SKY ENGINE AI
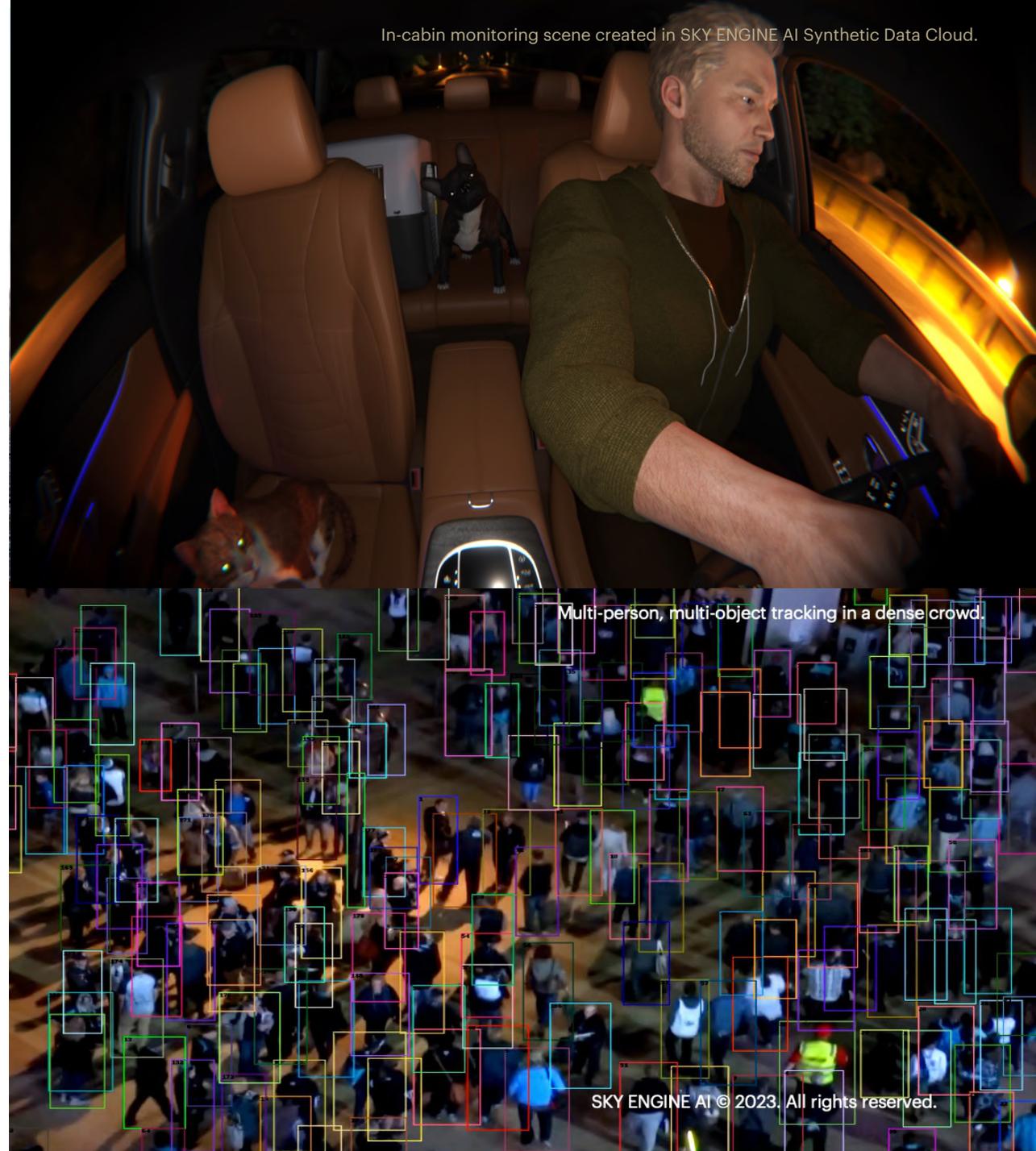### ADVANCING ARTIFICIAL INTELLIGENCE

Generative AI
Synthetic Data Cloud
for Deep Learning
in Vision AI

SKY ENGINE AI
Company Presentation

Prepared exclusively for Microsoft
March 4th, 2024

In-cabin monitoring scene created in SKY ENGINE AI Synthetic Data Cloud.

Multi-person, multi-object tracking in a dense crowd.

SKY ENGINE AI Partnerships with Microsoft & Nvidia

We are partnering Forbes top companies – Microsoft and Nvidia: Joint publications, research, reports, blog articles, co-sell and technology partner
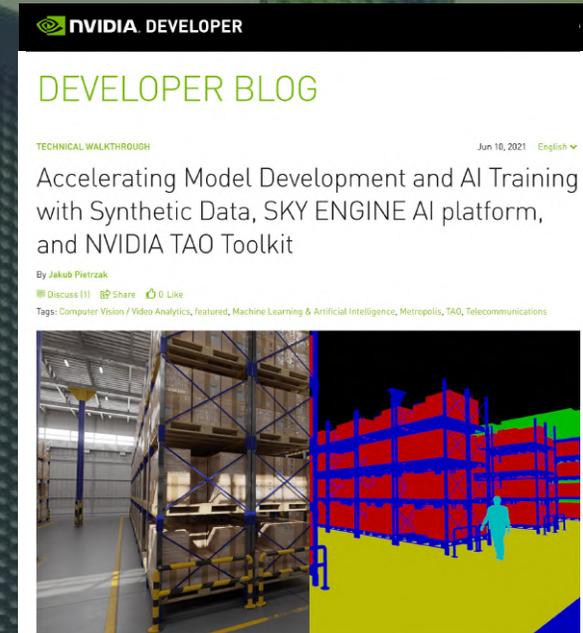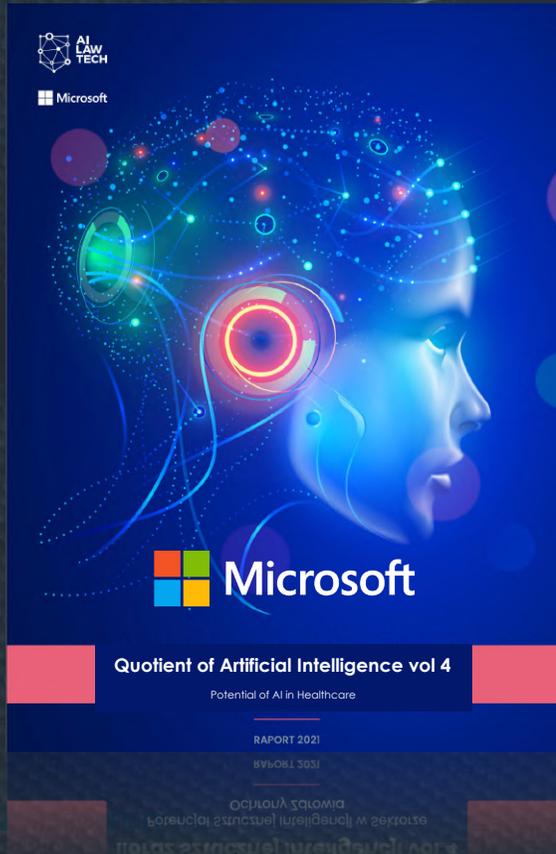
Efrat Swissa
Ex-NVIDIA
Director of Alliances, AI
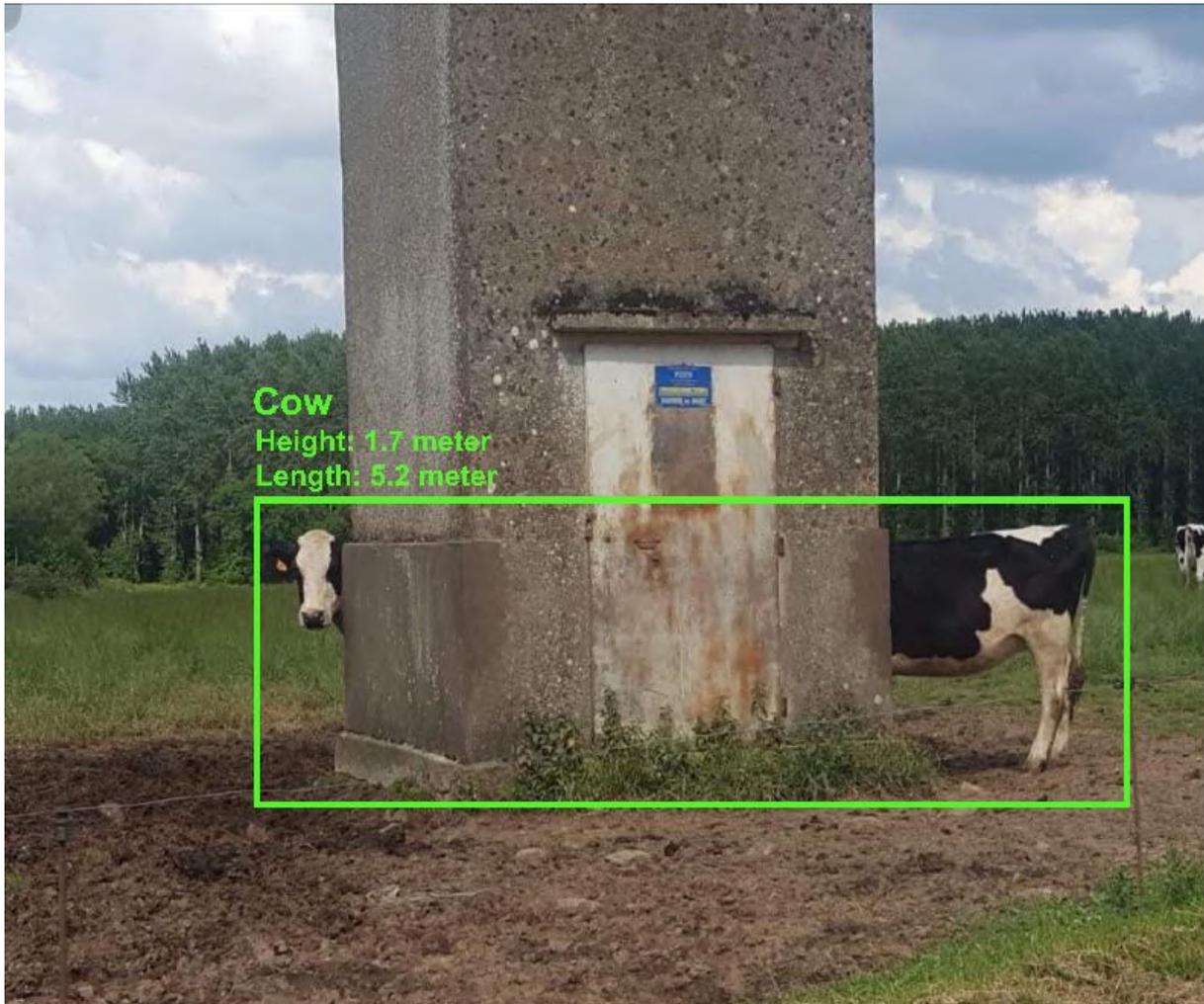
Currently Director Core ML, Google

"

My team and I take a great pleasure in supporting SKY ENGINE AI, our collaboration is a win-win for both Nvidia and SKY ENGINE AI.

SKY ENGINE showing what is possible with Nvidia tech and SKY ENGINE AI is leading the way with synthetic data and ML platform, which ultimately will dominate how the companies train DL models.

I look forward to more collaboration opportunities."

AI LAW TECH

Microsoft

Quotient of Artificial Intelligence vol 4
Potential of AI in Healthcare

RAPORT 2021

NVIDIA. DEVELOPER

DEVELOPER BLOG

TECHNICAL WALKTHROUGH   Nov 01, 2021 English

Advancing AI Sports Analytics Through the Data-Driven SKY ENGINE AI Platform and NVIDIA RTX

By Jakub Pietrzak

Discuss (0)   Share   0 Like

Tags: Computer Vision / Video Analytics, featured, Machine Learning & Artificial Intelligence, RTX, Sport Analytics, synthetic data, technical walkthrough

NVIDIA. DEVELOPER

DEVELOPER BLOG

TECHNICAL WALKTHROUGH   Jun 10, 2021 English

Accelerating Model Development and AI Training with Synthetic Data, SKY ENGINE AI platform, and NVIDIA TAO Toolkit

By Jakub Pietrzak

Discuss (1)   Share   0 Like

Tags: Computer Vision / Video Analytics, featured, Machine Learning & Artificial Intelligence, Metropolis, TAO, Telecommunications

Problems

Cow
Height: 1.7 meter
Length: 5.2 meter

Vision AI algorithms become better and better each day. And here we go:

Now they are able to even detect the **longest cow on Earth!**

Reminder: Data without the context is valuable but often it can introduce a lot of noise.

Today challenges in creating AI products

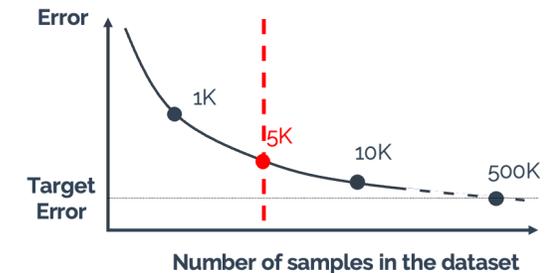AI-driven Computer Vision intends to train machines to understand the reality for metaverse operations, but...

Data acquisition is complicated and costly

Privacy constrained.
Edge cases are not covered well.
Metaverses are also deep fake prone.

Manual labeling is time consuming (plus costly labor)

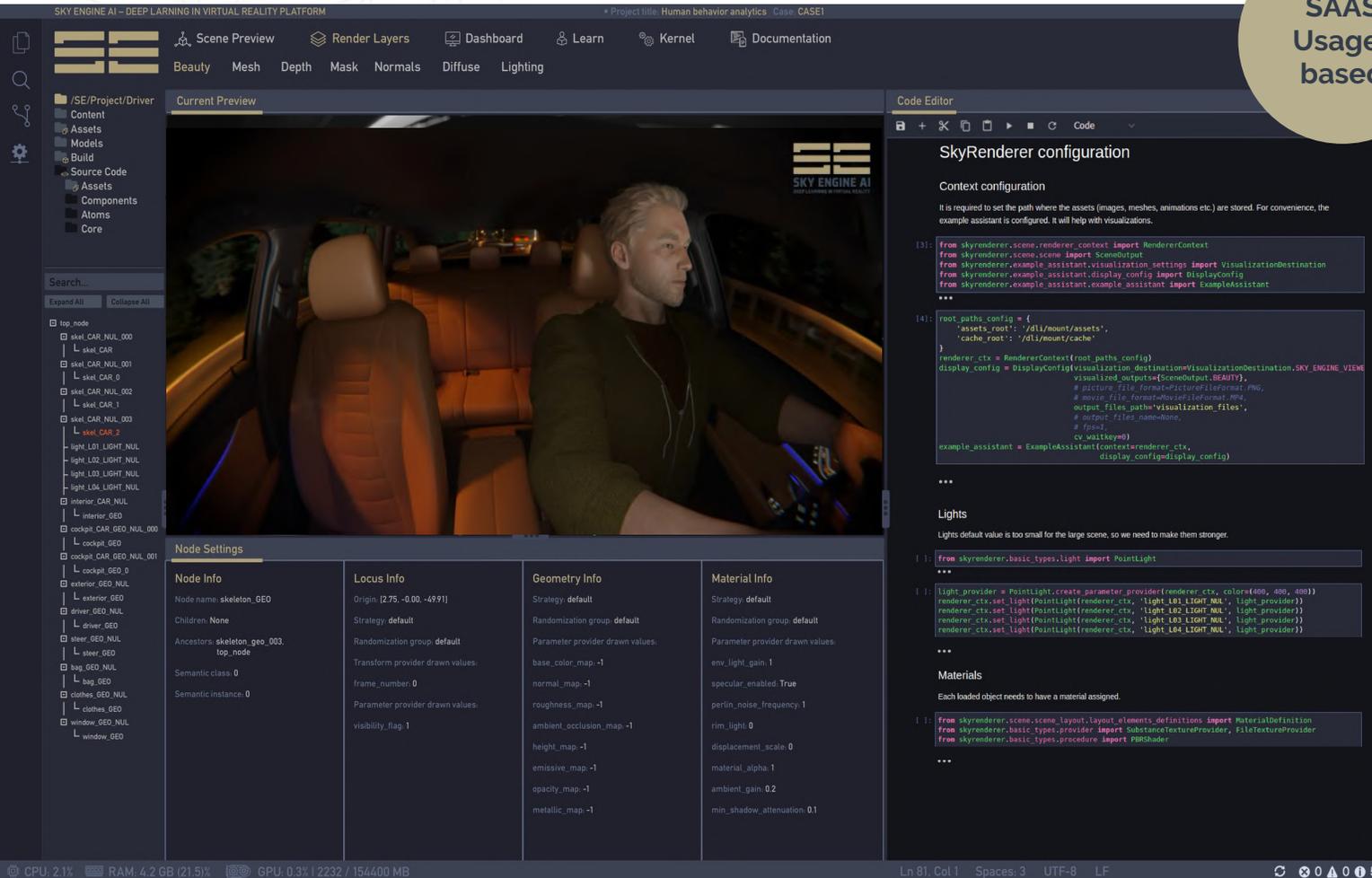7,500 man hours and £52,000 on just 5,000 images!

Accuracy of AI computer vision can be greatly improved

Example: 89% accuracy on real data vs. 96% on synthetics from SKY ENGINE AI (capsule endoscopy cancer detection)

SAAS Usage-based

Data Engine for

AI models training using Synthetic Data with Generative AI and Self-supervised Learning

SKY ENGINE AI software creates virtual and generative world, where objects and events can be simulated in a variety of configurations and environmental conditions and enables parallel AI models training

Scene Preview   Render Layers   Dashboard   Learn   Kernel   Documentation | Demo   User

Beauty   Mesh   Depth   Mask   Normals   Diffuse   Lighting

/SE/Project/Driver
Content
Assets
Models
Build
Source Code
  Assets
  Components
  Atoms
  Core

Current Preview

Search...
Expand All   Collapse All

top_node
skel_CAR_NUL_000
  skel_CAR
skel_CAR_NUL_001
  skel_CAR_0
skel_CAR_NUL_002
  skel_CAR_1
skel_CAR_NUL_003
  skel_CAR_2
light_L01_LIGHT_NUL
light_L02_LIGHT_NUL
light_L03_LIGHT_NUL
light_L04_LIGHT_NUL
interior_CAR_NUL
  interior_GEO
cockpit_CAR_GEO_NUL_000
  cockpit_GEO
cockpit_CAR_GEO_NUL_001
  cockpit_GEO_0
exterior_GEO_NUL
  exterior_GEO
driver_GEO_NUL
  driver_GEO
steer_GEO_NUL
  steer_GEO
bag_GEO_NUL
  bag_GEO
clothes_GEO_NUL
  clothes_GEO
window_GEO_NUL
  window_GEO

Node Settings

Node Info
Node name: skeleton_GEO
Children: None
Ancestors: skeleton_geo_003,
           top_node
Semantic class: 0
Semantic instance: 0

Locus Info
Origin: [2.75, -0.00, -49.91]
Strategy: default
Randomization group: default
Transform provider drawn values:
frame_number: 0
Parameter provider drawn values:
visibility_flag: 1

Geometry Info
Strategy: default
Randomization group: default
Parameter provider drawn values:
base_color_map: -1
normal_map: -1
roughness_map: -1
ambient_occlusion_map: -1
height_map: -1
emissive_map: -1
opacity_map: -1
metallic_map: -1

Material Info
Strategy: default
Randomization group: default
Parameter provider drawn values:
env_light_gain: 1
specular_enabled: True
perlin_noise_frequency: 1
rim_light: 0
displacement_scale: 0
material_alpha: 1
ambient_gain: 0.2
min_shadow_attenuation: 0.1

Code Editor

Code   Python 3

SkyRenderer configuration

Context configuration

It is required to set the path where the assets (images, meshes, animations etc.) are stored. For convenience, the example assistant is configured. It will help with visualizations.

```python
[3]:  from skyrenderer.scene.renderer_context import RendererContext
      from skyrenderer.scene.scene import SceneOutput
      from skyrenderer.example_assistant.visualization_settings import VisualizationDestination
      from skyrenderer.example_assistant.display_config import DisplayConfig
      from skyrenderer.example_assistant.example_assistant import ExampleAssistant
```

```python
[4]:  root_paths_config = {
          'assets_root': '/dli/mount/assets',
          'cache_root': '/dli/mount/cache'
      }
      renderer_ctx = RendererContext(root_paths_config)
      display_config = DisplayConfig(visualization_destination=VisualizationDestination.SKY_ENGINE_VIEWE
                      visualized_outputs={SceneOutput.BEAUTY},
                      # picture_file_format=PictureFileFormat.PNG,
                      # movie_file_format=MovieFileFormat.MP4,
                      output_files_path='visualization_files',
                      # output_files_name=None,
                      # fps=1,
                      cv_waitkey=0)
      example_assistant = ExampleAssistant(context=renderer_ctx,
                      display_config=display_config)
```

Lights

Lights default value is too small for the large scene, so we need to make them stronger.

```python
[ ]:  from skyrenderer.basic_types.light import PointLight
```

```python
[ ]:  light_provider = PointLight.create_parameter_provider(renderer_ctx, color=(400, 400, 400))
      renderer_ctx.set_light(PointLight(renderer_ctx, 'light_L01_LIGHT_NUL', light_provider))
      renderer_ctx.set_light(PointLight(renderer_ctx, 'light_L02_LIGHT_NUL', light_provider))
      renderer_ctx.set_light(PointLight(renderer_ctx, 'light_L03_LIGHT_NUL', light_provider))
      renderer_ctx.set_light(PointLight(renderer_ctx, 'light_L04_LIGHT_NUL', light_provider))
```
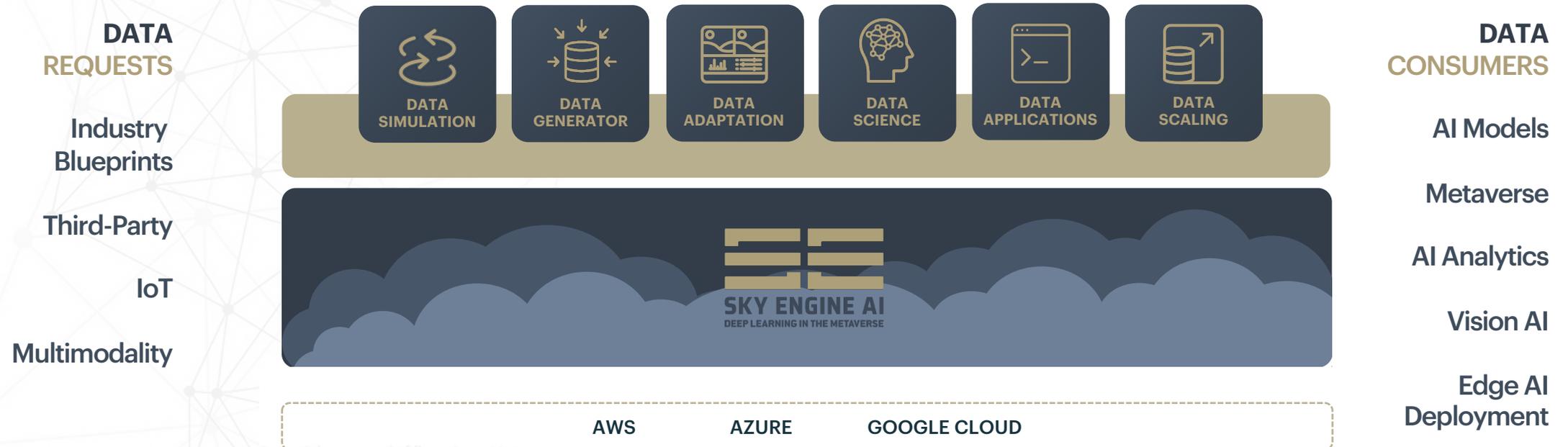
Materials

Each loaded object needs to have a material assigned.

```python
[ ]:  from skyrenderer.scene.scene_layout.layout_elements_definitions import MaterialDefinition
      from skyrenderer.basic_types.provider import SubstanceTextureProvider, FileTextureProvider
      from skyrenderer.basic_types.procedure import PBRShader
```
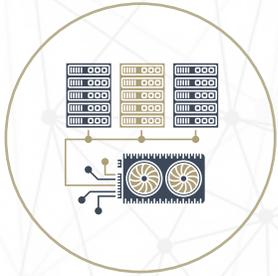
SKY ENGINE AI Platform & Architecture

DATA REQUESTS

Industry Blueprints

Third-Party

IoT

Multimodality

DATA SIMULATION · DATA GENERATOR · DATA ADAPTATION · DATA SCIENCE · DATA APPLICATIONS · DATA SCALING

DATA CONSUMERS

AI Models

Metaverse

AI Analytics

Vision AI

Edge AI Deployment

AWS   AZURE   GOOGLE CLOUD

Synthetic Data Cloud – Technology stack

GPU simulator
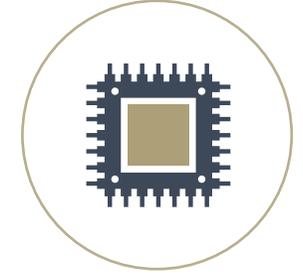with sets of Physics-based rendering shaders tailored to **sensor fusion**

AI-based image and video processor for **domain adaptation**

Garden of **deep neural network architectures** for 3D/4D training
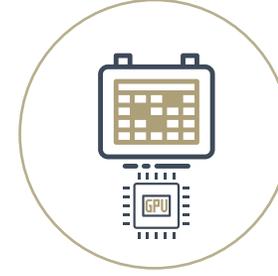
Multi-GPU and network level **adaptive deep learning** and tasks scheduler

GPU memory level **integration** with **PyTorch** and **TensorFlow**

includes deep integration of well-known technologies for
Data Scientists and **Software Engineers**

PyTorch

TensorFlow

GPU Simulator with Physics-based Rendering shaders for Sensor Fusion

- Multispectral, physics-based rendering and simulation:
  - **Visible light**
  - **NIR**
  - **Thermal**
  - **X-ray**
  - **Lidar**
  - **Radar**
  - **Sonar**
  - **Satellite**
- Render passes dedicated to deep learning
- Animation and motion capture systems support
- Determinism and advanced machinery for randomization strategies of scene parameters for active learning approach
- GAN-based materials and images postprocessing
- Support for Nvidia MDL and Adobe Substance textures
- Data scientist friendly
- Compatibility with popular CGI data formats

Sample synthetic data
Indoor scene for vision AI training

SKY ENGINE AI – Synthetic Data Cloud for Deep Learning in Vision AI – Workflow

Data Iteration

Continuous Learning

OUTPUT ANALYSIS

Design
Deep Learning
model

Create
Data model
& Training Plan

Generate Synthetic Data
for Deep Learning
in Virtual Reality

Adapt
Data
Domain

Train
Deep Learning
model

Deploy
trained AI model

Integrate
AI solution

AI Analytics
at Scale

Cloud Data Storage
Cloud Service Provider

Multi-GPU scaling

Start with SKY ENGINE AI-optimized AI model
architecture

Self-learning AI feedback loop
and AI model Iteration

Image Classification	Object Detection	3D Pose Estimation
EfficientNet ResNet	YOLO v5 RetinaNet	PoseNET HumanNET

OR
Start with SKY ENGINE AI pretrained AI models

People Detection	Image Segmentation	Gaze Estimation	Face Recognition	Action Recognition	Gestures Tracking	Emotions Understanding	Vehicle Classification

Full stack workflow
Tools for Developers

11 CONFIDENTIAL

SKY ENGINE AI – Synthetic Data Cloud for Deep Learning in Vision AI

Synthetic Data Cloud – Universe of the Metaverses

ENERGY INFRASTRUCTURE   **TELECOM**   **CONSTRUCTION**   **AGRICULTURE**   **HEALTHCARE**   **AUTOMOTIVE**   **MANUFACTURING**

WHY SKY ENGINE AI?

Proven Enterprise solutions +

Immediate OPEX reduction +

SAAS, consumption-based cloud +

Multisource Data Support +

Save on Human Resources +

Human works reliability Boost +

Energy Grid Optimisation   **Critical Infrastructure Assets Management**   **Effective Construction Monitoring**   **Crop management, Pests detection**   **Medical image diagnostics**   **AI-driven sensors analytics**   **Products monitoring, Robotics & Automatisation**

SKY ENGINE AI
DEEP LEARNING IN THE METAVERSE

Automotive Synthetic Data
In-cabin Monitoring

Sample RGB synthetic data for the DMS/OMS
with depth map and normals ground truth

Violent, angry, expressive, tension

Distracted female driver, using mobile phone

Children, child seats, harness

Driver close up, dazzling light from passing cars, road lamps light spills out in the car, seatbelts off

Driver turn toward rear, urban environment, objects on front row seat (handbag), child seat in 2nd row seat, evening

Pets of different breeds (cats, dogs, etc.), animal carriers, and accessories on the seats

Humans, pets, objects, activities, gestures, reactions, harness
can be introduced to the scene

Driver/Occupant/Objects Monitoring Data (DMS)
Created in the Synthetic Data Cloud for Vision AI and the Industrial Metaverse

Infrared data

RGB data

2D bounding boxes

Masks + 3D key points

Depth map

Infrared data
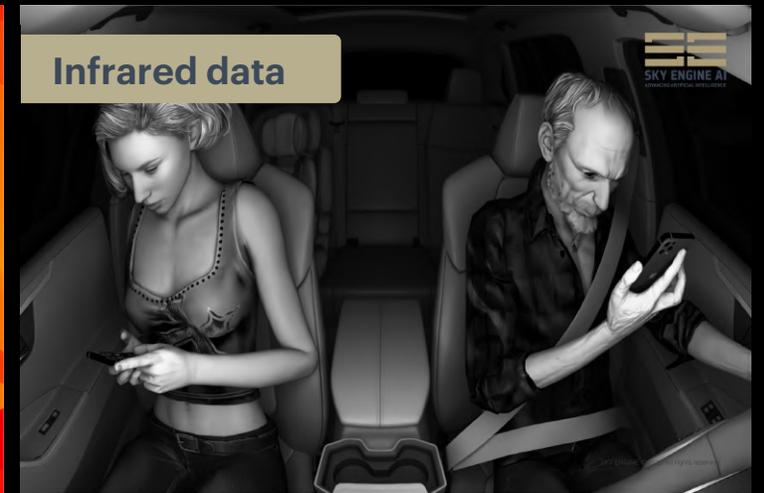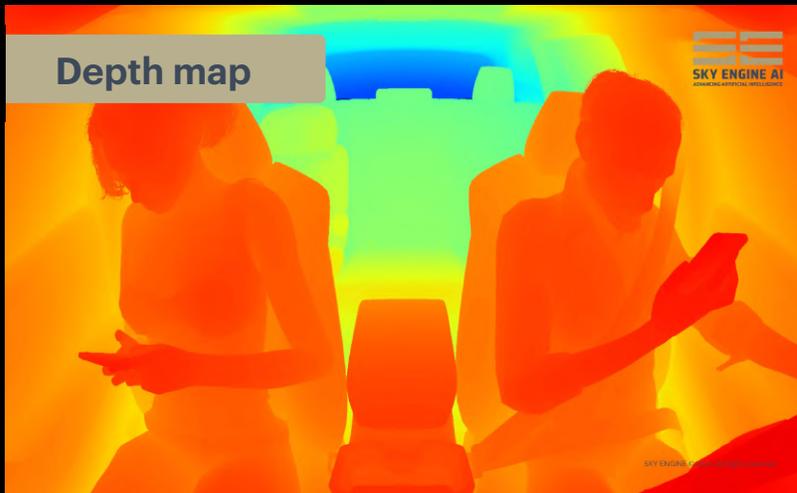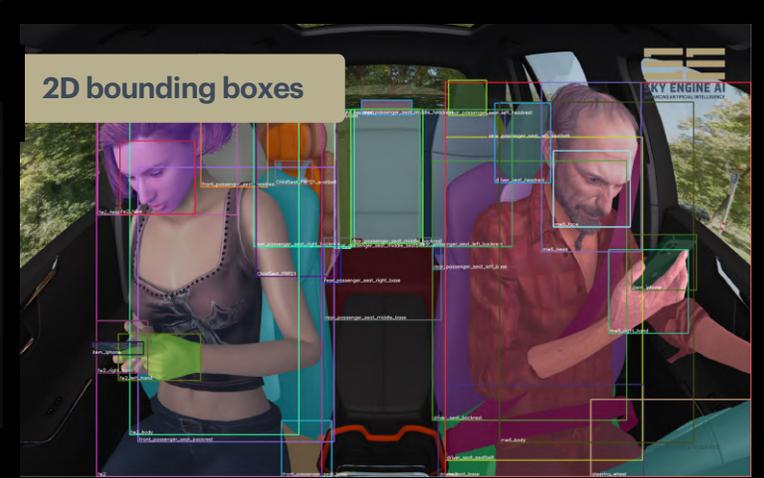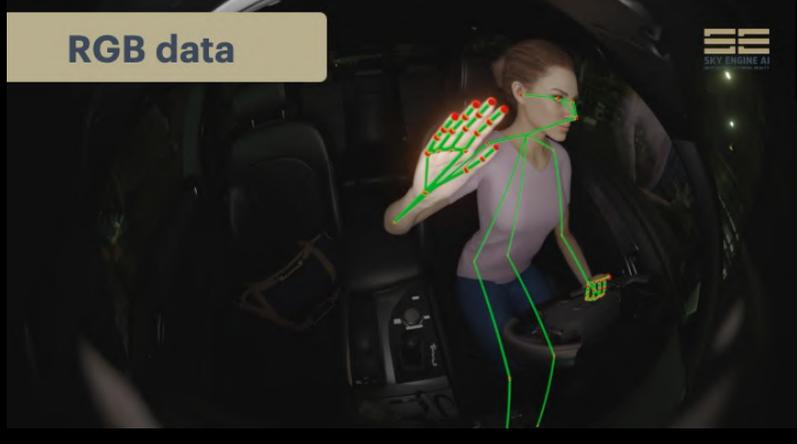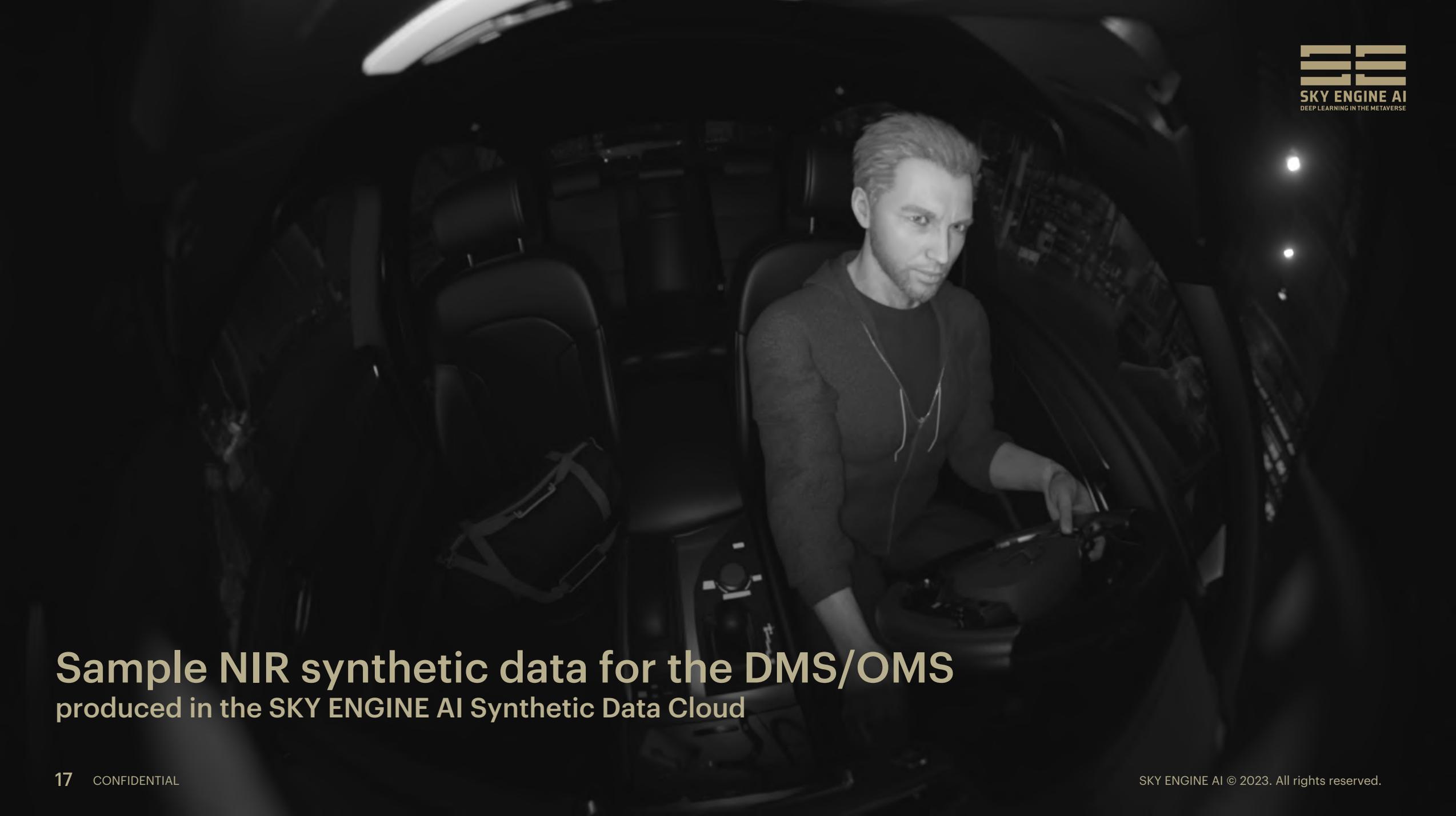
Sample NIR synthetic data for the DMS/OMS

produced in the SKY ENGINE AI Synthetic Data Cloud

SKY ENGINE AI
DEEP LEARNING IN THE METAVERSE

Solutions | In-cabin monitoring synthetic data for computer vision

The parameters that can be modified within the scene in SKY ENGINE AI cloud include following:

- Rendered image resolution and ray tracing quality.
- Scene textures resolution (full, reduced for space and time optimization).
- Scene textures parameters (car interior materials, patterns, colors).
- Outside environmental maps type.
- Environmental light intensity.
- IR point lights strength, angle and direction.
- Lens parameters: type (pinhole, fisheye, anamorphic), focal lengths, principal point, distortion coefficients (radial, tangential).
- Modality selector (visible light, near infrared).
- Camera position and orientation (like rear view mirror, console, etc.).
- Camera randomization ranges (X, Y, Z, roll, pitch, yaw).
- Shaders' parameters (clearcoat level, sheen level, subsurface scattering level, light iterations, antialiasing level, and more).
- Post Processing (tone mapping, AI denoising, blur / motion blur, light glow).
- Occupancy probabilities on each seat (adults, children on child seats, empty child seats, big items, piles of items, empty seats). For items, also between seats.
- Driver and occupant action probabilities (drinking, eating, smoking, driving, idle, looking around, grabbing an object from another seat etc.).
- Seatbelt status (fastened/unfastened, incorrectly fastened) probabilities.

Note: All parameters can be defined as the rules for randomization (range, predefined distribution, custom probabilistic distribution).

SKY ENGINE AI Synthetic Data Cloud offers efficient solution for simulating data in several modalities including ground truth generation of any kind, so that the computer vision developers can quickly build their data stack and seamlessly train the AI models covering numerous situations and corner cases in the dataset.

SKY ENGINE AI
DEEP LEARNING IN THE METAVERSE

Robotics
Synthetic Data for Factory of the Future

SKY ENGINE AI

DEEP LEARNING IN VIRTUAL REALITY
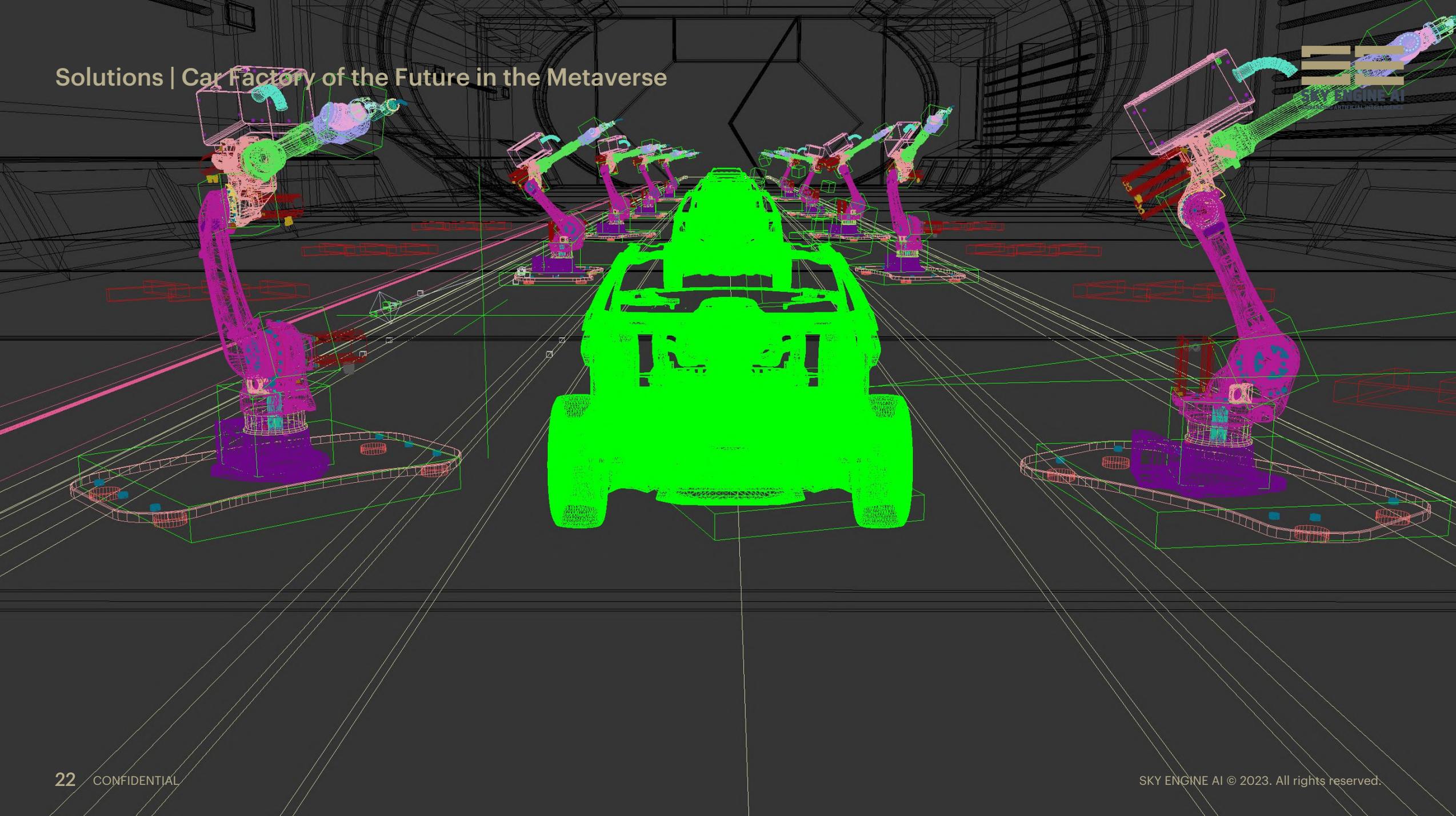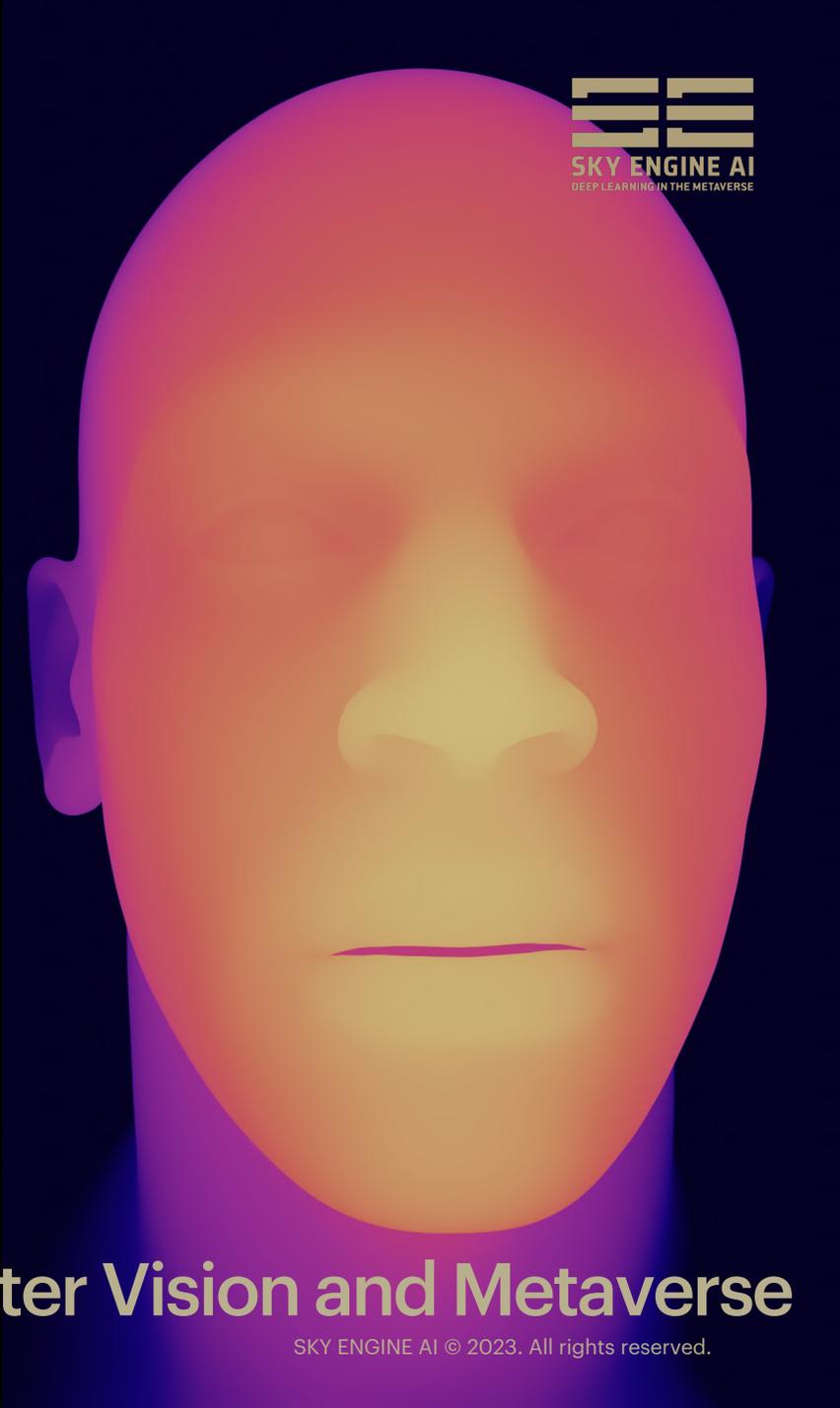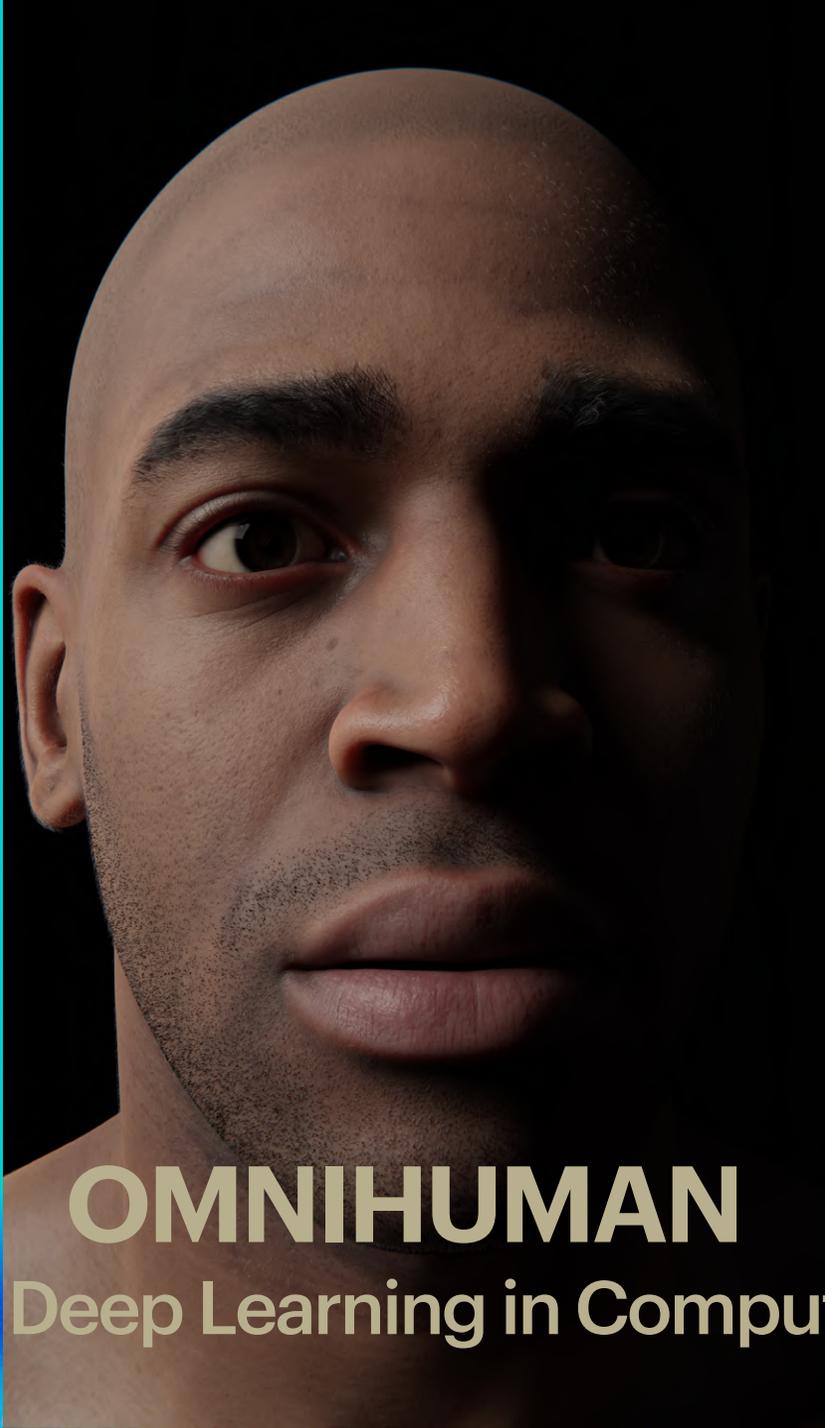
OMNIHUMAN

Synthetic human data for Deep Learning in Computer Vision and Metaverse

SKY ENGINE AI
DEEP LEARNING IN THE METAVERSE

Data Engine for
AI models training using Synthetic Data with Generative AI and Self-supervised Learning

SKY ENGINE AI software creates virtual and generative world, where objects and events can be simulated in a variety of configurations and environmental conditions and enables parallel AI models training
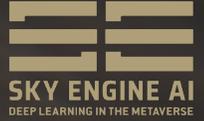
Facial expressions according to facial action coding system (FACS)
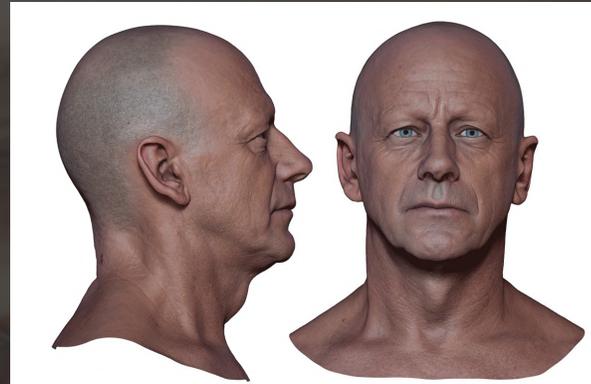
Ultra high quality data

Generative and morphable geometries

Advanced skin properties

Generative skin

High quality, multi-layer rendering & subsurface scattering

Generative ageing

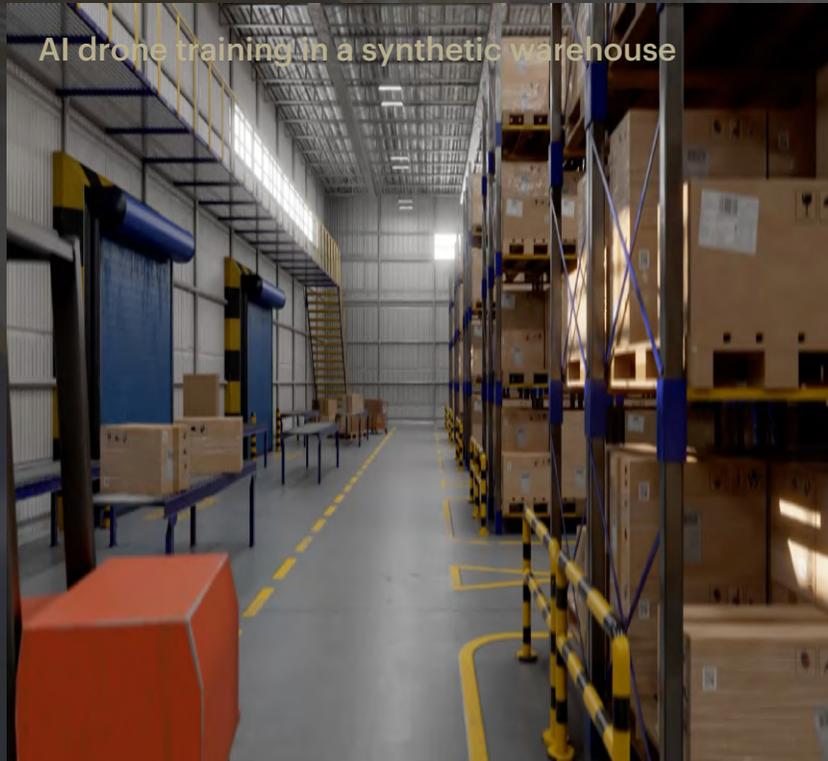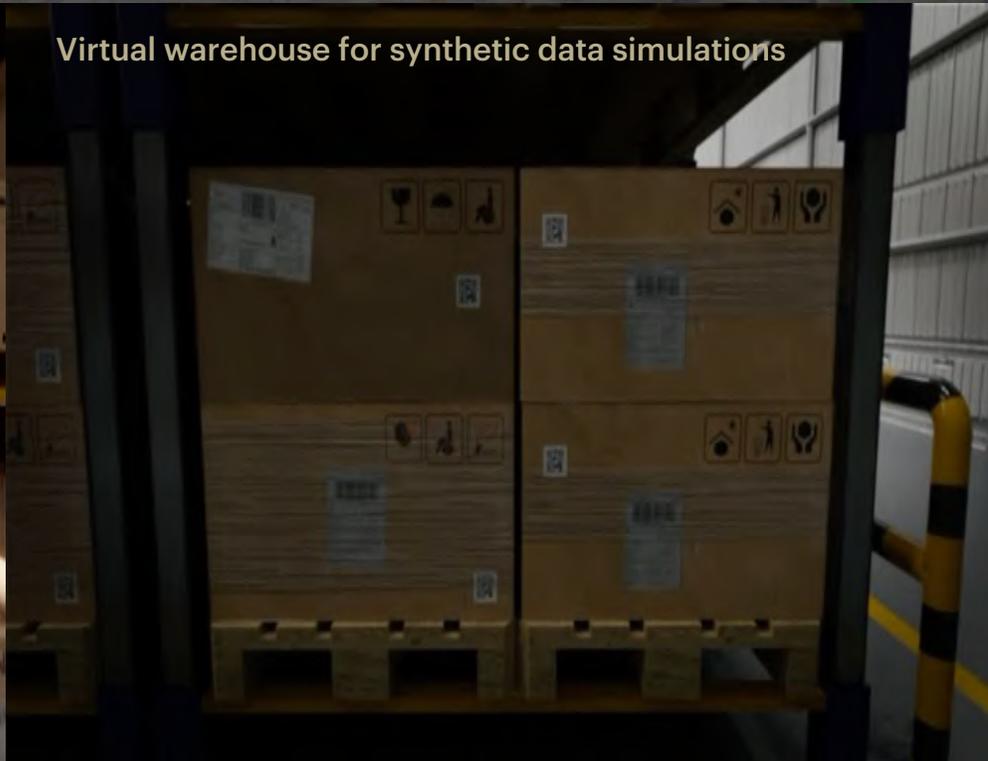3D keypoints and motion capture support

Generative ageing

Warehousing
Unlocking accurate solutions

Solutions | Warehousing & inventorying made easier with Synthetic Data

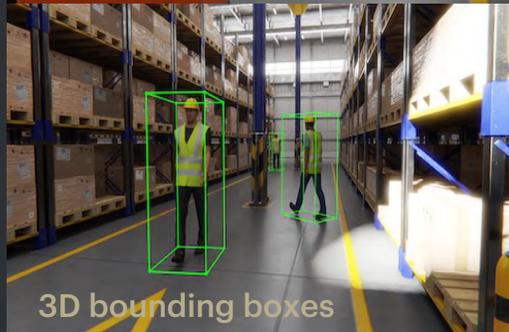AI drone training in a synthetic warehouse

Virtual warehouse for synthetic data simulations

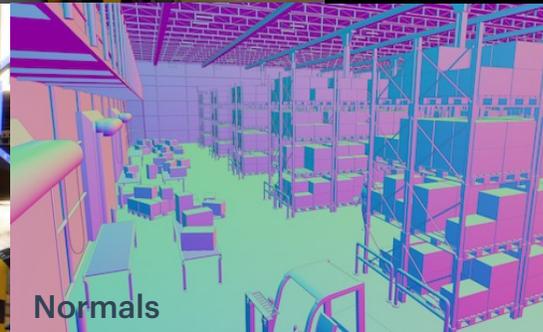AI-driven recognition of barcodes, QR-codes, labels, and 3D objects

Synthetic ground truths: 3D or 2D bounding boxes, semantic segmentation, depth map, normals, instance segmentation

Robots, drones can be effectively trained and tested in a virtual warehouse prior real-world deployment

Any camera characteristics can be reproduced and simulated (RGB, IR, etc.)

3D bounding boxes

Normals

Depth maps

3D instance segmentation

Parallel stereo camera system rendering

Off-axis stereo camera system with a distance to convergence plane set to 2m

AI-driven recognition of barcodes, QR-codes, labels, and 3D objects

Synthetic ground truths: 3D or 2D bounding boxes, semantic segmentation, depth map, normals, instance segmentation

Robots, drones can be effectively trained and tested in a virtual warehouse prior real-world deployment
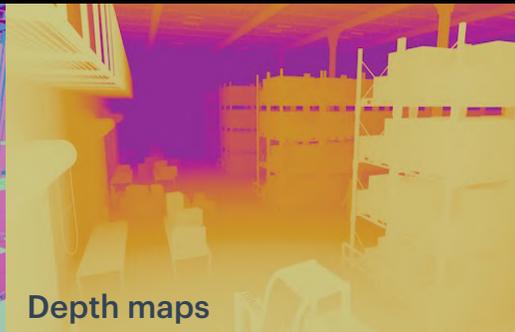
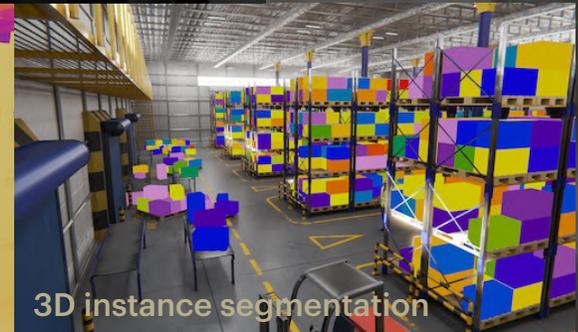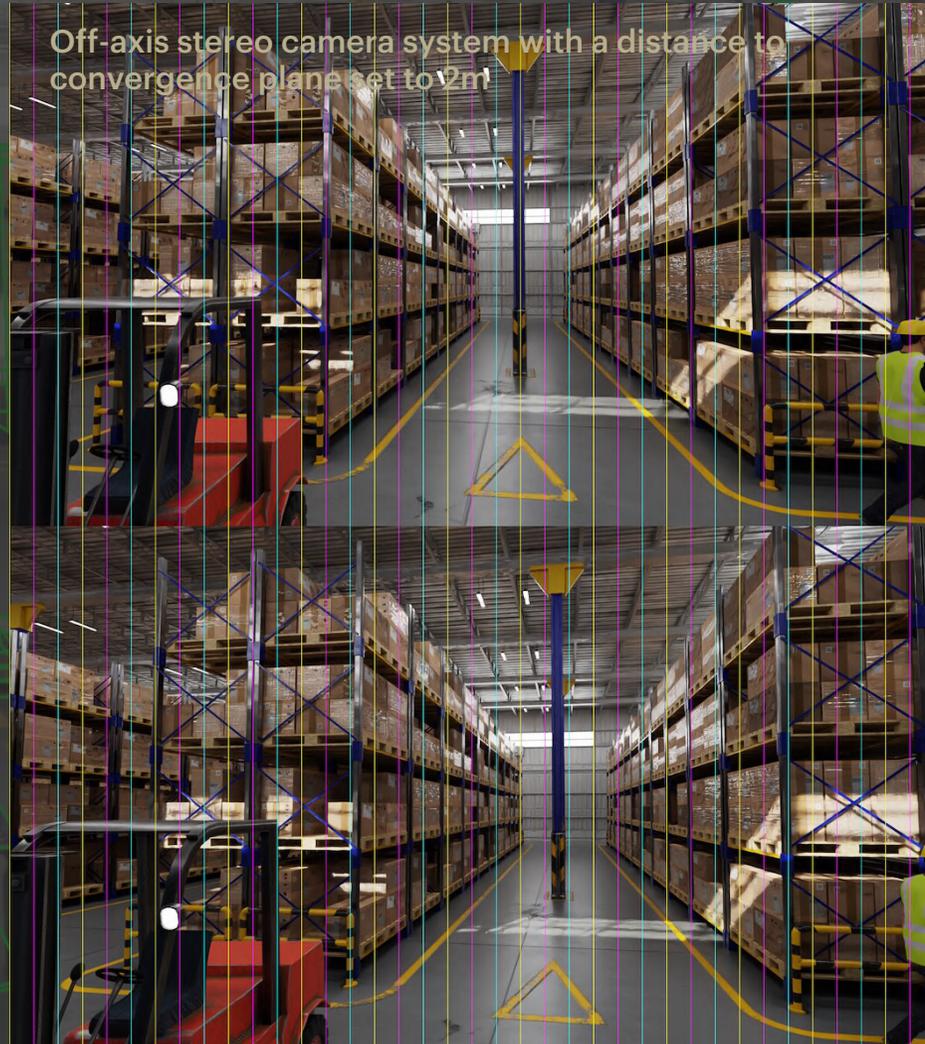Any camera characteristics can be reproduced and simulated (RGB, IR, etc.)

Solutions | Synthetic Indoor Scenes Data

AI-driven recognition of barcodes, QR-codes, labels, and 3D objects

Synthetic ground truths: 3D or 2D bounding boxes, semantic segmentation, depth map, normals, instance segmentation

Robots, drones can be effectively trained and tested in a virtual warehouse prior real-world deployment

Any camera characteristics can be reproduced and simulated (RGB, IR, etc.)

SKY ENGINE AI
DEEP LEARNING IN THE METAVERSE

Outdoor Synthetic Scenes
Vision AI Robots Training

Synthetic outdoor environment for robots vision AI training

Synthetic ground truths: 3D or 2D bounding boxes, semantic segmentation, depth map, normals, instance segmentation

Robots, drones can be effectively trained and tested in a virtual environment prior to real-world deployment

Any camera characteristics can be reproduced and simulated (RGB, IR, etc.)

SKY ENGINE AI
DEEP LEARNING IN THE METAVERSE

Synthetic outdoor environment for robots vision AI training

Synthetic ground truths: 3D or 2D bounding boxes, semantic segmentation, depth map, normals, instance segmentation

Robots, drones can be effectively trained and tested in a virtual environment prior to real-world deployment

Any camera characteristics can be reproduced and simulated (RGB, IR, etc.)

Synthetic outdoor environment for robots vision AI training

Synthetic ground truths: 3D or 2D bounding boxes, semantic segmentation, depth map, normals, instance segmentation

Robots, drones can be effectively trained and tested in a virtual environment prior to real-world deployment

Any camera characteristics can be reproduced and simulated (RGB, IR, etc.)

SKY ENGINE AI
DEEP LEARNING IN THE METAVERSE

Synthetic outdoor environment for robots vision AI training

Synthetic ground truths: 3D or 2D bounding boxes, semantic segmentation, depth map, normals, instance segmentation

Robots, drones can be effectively trained and tested in a virtual environment prior to real-world deployment

Any camera characteristics can be reproduced and simulated (RGB, IR, etc.)

SKY ENGINE AI
DEEP LEARNING IN THE METAVERSE

Synthetic outdoor environment for robots vision AI training

Synthetic ground truths: 3D or 2D bounding boxes, semantic segmentation, depth map, normals, instance segmentation

Robots, drones can be effectively trained and tested in a virtual environment prior to real-world deployment

Any camera characteristics can be reproduced and simulated (RGB, IR, etc.)

SKY ENGINE AI
DEEP LEARNING IN THE METAVERSE

Synthetic outdoor environment for robots vision AI training

Synthetic ground truths: 3D or 2D bounding boxes, semantic segmentation, depth map, normals, instance segmentation

Robots, drones can be effectively trained and tested in a virtual environment prior to real-world deployment

Any camera characteristics can be reproduced and simulated (RGB, IR, etc.)

SKY ENGINE AI
DEEP LEARNING IN THE METAVERSE

Synthetic outdoor environment for robots vision AI training

Synthetic ground truths: 3D or 2D bounding boxes, semantic segmentation, depth map, normals, instance segmentation

Robots, drones can be effectively trained and tested in a virtual environment prior to real-world deployment

Any camera characteristics can be reproduced and simulated (RGB, IR, etc.)

Maritime
Synthetic boats & ocean

Navy
Warships in context

SKY ENGINE AI
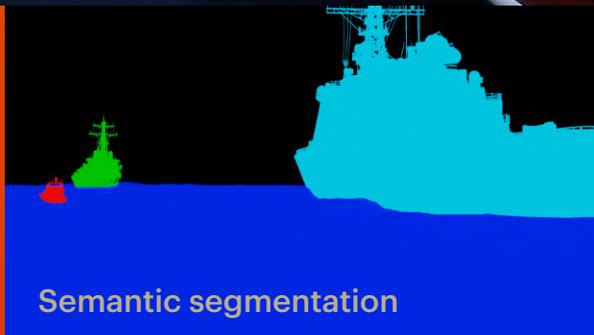DEEP LEARNING IN THE METAVERSE

Homeland Security
Synthetic rhibs, vessels

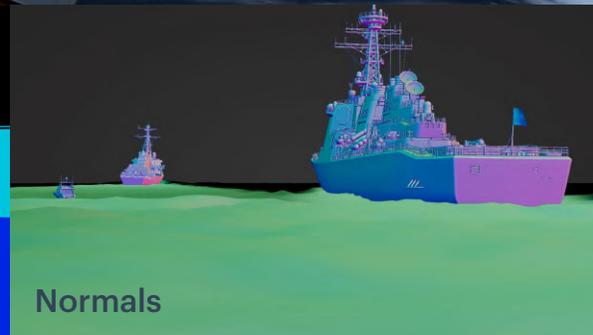Homeland Security
Synthetic rhibs, vessels

Synthetic warships, boats, in context for edge cases simulation in the AI models training

Depth maps

Semantic segmentation

Normals

Synthetic warships and virtual context for AI models training in unusual situations

Synthetic ground truths: 3D or 2D bounding boxes, semantic segmentation, depth map, normals, instance segmentation

Automated docking and navigation AI training data

Edge cases simulations for combat and operations

Key Differentiators – Unfair Advantages

╬ Multispectral ray tracing, Physically-based rendering engine (developed from scratch) with accurate simulation of physics of visible light, available as well **for infrared sensors, radars, lidars, UWB sensors** and more.

╬ Enables efficient training of neural networks for very wide group of use cases including (but not limited to) deep learning:
- Operating on **X-rays** (in medicine, or security),
- For **signal analysis** and **pattern/objects detection on indoor radar data,**
- For **data fusion** and **object detection and recognition** of multi-sensor data, like **satellite images combined with lidar and radar** measurements from the plane to **enable underground objects detection.**

SKY ENGINE AI is easily extendable and scalable with new modalities (like sonars or other types of sensors).

╬ Provides tools which can learn the distribution of key parameters of the scene of interest in an unsupervised way from a very small sample of unlabelled data. Moreover, our engine is equipped with the functionality enabling the understanding of the characteristics of target sensor (**domain adaptation**).

╬ **Automatic balancing of the dataset** by thorough analysis of model performance during the training stage by on-the-fly adjustments of certain scene parameters.

╬ SKY ENGINE is **deterministic and designed for data science engineers** with lots of modules for parameter randomisations, distribution sampling and learning and supports **generative textures and geometries** and **multi-GPU and multi-node network environments.**

╬ SKY ENGINE AI does not require sophisticated rendering and imaging knowledge, so the entry barrier is very low and it has a **Python API** including a large number of helpers to quickly build and configure the environment by Data Scientists, Developers and Software Engineers.

Synthetic Data Cloud
for Deep Learning
in Vision AI and Metaverse
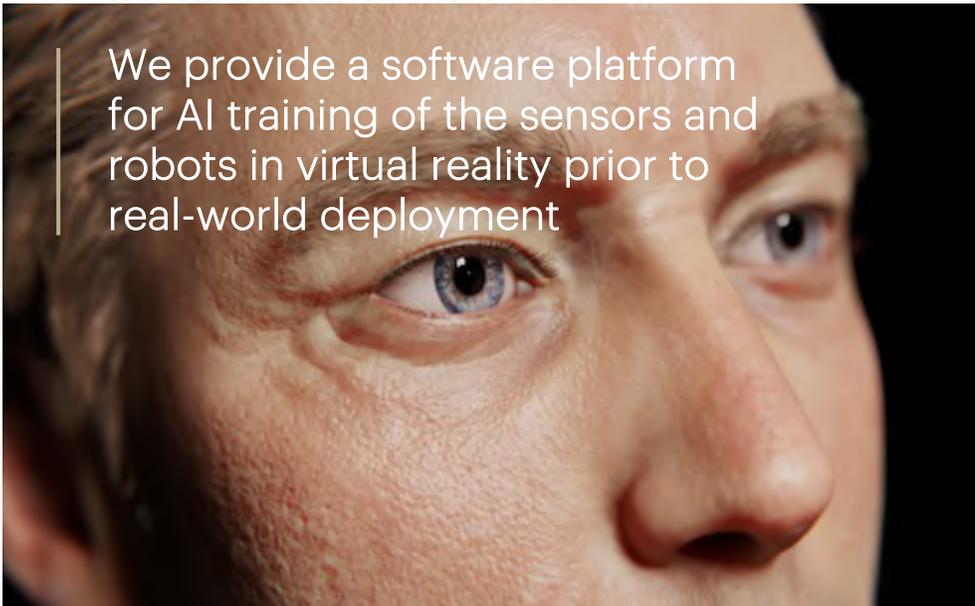
> We provide a software platform for AI training of the sensors and robots in virtual reality prior to real-world deployment

Omnihuman created in the SKY ENGINE AI Synthetic Data Cloud

Up to 50% more accurate computer vision
Training AI models with synthetic data and advanced domain adaptation as testing digital twins in virtual reality greatly improves model performance.

Up to 40x faster AI model development
Accelerate development of computer vision AI models by shortening training iteration cycles with full-stack synthetic data simulation & deep learning workflow.

Up to 85% cost savings
AI business transformation can be reality when generating massive synthetic training datasets at fraction of real-world data collection and labelling cost.

Balance data to reduce bias
Large chunks of real-world training images are no longer required reducing data acquisition costs as synthetic data is diverse and covers edge-cases.

Augment limited datasets
Synthetic data, digital twins come with labels, annotated instances and ground truths, reducing humans work.

Making sensitive data accessible
Build trust with your customers and community when creating anonymized synthetic datasets and work safely with data while preserving privacy.

SKY ENGINE AI Business model – **Synthetic Data Cloud**

Accelerate and unleash the potential of the AI models for Computer Vision at scale using full stack Synthetic Data Cloud with Deep Learning in the Metaverse that enables massive and balanced training data for adaptive AI models training.

SYNTHETIC DATA CLOUD GET USAGE-BASED SAAS

Create virtual environments, simulate and generate image and video datasets, and train AI models highly performant in reality.

Synthetic Data Cloud for Deep Learning in the Metaverse

- Synthetic data multimodality simulator and image renderer with parallel AI training
- Garden of computer vision deep neural network architectures
- Library of pre-trained AI models and domain adaptation algorithms
- Purchase option for professional services, research & assets

SYNTHETIC DATA GET CONTENT

Our synthetic data cloud will enable production of high quality datasets for deep learning in vision AI and industrial metaverse.

Simulated Multispectral Imagery Synthetic Data

- Multimodality data physically-simulated in the SKY ENGINE AI Synthetic Data Cloud
- Balanced and perfectly labelled datasets with tailored data generation
- High quality synthetic data for computer vision AI tasks

METAVERSE GET BLUEPRINTS

Our data science and simulation experts will customize a pre-configured metaverse for your industry.

AI, Synthetic Data and Computer Vision tools to build the Metaverse

- Industry-domain specific generative scenes and assets for data simulation
- Pre-configured sensors and render scenarios
- Pre-trained and pre-configured AI models

Customer Requirements – subscription Enterprise model

1. Number of Users: **How many to start? How many at ramp up?**

2. Time slot: **Hours per day per User**

3. Cloud server location preference: **Physical server location**

4. Serverless features: **RGB modality simulator, IR, X-ray, Radars, etc.**

5. Blueprint scene: **User-created or SKY ENGINE AI-ready**

SKY ENGINE AI

THANK YOU & TAKE THE NEXT STEP

ANY ADDITIONAL QUESTIONS? LET US KNOW.
www.SKYENGINE.AI

Speak with a Synthetic Data Expert

Talk to one of our AI experts about what our synthetic data can do for your sector.

Request a demo

See the SKY ENGINE AI Synthetic Data Cloud in action and learn more about our applications.

Schedule a briefing

Meet the SKY ENGINE AI team in person and see what it's like to work with us.