



Generated by
UNIGINE 3D engine in real-time

:: UNIGINE 2 Sim

Real-Time 3D Visualization For Deep Learning In Automotive

Deep Learning In Autonomous Vehicles / ADAS

Autonomous vehicle operation:

1. Perception
2. Localization
3. Path Planning
4. Control

Computer vision (**Perception**) learning requires a lot of visual data, which can be easily generated by real-time 3D engine software from virtual scenarios.

Virtual scenarios can be used for pre-validation of autonomous systems behavior (**Control**) as well (virtual test driving).

Requirements for virtual 3D environments:

- Photorealistic image quality
- Physically correct lighting
- Multiple wide-angle surrounding cameras
- Sensor simulation (LIDAR, radar, ultrasonic...)
- Access to semantic data of objects (labels)
- Procedural scene configuration (vehicle/pedestrian positions, obstacles, lighting, weather conditions)
- Deterministic behavior from run to run

Compared to conventional approaches (manual dataset gathering and labeling, vehicle testing tracks), using a 3D engine requires less time, effort, and resources.

UNIGINE 2 Sim: Real-Time 3D Visualization Software Development Kit

Photorealistic Visuals

- Physically-based rendering
- Energy conservation model
- Dynamic lights, shadows, and reflections
- GGX BRDF: realistic speck from light sources
- Fresnel reflections, reflections on rough surfaces
- Screen Space Ray Tracing Reflections (SSRR)
- Configurable anti-aliasing algorithms
- Unique Screen-Space Ray Tracing Global Illumination (SSRTGI) technology

Physically-correct visualization of the learning dataset = reliable **computer vision** for real roads.

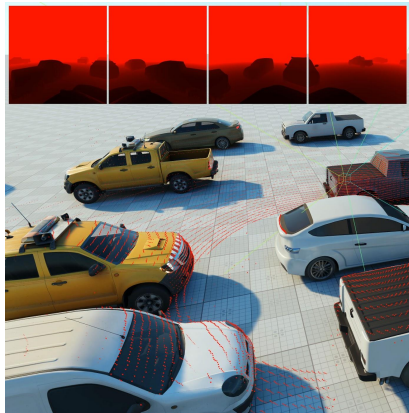


Virtual Cameras & Sensor Fusion



Surround Cameras

Multiple surround cameras can be implemented with linear or fisheye (panoramic) views. Monocular / stereo dash cam setups for ADAS are also easily configurable.



LiDAR

360° scanning laser sensor is supported. Distances to the surrounding objects can be fed into AI algorithms in real-time, regardless of lighting conditions.

Radar

Short-wave radars can be imitated with fast access to the scene depth data. The same precise data can be used for short-range sonar imitation.



Special-Purpose Sensors

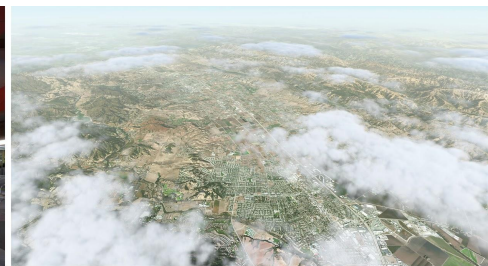
UNIGINE 2 Sim can be used to imitate other types of special sensors, e.g. thermal, night vision, and infrared ones.



Georeferenced Scenes

UNIGINE 2 Sim SDK is built for the correct virtual representation of the real world, at scale.

- Increased object positioning precision: 64-bit precision per coordinate
- Support for 3D ellipsoid Earth model (WGS84, other coordinates systems)
- Support for geodata formats (elevation / imagery / vector)
- Ephemeris system for celestial bodies positions depending on time/coordinates
- The performance-optimized object cluster system



Automatic Data Annotation

UNIGINE 2 Sim scenes already contain the classification information for each frame, making them an auto-labeled ML dataset. Ground truth data can be easily accessed for each pixel. Unlike manual tagging, there is a 0% classification error.

- Per-object property system for semantic data
- Easy object masking
- Extensive access to the scene graph
- Fast object visibility checks
- Efficient occlusion control
- 24-bit material masks
- Object bounds info for segmentation evaluation

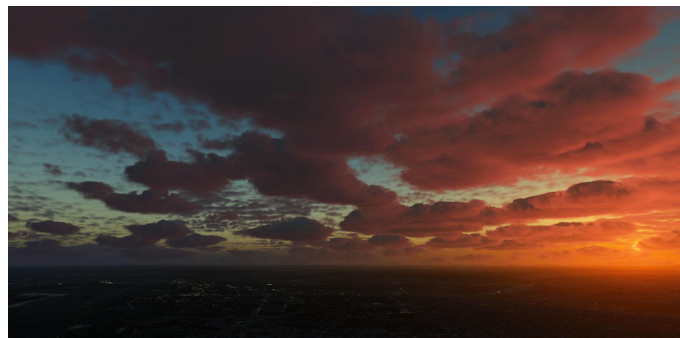


Easy Scenario Reconfiguration

You can get an unlimited number of scenarios by changing any of these variable parameters, which are dynamically controlled via API:

- Autonomous vehicle position
- Surrounding traffic
- Pedestrians
- Obstacles
- Accidents
- Road condition
- Lighting conditions
- Weather conditions

The increased number of situations and test cases explored in this way should improve system reliability dramatically.



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High Performance

UNIGINE 2 Sim was designed to handle large, complex procedural scenes, filled with dynamic entities.

The 3D engine demonstrates high and stable performance even working on consumer-grade hardware. This proves useful and time-saving when it comes to iterative AI training.

There is the multi-years close cooperation of UNIGINE with leading hardware vendors (AMD, Intel, NVIDIA) on performance optimization.



Vehicle Dynamics Simulation

UNIGINE 2 Sim SDK includes a generic vehicle dynamics system, which can be fine for background traffic or prototype applications (before you bring more sophisticated software algorithms or hardware-in-the-loop simulation in).

- Main vehicle systems: engine, gearbox, transfer case, axles, differential, wheels, suspension, steering, brakes
- Configurable drivetrain: FWD, RWD, 4WD, multi-axle vehicles
- Simulation of various surface conditions (dry, wet, snow-covered, or icy road, mud, and so on)
- Visual control/debug of parameters in real-time

There are also essential built-in components for traffic simulation (spatial triggers, pathfinding module).



Powerful C++ or C# API

Support for both C++ and C# programming languages provides decent flexibility for development teams. Both APIs are identical in terms of the access level:

- Deep access to the rendering pipeline
- Flexible multi-viewport mode
- Extensive access to the scene graph and all parameters
- CUDA support for fast GPU-CPU data transfer
- Raw texture access
- Extendible design for custom objects and shaders

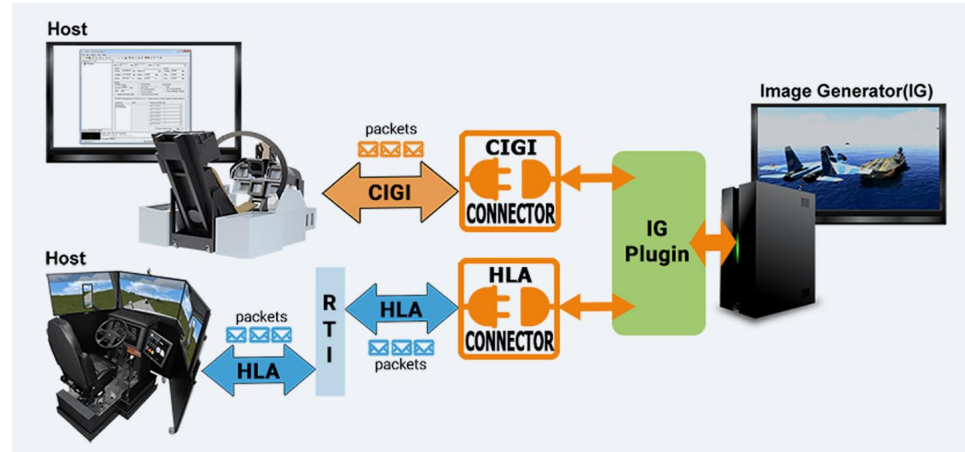


Proven By Training Humans

UNIGINE 2 Sim has been proven for years in building professional simulators to train people. The SDK was designed to work as a part of modular distributed systems.

There are a lot of common tasks in generating virtual 3D environments for humans and AI.

A great variety of driving simulation systems created by our customers are installed worldwide. Cars, trucks, special vehicles, trains, military vehicles - all sorts of ground transportation simulators are powered by UNIGINE Engine.

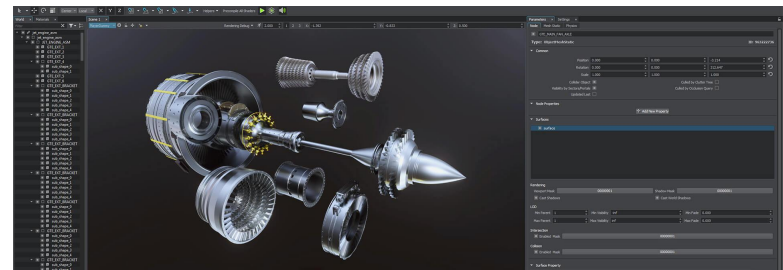
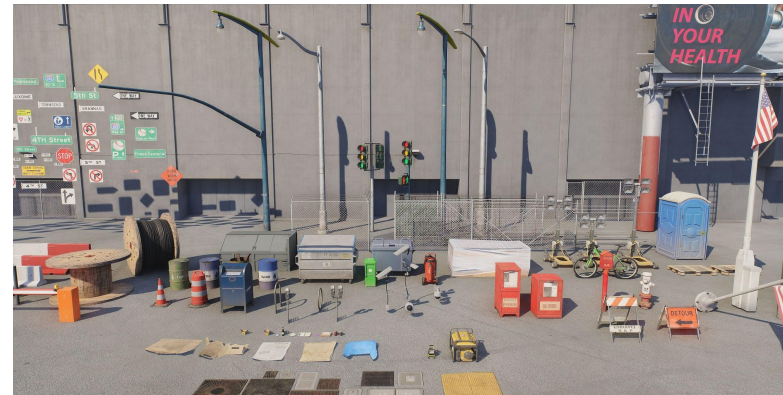
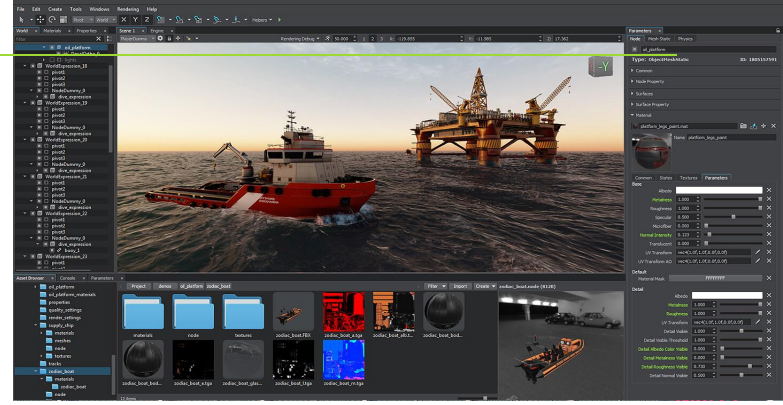


Various Types Of Vehicles



Streamlined Content Workflow

- WYSIWYG 3D scene (visual database) editor
- Landscape tool with support for procedural data refinement
- PBR workflow for 3D assets (compatible across modern engines)
- Support for CAD and GIS data formats
- 3D content library

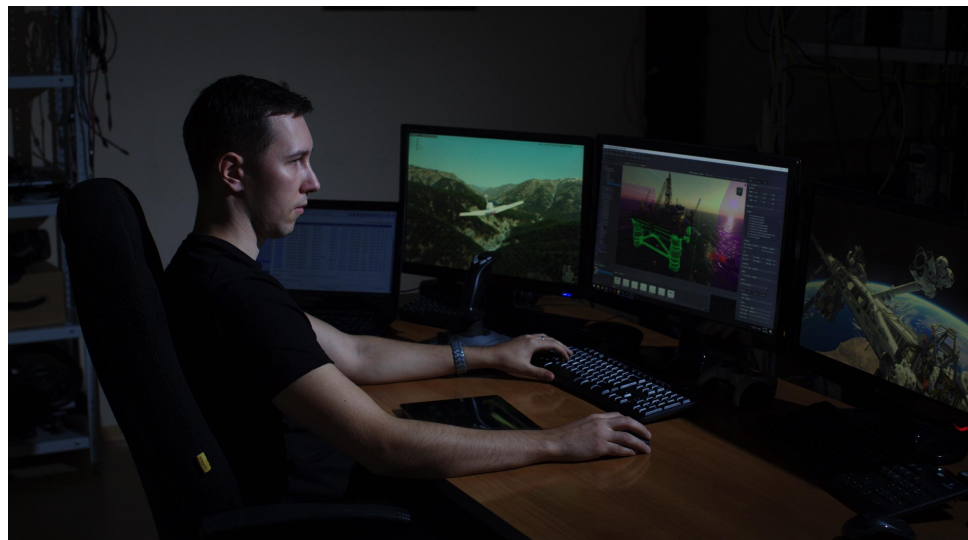
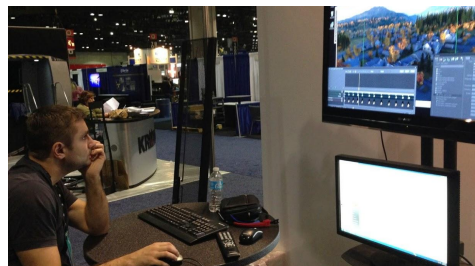
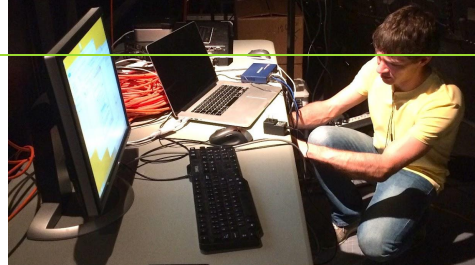


Team Of Experts

UNIGINE team has been working with simulation & training tasks for more than ten years (and AI training-specific tasks for four years), having directly participated in many projects, receiving hands-on experience ourselves, and realizing many turnkey projects.

All our experience was converted into UNIGINE 2 Sim software platform; so, our clients can use ready-made components that have been developed especially for solving similar tasks.

Our technical experts are always here to help your team with any questions.



UNIGINE Advantages Summary

- Photorealistic image quality
- Camera and sensor output
- Automatic semantic data labeling
- Easy scenario reconfiguration
- Deep access to the rendering pipeline
- Embeddable into C++ / C# codebase
- Extremely performance-optimized
- Georeferenced scenes support
- A large number of out-of-the-box features
- Visual scene editor + 3D content library
- Generic vehicle dynamics simulation
- Support for various types of vehicles
- Proven in human-oriented simulators
- Brought to you by experienced, enterprise-oriented experts

Autonomous Everywhere

Regardless of the type of autonomous vehicles, their AI should undergo a training process, facing all the same common challenges, before they hit mass deployment:

- Self-driving cars (SAE Level 4/Level 5)
- Autonomous flying drones and UAV
- Maritime autonomous surface ships and submarines
- Autonomous spacecrafts

UNIGINE 2 Sim is capable to visualize all of these scenarios.



Try Today

Developers from 250+ companies across all the continents use UNIGINE technologies to realize their projects.

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