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Definition Performance Limiting Factor (PLF): A measurable factor, either

- Direct physical effect or
- Model of effect

that leads to drops in perception performance

In the argumentation we provide evidences to identify and mitigate PLFs.

Evidences to identify PLFs

The complete GSN argumentation provides the following approaches to **identify** PLFs:

- Use a-priori knowledge about physical and technical system context
- Use methods to identify PLFs (Fig. 4):
PCA: PLFs are extracted by comparing Synthetic- and Real-World-Data distributions (Fig. 1)

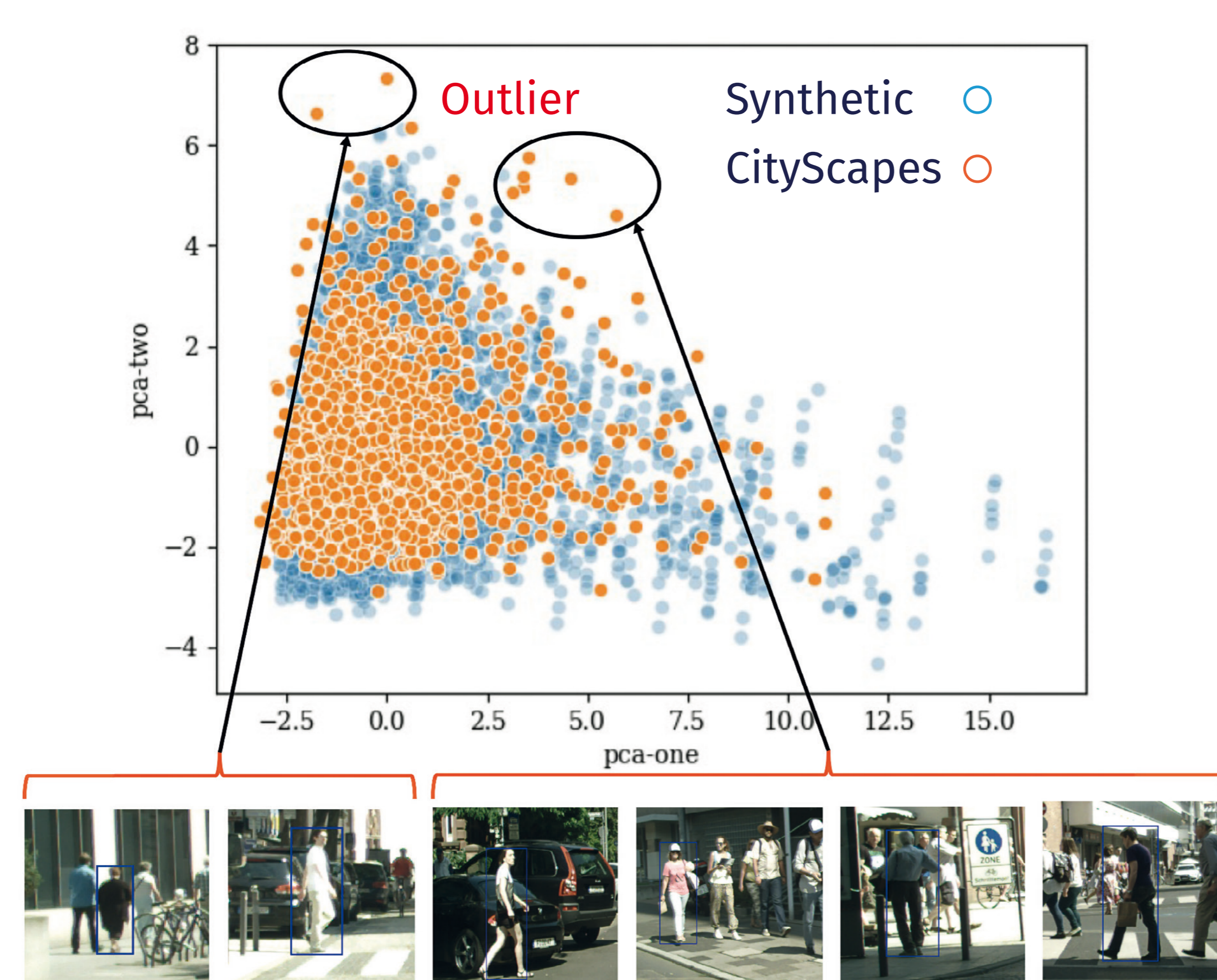


Figure 1: PLF PCA transformation to detect missing datapoints in synthetic data (Intel)

- **Combinatorial Testing:** Determine PLF Dimension and Alternatives distribution discrepancies in datasets to refine PLFs
- **Search-Based Testing:** Determine where the DNN performance is low to reveal critical test cases as PLFs



Figure 2: Examples for performance limiting factors

In-depth data analysis and filtering PLFs:

- **automatically annotated as metadata** to the different images and pedestrians
- **Linked with KI-A ontology**

The provided evidences for mitigation of identified PLFs include:

- **Retraining** with updated dataset (Fig. 3)
- Possible **component modifications** (but not limited to): loss function, architecture, etc.
- PLFs are mitigated by **different component(s) on system-level** (e.g. sensors, monitors, trajectory planning, etc.)

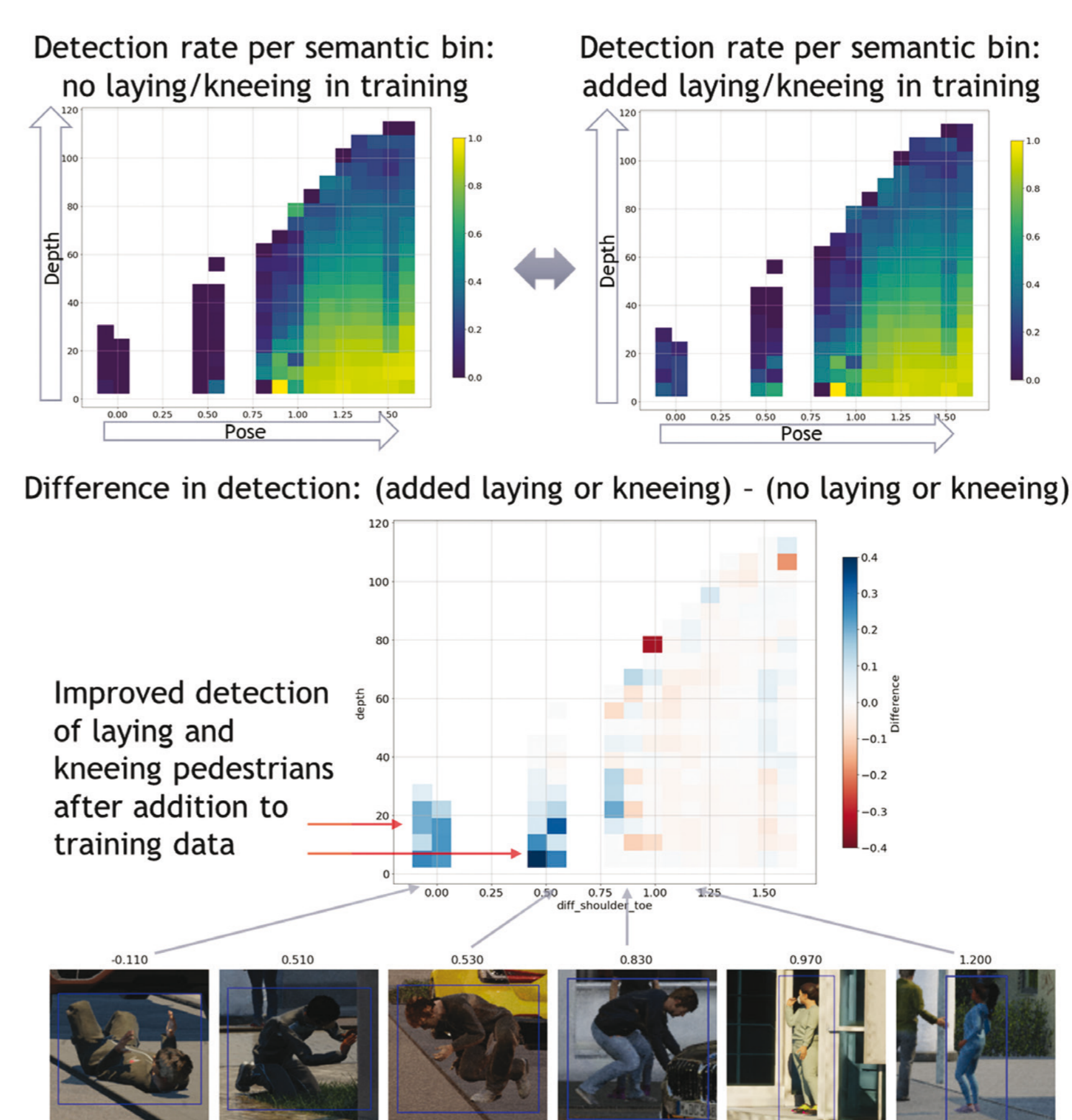


Figure 3: Training of SSD detector with training data including/excluding PLF. Comparison of detection performance w.r.t. semantic dimension as evidence for mitigation (Bosch)

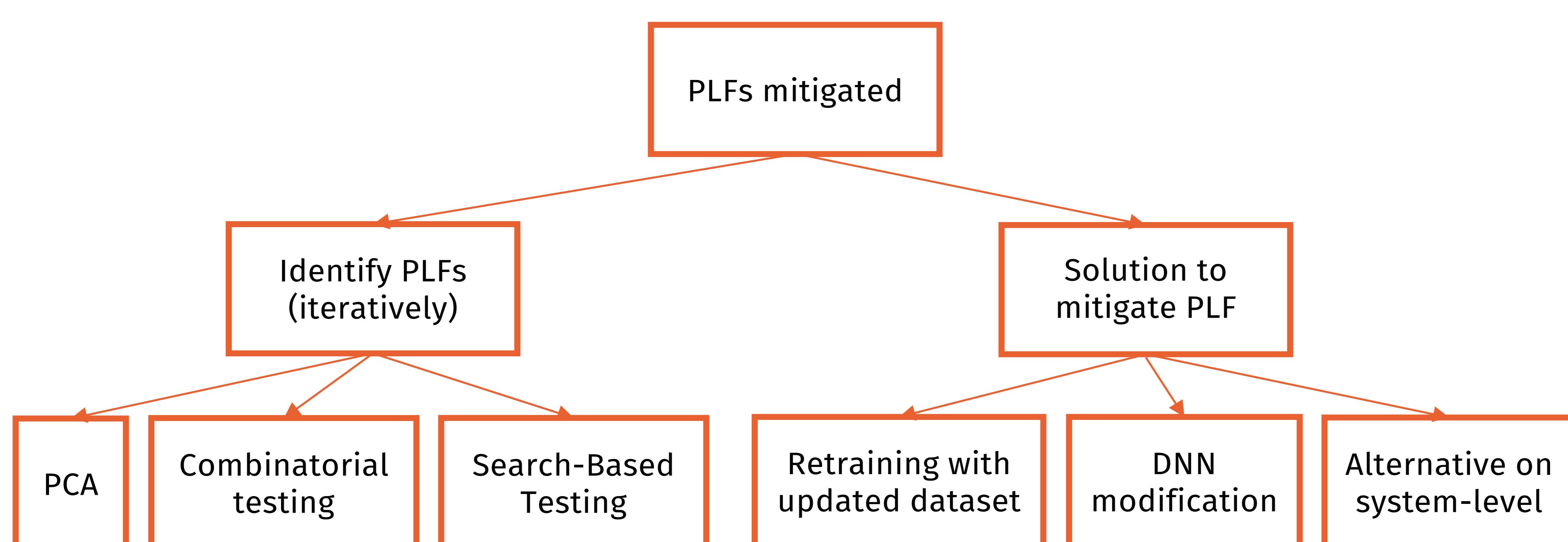


Figure 4: Schematic overview of the GSN safety argumentation for PLF mitigation (Bosch, FhG IKS)