KI ABSICHERUNG
Safe AI for Automated Driving

Parametrized, safety relevant test-scenarios for DNN assessment (ENCAP-like)

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Motivation

The detection of objects in standardized scenarios like ENCAP is crucial, as the automotive industry uses those scenarios as reference for the homologation of their ADAS SAE level 1 and 2 functions in vehicles. This leads directly to the requirement, that the DNN based pedestrian detection function shall be capable of detecting objects in the scenarios from the ENCAP specification like:

- crossing pedestrian,
- crossing bicycle and
- different turn scenarios

The scenarios created in KI-A (example in figure 1) are derived from ENCAP but do not strictly adhere to the specification.
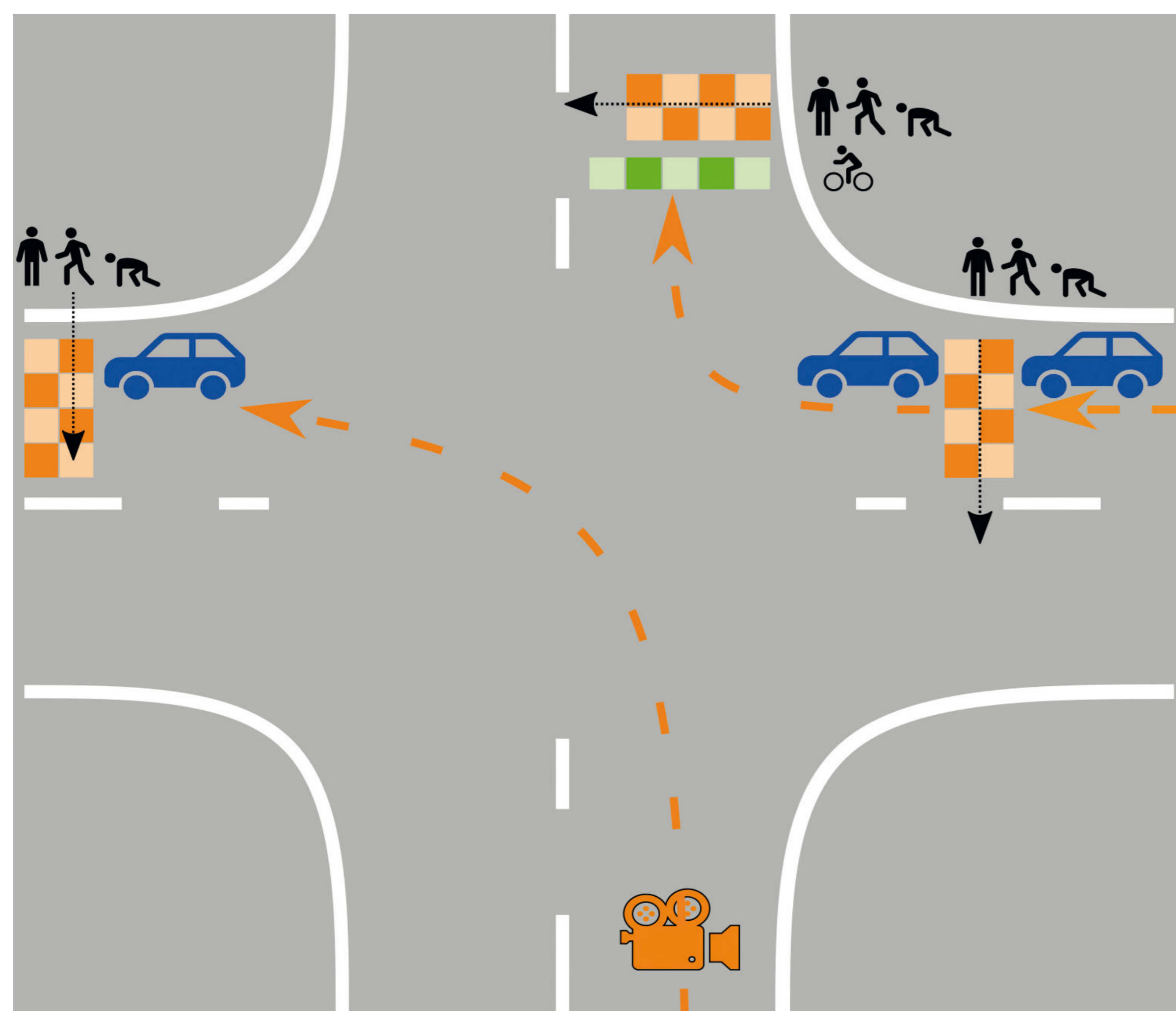

Figure 1: Example of scenarios

Approach

The geometrical structure of those scenarios was used and extended with the, from the project as important rated, parameters.
For creating the test set, the parameters are structured according to the developed KI-A ontology and embedded in a so called combinatorial "Zwicky Box". An example is shown in figure 2. This structure is used as an input for the t-wise test set creation.

Figure 2: Example of scenarios

For the automated generation of the specific test scenes, the scenarios can be created by defining a path of the camera and the objects. The path information of the objects is then combined with the positional offset information and other parameters for the generation of simulation instructions in a machine readable format in the data production. Additionally, an extra module of the tool allows the placement of pedestrians with specific poses in a scene. The overall setup is shown in figure 3.

Results from experiments

The analysis of the inference results from the SSD based pedestrian detector have shown, that by altering the pedestrian poses, rotation and contrast a performance drop occurred. Enriching the training data set with comparable images including the above mentioned parameters could help to reduce and mitigate this performance gap. In consequence of these results, an additional test set, that contains similar poses in different scenes, but with a high structural similarity, was defined to analyse for evidence of independence to other variated parameters.
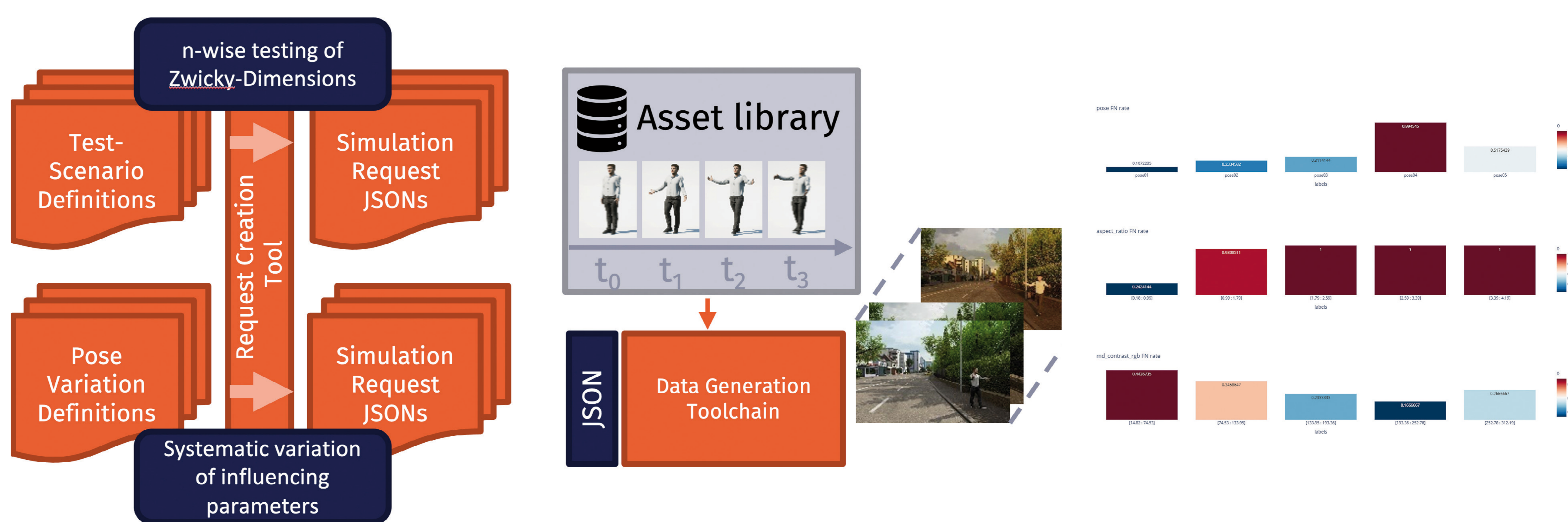

Figure 3: Overall data production and data analysis process

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Image sources: Fig. 1: ZF Friedrichshafen AG; Fig. 2: Robert Bosch GmbH; Fig. 3: Mackevision Medien Design GmbH