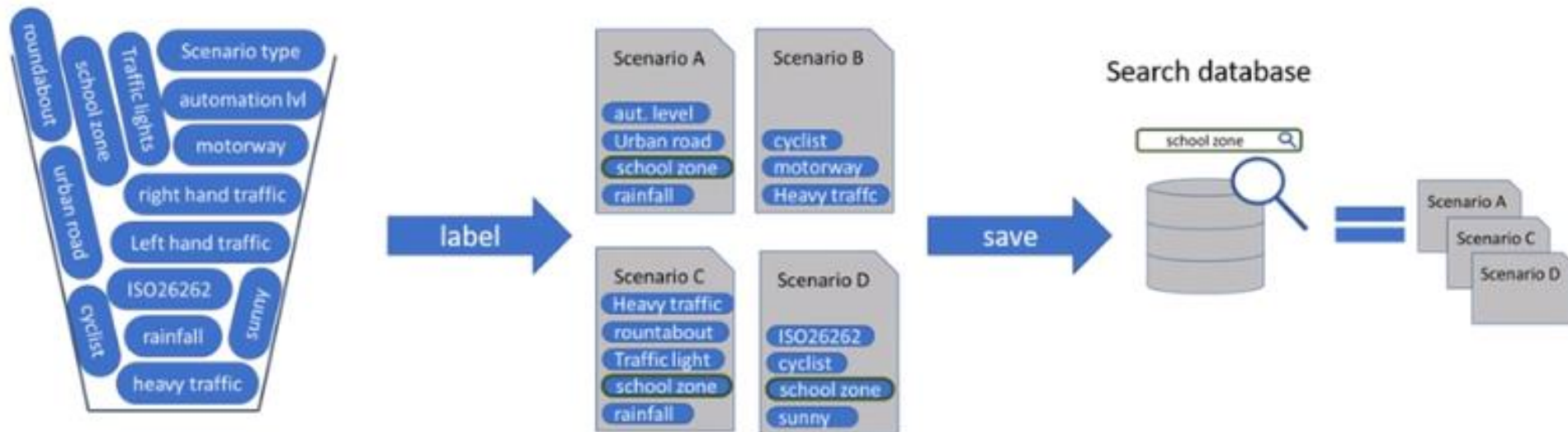

An example of using labeling to retrieve similar scenarios

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OpenLABEL Scenario Tags

Scenario Tagging

In the context of OpenLABEL, Scenarios are specific artifacts, or files (such as openSCENARIO, M-SDL, Geoscenario, H-SDL, or any other Scenario Description Language or format)

Such artifacts describe a driving situation unfolding through time usually detailing a sequence of events and actions taken by relevant actors situated in a scenery under certain environmental conditions.

Scenarios can have different purposes, the most common one being executing the detailed driving situation in a virtual driving simulator for testing purposes.
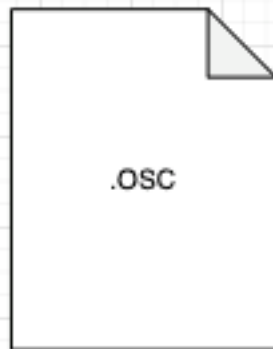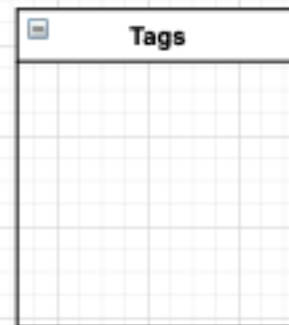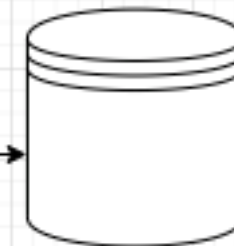
Questions?
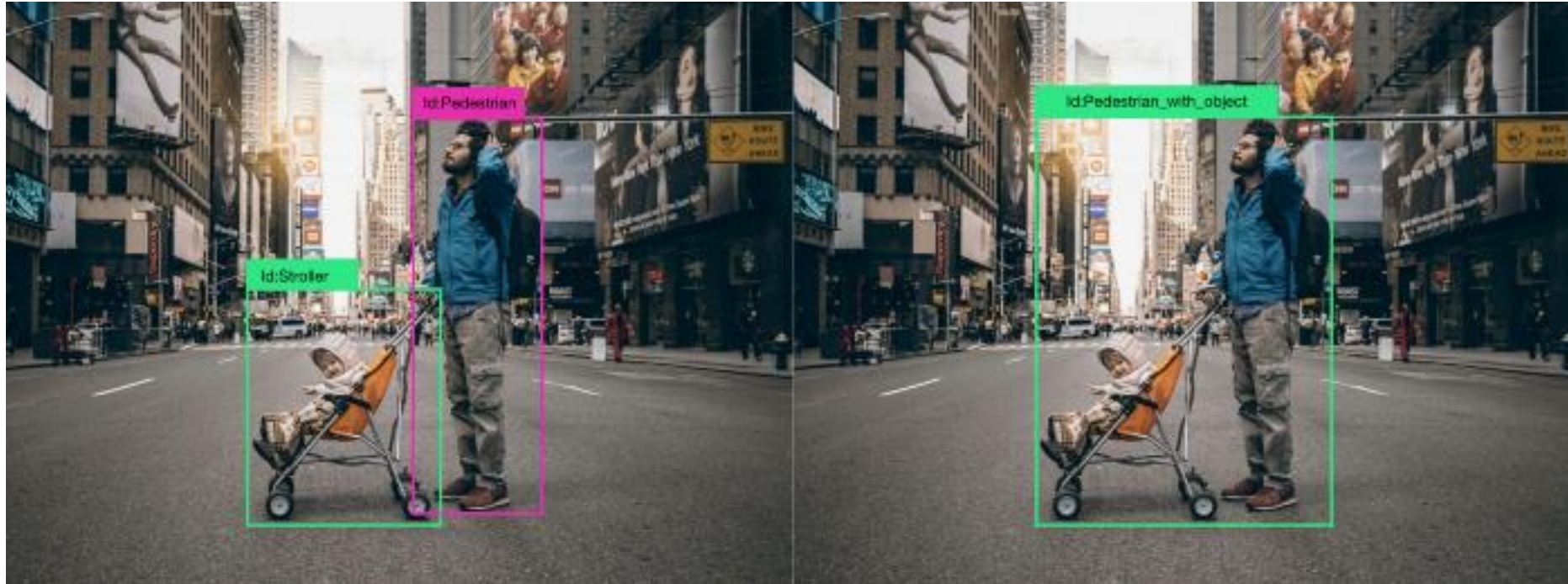
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