KI DATA TOOLING
The Data Kit for Automotive AI

Physical Radar Simulation

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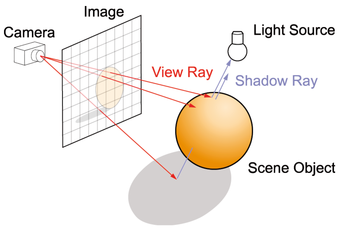
Challenges in physical radar simulation

Ray-tracing for radar is much more complex than for camera, the following effects should be taken into simulation design:

- **Maxwell's equation**
- **Doppler effect**
- **Polarization**
- **Antenna Gains**
- **Target shape**
- **Type of material**

Considering those properties, compute intense simulation results compared to camera:



https://www.researchgate.net/figure/1-This-figure-demonstrates-the-concept-of-ray-tracing-A-ray-is-cast-from-the-camera_fig1_236342499

Comparison	Camera	Radar
Time	1	>100
Memory	1	5
Interference	NO	YES
Diffraction	NO	YES
Physical quantities	1	> 5

Figure 1: Compute effort estimation for radar

Solution - Wave spectrum simulation

Simulation and generation of synthetic data for AI based on a single model source with physically based material & sensor models:

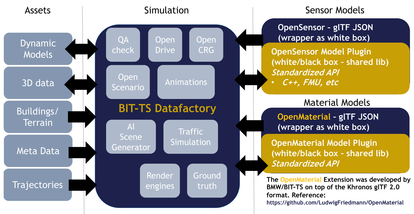


Figure 2: Architecture for versatile synthetic data generation

Introduction of an open sensor interface plus reference models implementing radar signal simulation on analog level:

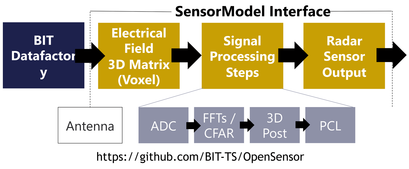


Figure 3: Analog signal processing flow

Results

Calibration using a static test setup. Three corner reflectors are aligned with the radar sensor in three different directions:

Figure 4: Static test setup for calibration of radar sensor model. Figure shows projected radar points into simulated camera space

Figure 5: Dynamic highway setup on A9 with multiple driving cars, guard rails and vegetation.

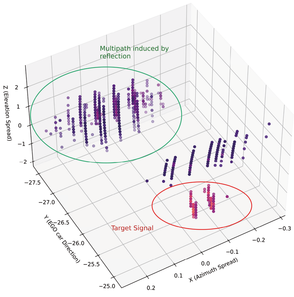


Figure 6: Analysis of data showing desired features in radar point clouds.

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KI Data Tooling is a project of the KI Familie. It was initiated and developed by the VDA Leitinitiative autonomous and connected driving and is funded by the Federal Ministry for Economic Affairs and Climate Action.

KI FAMILIE

Supported by:
Federal Ministry for Economic Affairs and Climate Action
on the basis of a decision by the German Bundestag