KI DATA TOOLING
The Data Kit for Automotive AI

Context Generation from Images and Structured Data

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Acquisition, Curation & Refinement of Real Data

Context in KI Data Tooling

In KI Data Tooling, we use the term "context" to describe **metadata** about a recording (a sequence of frames) in our dataset. It can apply to the sequence as a whole or just one frame, and is created both for sequences that represent **real-world recordings** from vehicle sensors and for **synthetic 3D-rendered scenes**.

Having context available makes it easy to find sequences matching certain properties, which enables use cases such as **search, filtering and statistical evaluation**. The ability to analyze a dataset based on context also helps to **identify systematic gaps** in the dataset.
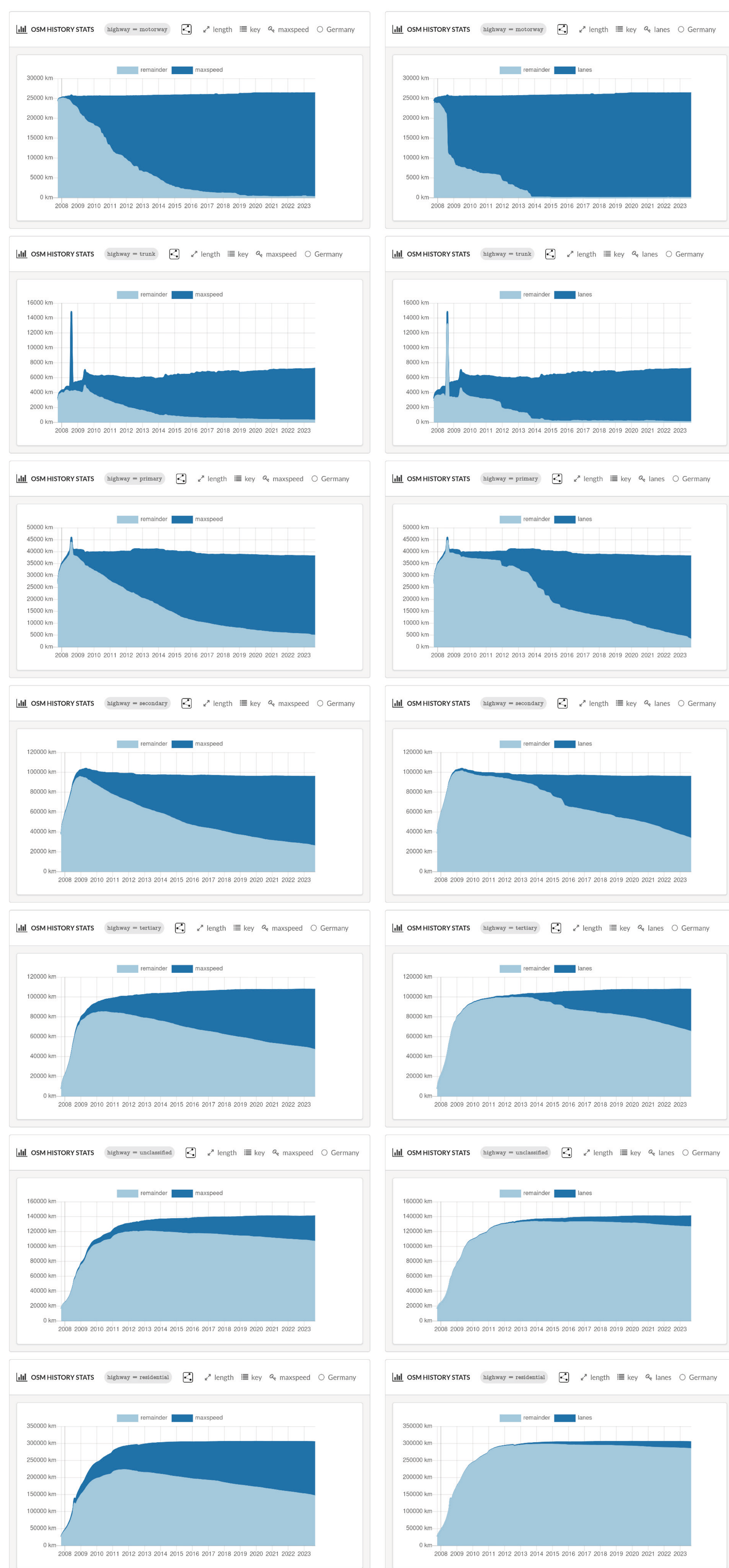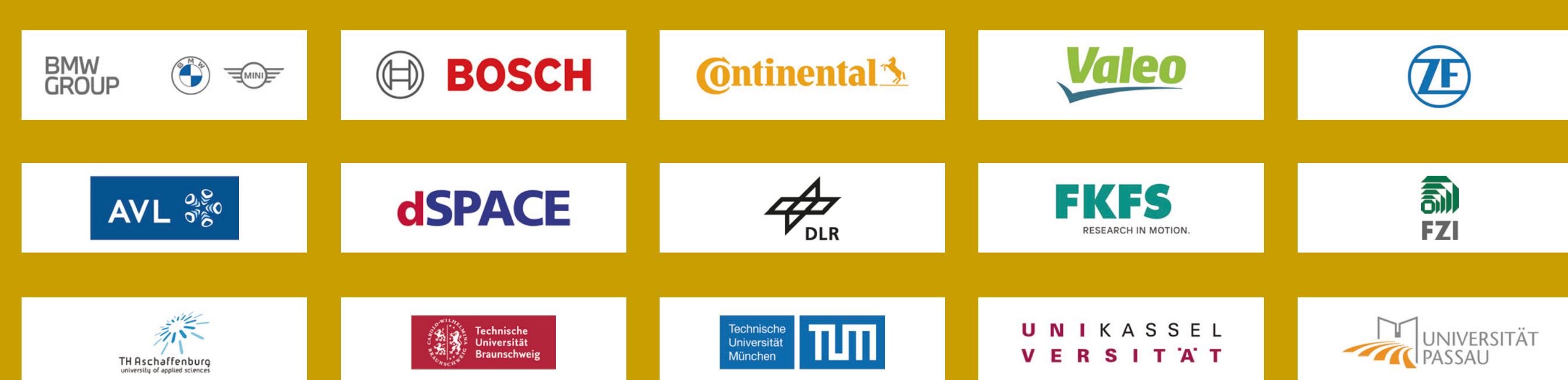

Figure 1: Coverage for lane count and explicit speed limit attributes in OpenStreetMap (OSM) data for Germany by road type. OSM offers a large amount of useful data, but cannot provide complete coverage, especially for minor roads. Produced with Ohsome Dashboard.

Data sources for context

Context is gathered from a variety of sources. Part of the value of the KI Data Tooling pipeline is in collecting the output of diverse methods in a **single, consistent data structure** for all types of recordings. These data sources and methods include:

- **Context from camera images**
  We classify weather and road properties such as cloud cover, precipitation and the surrounding infrastructure by applying CNNs to RGB images. This approach isn't specific to KI Data Tooling, but generalizes to synthetic data and other datasets.

- **Context from CAN bus data**
  For data collected by the vehicles operated by KI Data Tooling project partners, we have access to numerous properties recorded by the vehicle's sensors.

- **Context from stationary sensors**
  Some partners in KI Data Tooling operate stationary sensors to capture various types of context which may go beyond what's visible from the limited perspective of a vehicle. For sequences recorded at locations equipped with these sensors, we combine their output with other sources.

- **Context from synthetic data generation**
  The tools used to generate synthetic data have perfect knowledge about the virtual scenes they render. This makes exports of structured metadata provided by these tools a highly accurate source of context. We use this as a source for types and properties of entities present in virtual scenes.

- **Context from third-party databases**
  Accurate time and location data unlocks various third-party databases as sources for context. Using vehicle locations derived from CAN bus data, we demonstrate this by looking up roads and their surroundings in OpenStreetMap. While coverage is incomplete (as shown by the examples in figure 1), it can easily be used as a fallback where no HD data is available. Representing HD data or data about virtual worlds using the OpenStreetMap data model allows the same tools to be used.
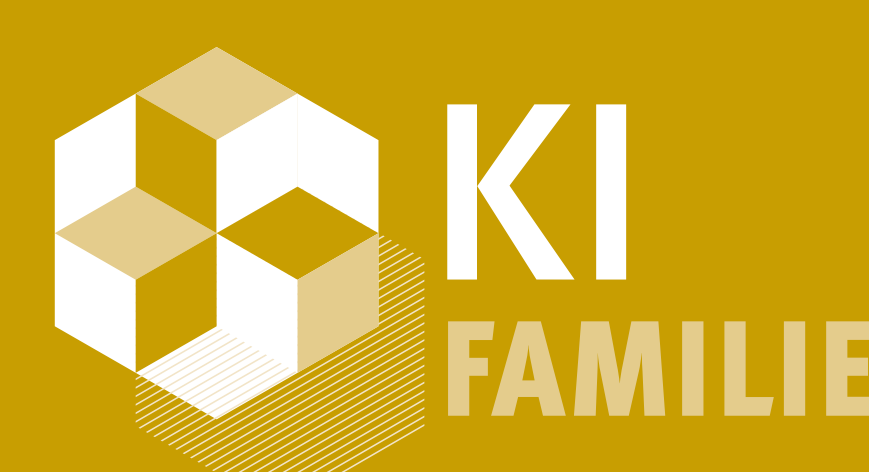
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