KI DATA TOOLING
The Data Kit for Automotive AI

Mixing Procedural Methods and Annotation to Reconstruct 3D Worlds for Sensor Simulation

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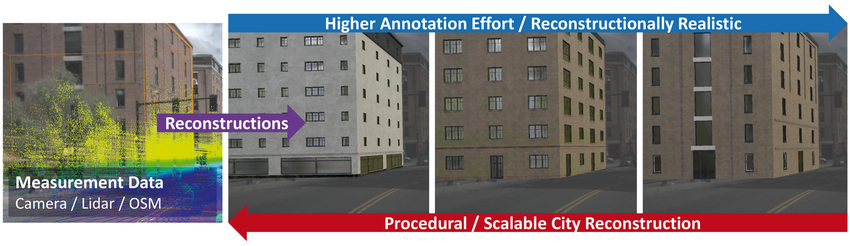

Figure 1: Measurement data (source: NuScenes 103) is used to extract features of the environment in the form of annotations. Annotation amount and quality define the reconstructional realism of procedural generators.

Reconstruction Goals

With increasing virtual testing and validation of ADAS/AD algorithms, the demand for virtual 3D worlds is high. The quality metrics are:
Sensor Realism – are the simulated sensor responses generally comparable to real world measurements?
Reconstructional Realism – to which extend does the 3D world represent a specific real world location?
While a perfect digital twin of the real world is the ultimate goal, various use cases may require less realism to save reconstruction effort.

Sensor Realism

Our automated toolchain generates 3D worlds based on annotations (e.g. floor plans, façade materials, window positions...). We achieve a level of sensor realism that is mostly constant for all generated worlds. The quality of the geometry, textures and sensor-material properties defines the realism and depends on the used assets and algorithms.

Reconstructional Realism

In contrast, reconstructional realism has reoccurring effort as some kind of real world measurement data has to be utilized and is not fully automatically transformable into a sensor-ready 3D world yet. In fact, we do not use transformed measurement data at all, but extract (manually and automatically) meta data from it (annotations), which is used as input for procedural 3D generators.

Approach at dSPACE

An exemplary generation workflow looks as follows: A building is annotated as residential and german. An algorithm decides to annotate roofs, windows and facades. While being sensor realistic, the algorithmic decisions do not intentionally match a real world building. The operator starts adjusting annotations until the desired level of reconstructional realism has been achieved. On every annotation change, a new version of the building is generated and immediately visible. Annotations set by an operator are locked as ground truth data. A window with a width of 3 meters set by an operator will keep its width, even if other high level decisions may interfere.

Summary

Operators can limit annotation effort according to their use cases, because missing parameters are generated procedurally. We are planning to increase the impact of lower level annotations: Instead of just limiting parameter overrides, we want to affect high level decisions. For example, buildings with renaissance windows are less likely to have modern wood or concrete facades. Visionary spoken, operators annotate just the aspect that leads to an edge case, while the system generates a procedural consistent environment around it.

Figure 2: Measurement data in comparison to a virtual sensor simulation (Source: KIAPI).

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KI FAMILIE

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