AUTOMOTIVE ARTIFICIAL INTELLIGENCE

AAi ReplicaR®

Version 4.0, Feature Release, 25.12.2022

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AAI ReplicaR 4.0.0 comes out 25.12.2022 with the following features:

1.1 – Platform Features

- AAI **ReplicaR hosted on cloud with on-demand scalability** on either MS Azure or AWS
- C++ SDK for external ego/vehicle under test
- **Scenario Extraction** with Pegasus scenario-based categorization and easy-to-integrate customer categorization extensions
- **Synthetic image generation**, with various camera configurations (depth camera, fisheye camera, etc.)
- Platform **user management with integration of 3rd party** authentication services (such as Okta)
- **FMU** Integrations
- **Enhanced** user interface for improved ease-of-use
- **ODR map viewer** exposed to the customer via the user interface
- **Logical/concrete scenario execution** from imported **OpenSCENARIO®s** as well as scenarios generated from simulation and scenarios extracted from the measurement drives

1.2 – AAI ReplicaR introducing ASDL (Automotive Scenario Descriptor Language)

AAI ReplicaR introduced a scenario description language – called **ASDL** - **Automotive Scenario Description Language**, used for scenario description, prioritization with customer-defined rules, analysis, and execution. All in one formal language.

Customers can write logical scenarios programmatically, using various features exposed by AAI such as scalable mapping, sensor simulation, environment, etc.

1.3 – Scenario extraction based on ODD (operational design domain)

AAI ReplicaR offers an improved and efficient upgrade of its **Scenario Extraction** module, which now comes with:

- **ODD labeling for extracted scenarios** to enable scenario exploration to find relevant scenarios as per the function to test
- Improved **scenario quality** in terms of using elaborate extraction criteria (e.g: fitness, the measure of vehicle's jerk, etc.)
- **Enhanced analysis** of individual scenarios to better comprehend the scenario

1.4 – Traffic to generate scenarios

- Traffic agents follow the **parking** regulations
- Motorcycles traveling **side-by-side** in one lane
- User-defined **navigation**

- **Various spawning strategies** to simulate various traffic situations:
  - traffic can be spawned within a region around ego;

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- or to always have a set number of vehicles around the ego,
- or traffic can be spawned at the map end-points to have vehicles spread out and simulate a natural traffic flow in any region

1.5 – Traffic Agents training using Artificial Intelligence

AAI ReplicaR's traffic module also enhanced the AI-based agents to closely represent real-world driving behavior. Specifically, we introduce:

- **Reinforcement learning** agents can evade obstacles
- **Agents training** using drone data of city and highways
- **Customers can define, create and reward** their own reinforcement learning traffic agents

1.6 – Sensor Simulation

AAI ReplicaR's **sensor simulation** has improved existing features as well as introduced:

- **Weather** conditions & severity (rain, fog, rain, snow)
- Improved **rendering** resolution
- Improved **trees shader**
- Wipers in vehicles
- **ASAM OSI ®** — expose & dump sensor data in OSI3 format
- Ground Truth now contains **TrafficLightStates** in the OSI3 data
- Area-based asset spawning
- **Procedural Generation** - Bridge, fence, noise barrier, etc.
- **Street lights control** is based on the time in simulation

1.7 – Automatic Scene generation

AAI ReplicaR's tool **Scene Generator** has introduced the following features:

- Customers can **procedurally generate scenes** around the ODR maps and export the FBX file
- 3D objects/assets can also be manually
  - AAI ReplicaR offers an abundance of 3D assets to build complicated scenes/situations with dynamic/static objects
- **Area-based placement** of houses & vegetation

1.8 – Raytracing

AAI ReplicaR's Raytracing SDK provides examples to showcase:

- Radar sensor SDK
- Camera raytracing
- Volumetric rendering in OptiX

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1.9 – HERE HD Maps Automatic conversion to OpenDRIVE®

HERE HD Maps conversion & correction automatically to OpenDRIVE®

- Trajectory-Based Route Map
- Geometry generation of HERE reference line via spiral, arcs, and lines
- Introduction of Signs Layer to OpenDRIVE®
- Region-based Map Generation
- Introduction of Poles Layer to OpenDRIVE®
- Navigation and Route Planning
- Multiple Tiles Map Generation
- Map Warning Reduction
    - Mesh Enhancement
    - Continuity Enhancement
    - Artificial Road/Lane Creation
- Logging and Warning Reports
- Correction of 'None Type' Roads/Lanes
- Introduction of Barriers Layer to OpenDRIVE®
- Introduction of ADAS Layer to OpenDRIVE®
- Availability of Entire routes extracted from HERE Routing API for simulation as Open
- Road Geometry | Top Down (Width)
- Road Geometry | Macro Road shape
- Road Geometry | Elevation & Superelevation
- Road Geometry | Missing Road
- OpenDRIVE® File | Tunnels and Bridges
- OpenDRIVE® File | Object Placement
- OpenDRIVE® File | Object Representative
- OpenDRIVE® File | Speed limit (road, lanes)
- OpenDRIVE® File | Road Description
- Road markings | Lines (Existence)
- Road markings | Lines (Type)

2.0 – One Engine Compute

AAI ReplicaR's **real-world pipeline** offers digitizing of real-world data to simulation platforms. Detailed toolchain step-by-step with detailed KPIs to generate a ground truth and extract real-world scenarios.

- LiDAR fusion module
- Pipeline for continuous improvement if the data format remains the same
    - Addition/Integration of Custom Localizer (can be different for different data sets)
- Calibration tool
    - Lidar-camera
    - Lidar-n-cameras
    - Homography
- Scenario extraction, analysis, and evaluation of customer data
    - Processed and corrected map+ego+actors

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- Scenarios manually extracted
- Scenario analysis/evaluation (ReplicaR)

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