SKY ENGINE AI

DEEP LEARNING IN THE METAVERSE

Synthetic Data Cloud

for Deep Learning in Vision AI

Synthetic data is fundamental to deploying accurate
AI solutions in a real world and the metaverses

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Synthetic marina created in SKY ENGINE AI cloud for automatic docking of boats.

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

Synthetic data is fundamental to deploying accurate
AI solutions in a real world and the metaverses

Microsoft

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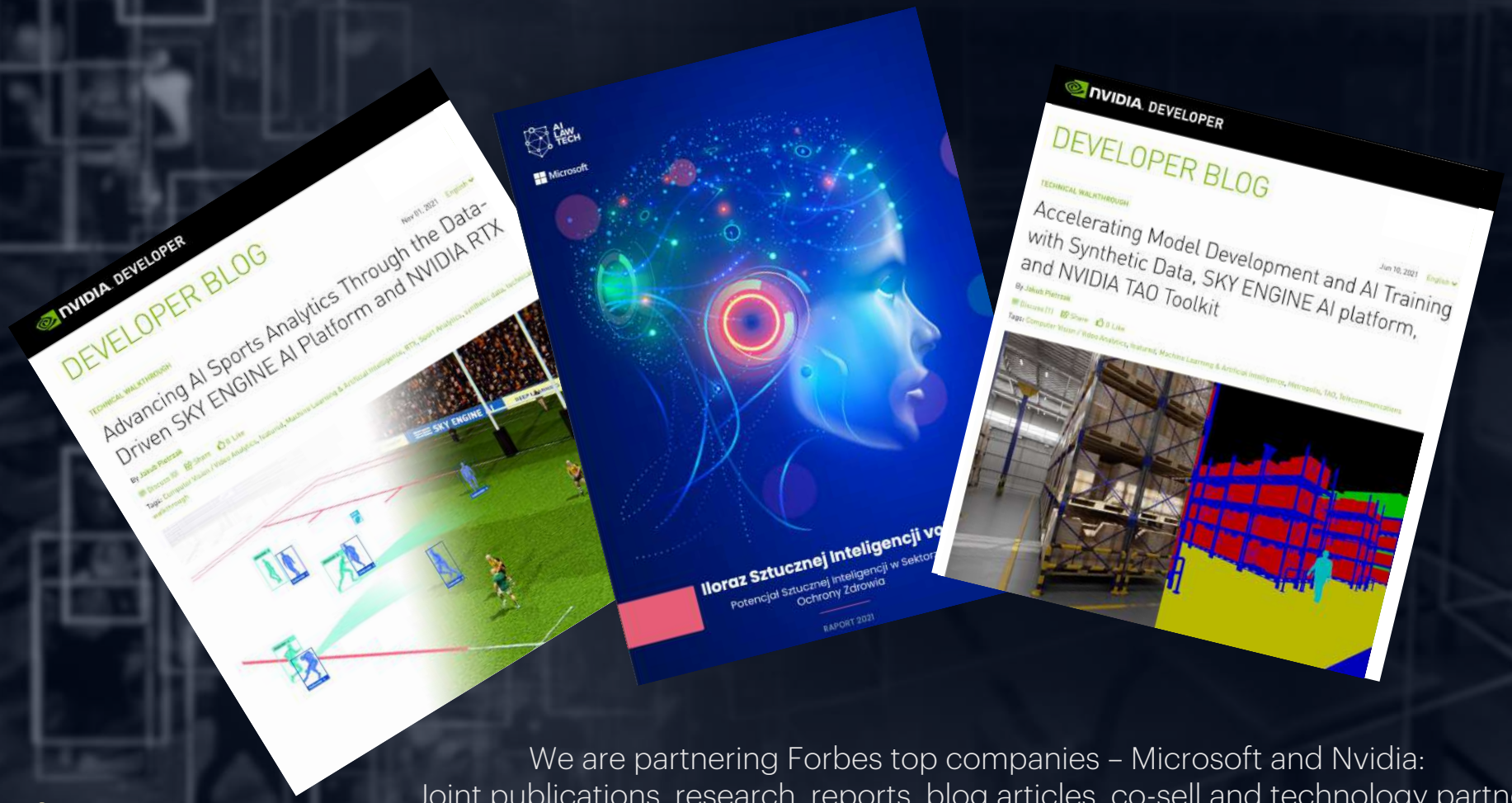
NVIDIA

Partnerships with Microsoft & Nvidia



Efrat Swissa
Ex-NVIDIA
Director of Alliances, AI

Currently Director Core ML, Google

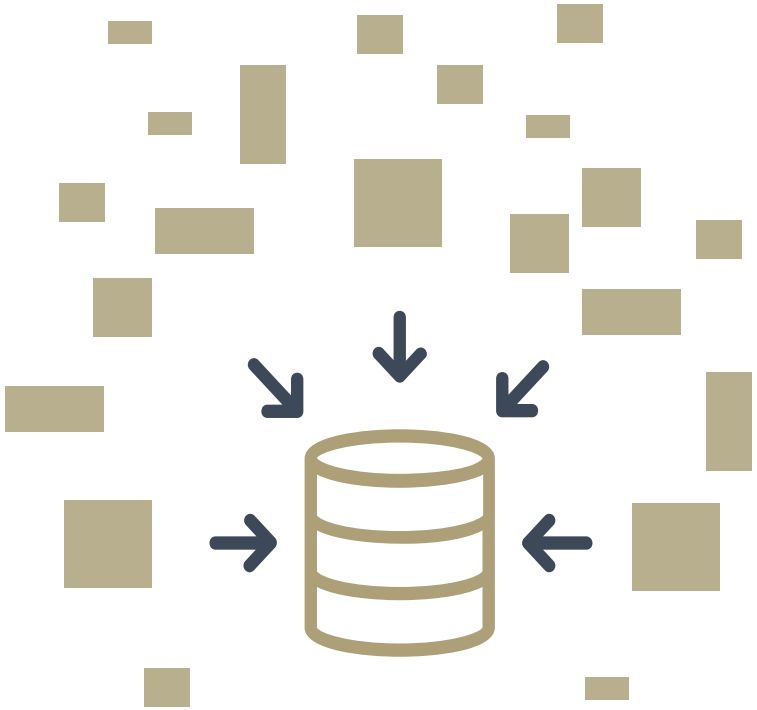
My team and I take a great pleasure in supporting SKY ENGINE AI, our collaboration is a win-win for both Nvidia and SKY ENGINE AI.

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.

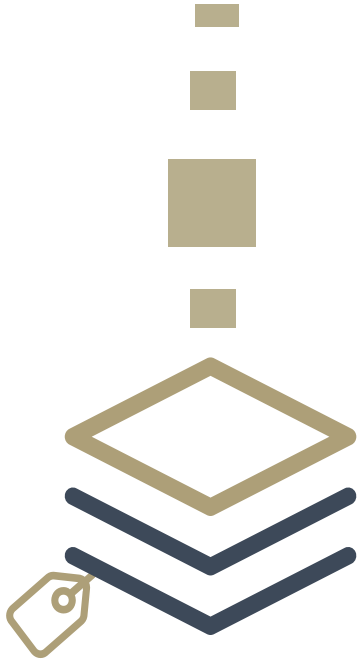
I look forward to more collaboration opportunities."

We are partnering Forbes top companies – Microsoft and Nvidia:
Joint publications, research, reports, blog articles, co-sell and technology partner

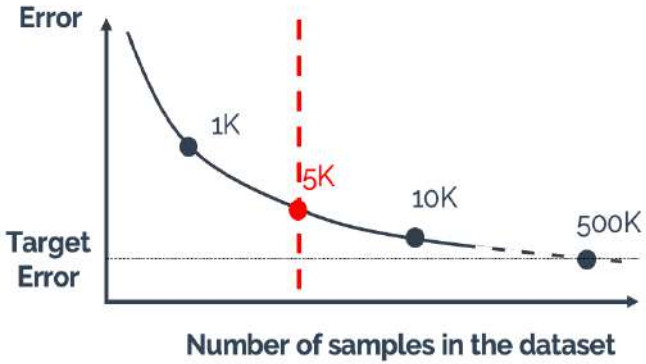
Vision AI algorithms become better and better each day. And here we go:
Now they are able to even detect the longest cow on Earth!



Data acquisition
is complicated
and costly



Manual labeling
is time consuming
(plus costly labor)



Accuracy of
AI computer vision
can be greatly improved

Scene Preview | Render Layers | Dashboard | Learn | Kernel | Documentation | User

Beauty | Mesh | Depth | Mask | Normals | Diffuse | Lighting

| Demo

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

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

Current Preview

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.

[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
```

[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.

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

[ ]:
```
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.

[ ]:
```
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
```

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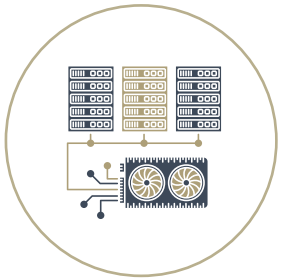
Synthetic Data Cloud
for Deep Learning in Vision AI

TECHNOLOGY

TECHNOLOGY STACK

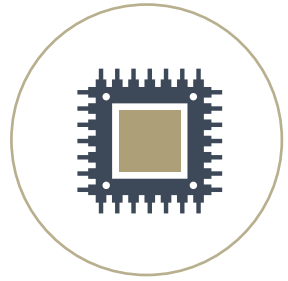


GPU simulator with sets of Physics-based rendering shaders tailored to **sensor fusion**

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

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Synthetic Data Cloud
for Deep Learning in Vision AI

SIMULATORS

GPU Simulator with Physics-based Rendering Shaders for Sensor Fusion

■ 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

Synthetic Data Cloud

for Deep Learning in Vision AI

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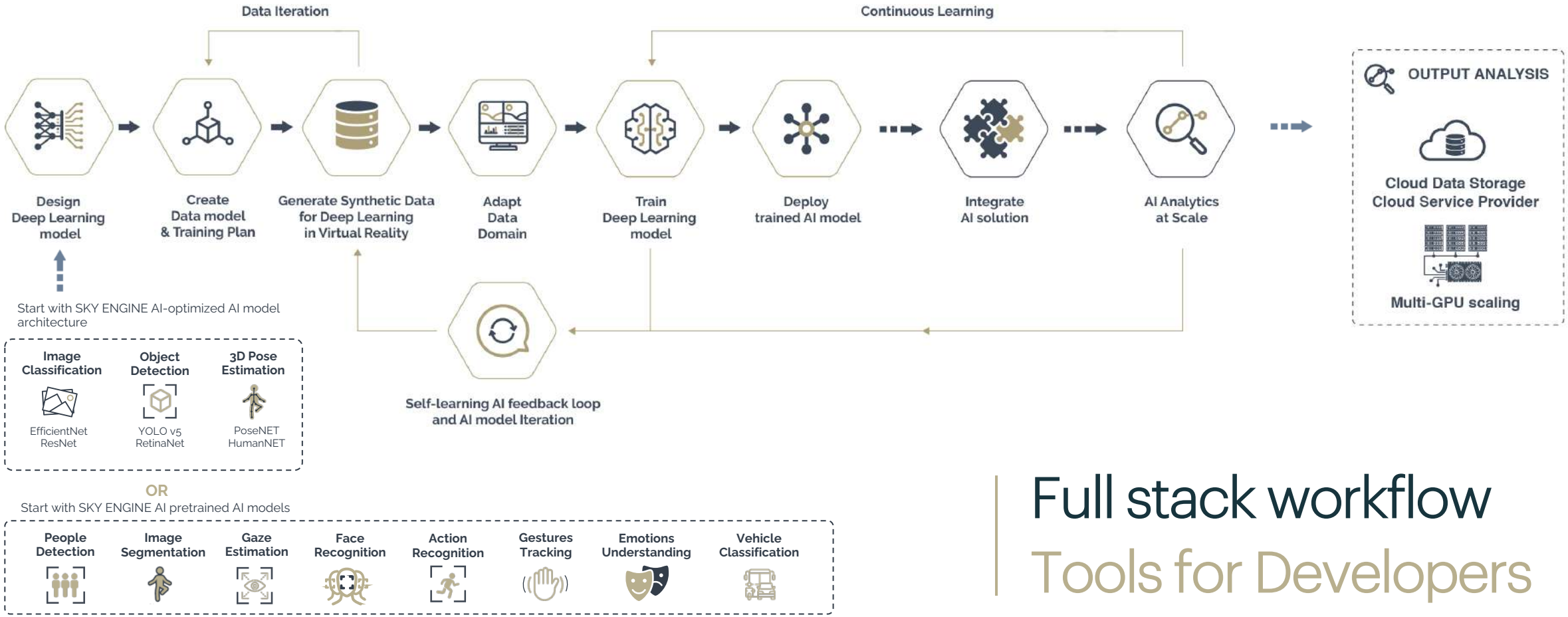
WORKFLOW



Full stack workflow
Tools for Developers

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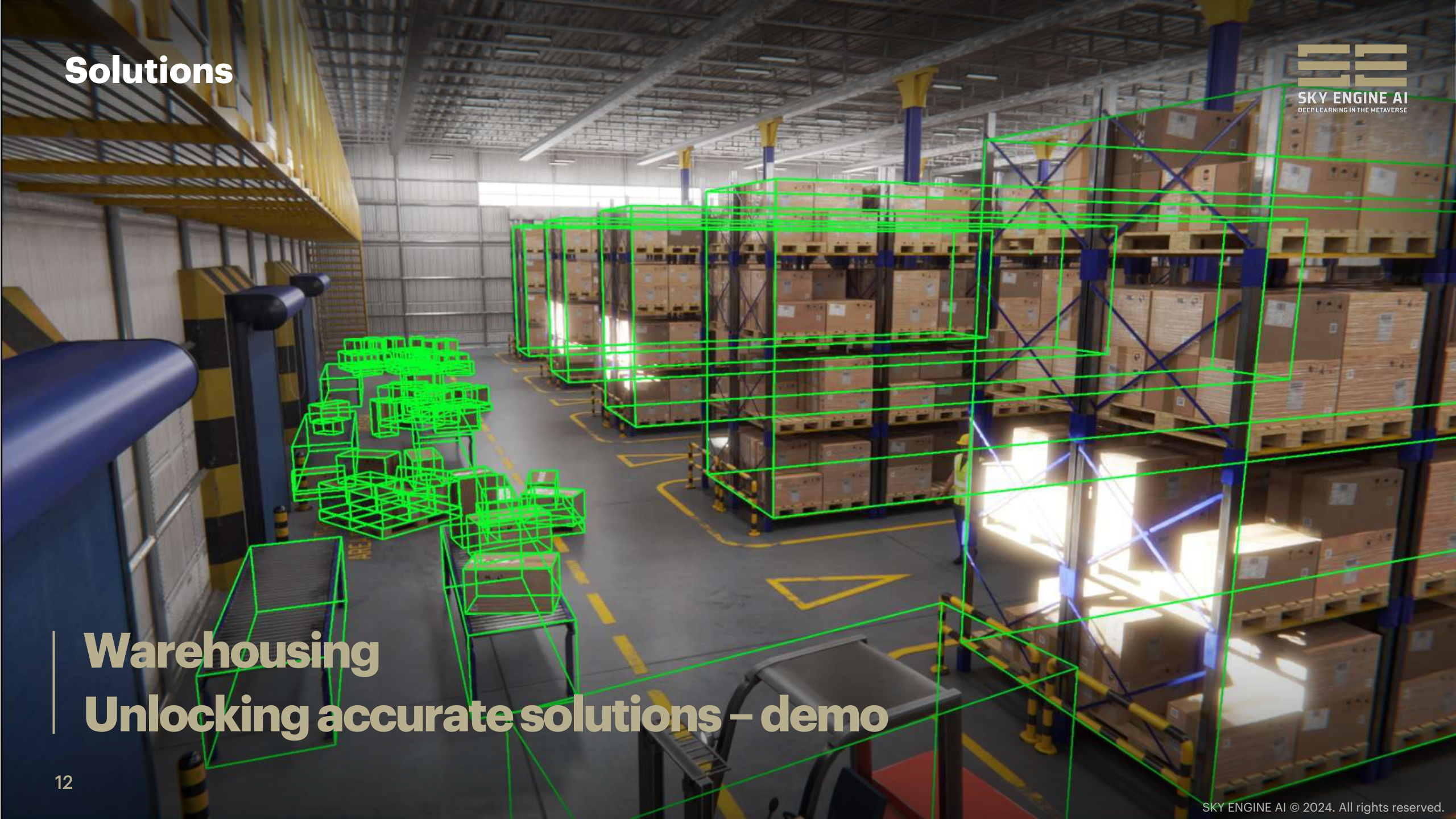

Warehousing
Unlocking accurate solutions – demo

Procedural warehouse
Scene definition

GEOMETRY

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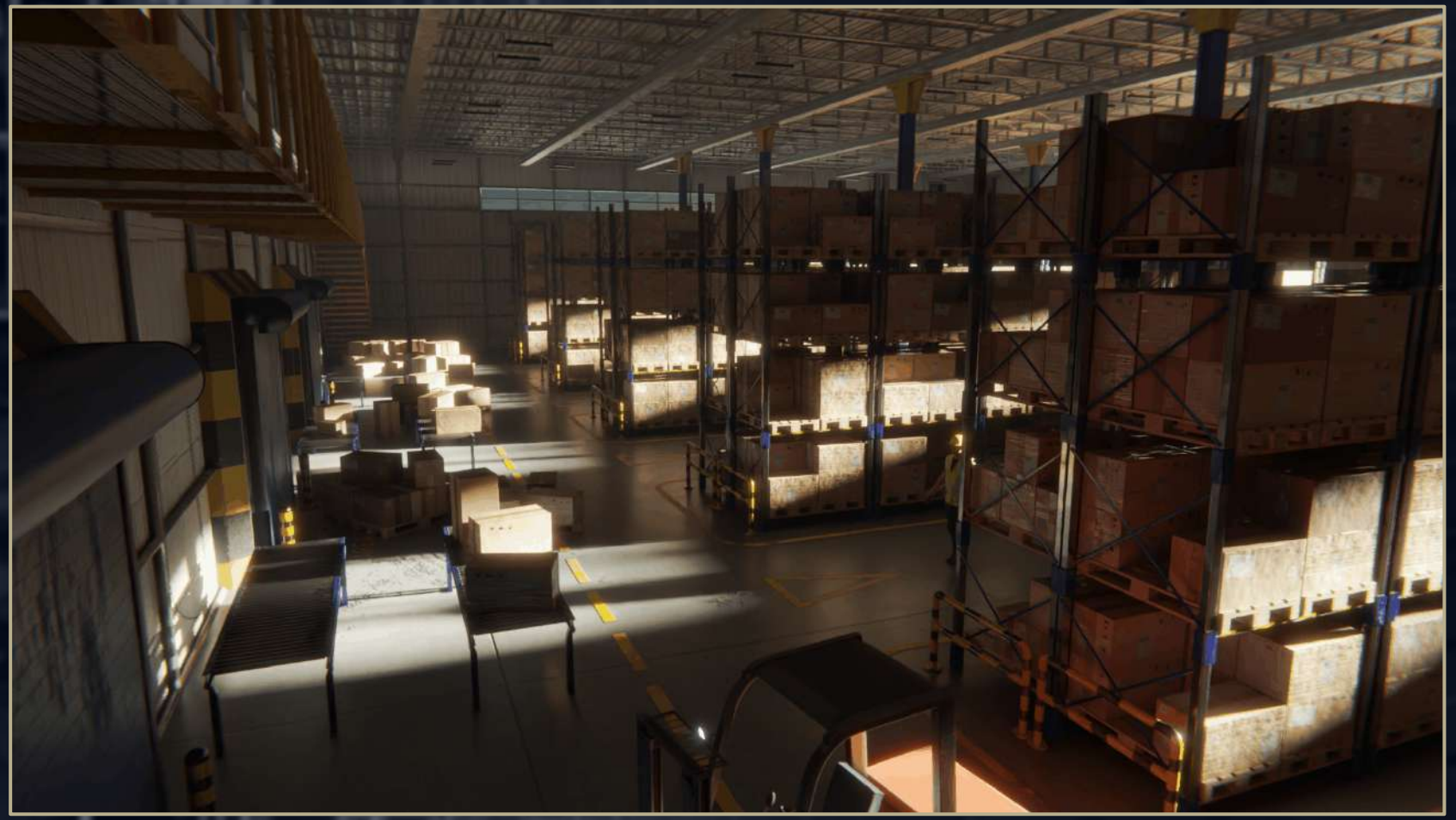
Geometry

Generative definition of the environment

- Probability maps for object position randomisation
- Objects' trajectories
- Configurable, probabilistic layout definition
- Parametrised materials for objects and elements of the environment

Procedural warehouse
Scene definition

LIGHTS



Lights

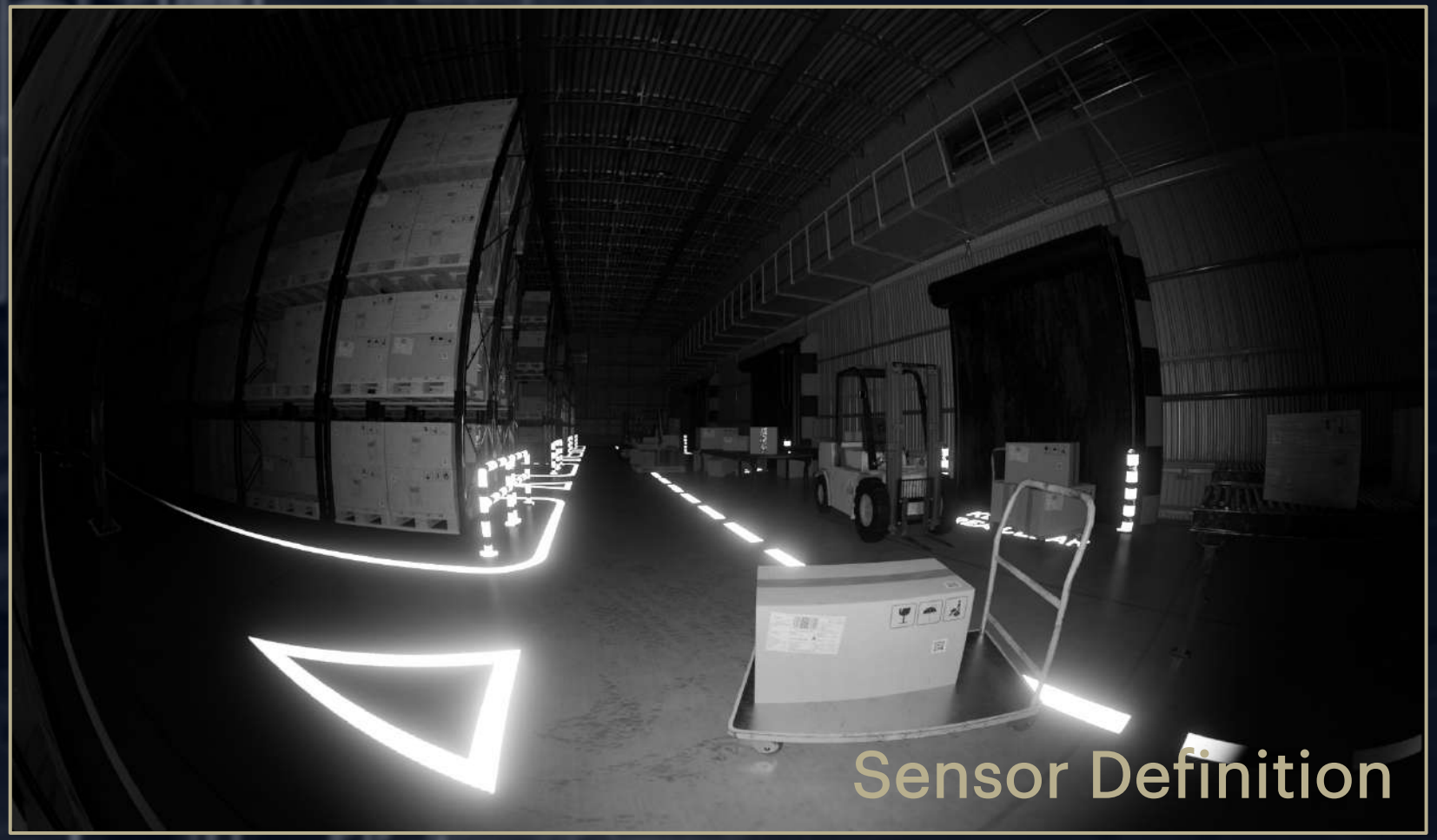
Generative definition of light arrangement

- HDR environmental sampling
- Point lights and aerial lights randomised from probabilistic distributions
- Volumetric shaders for dust or smoke
- AI optimised ray tracing

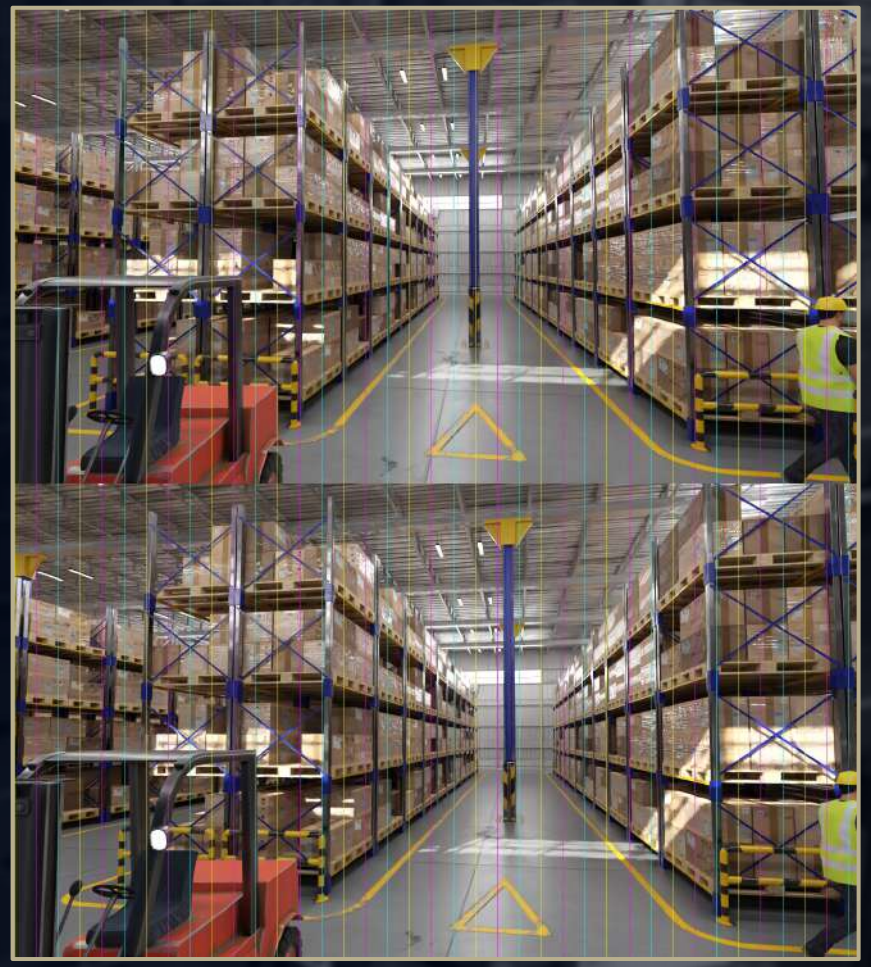
Procedural warehouse

Scene definition

SENSOR DEFINITION



Infrared camera with light source



Stereoscopic & off-axis camera systems support

Procedural warehouse

Scene definition

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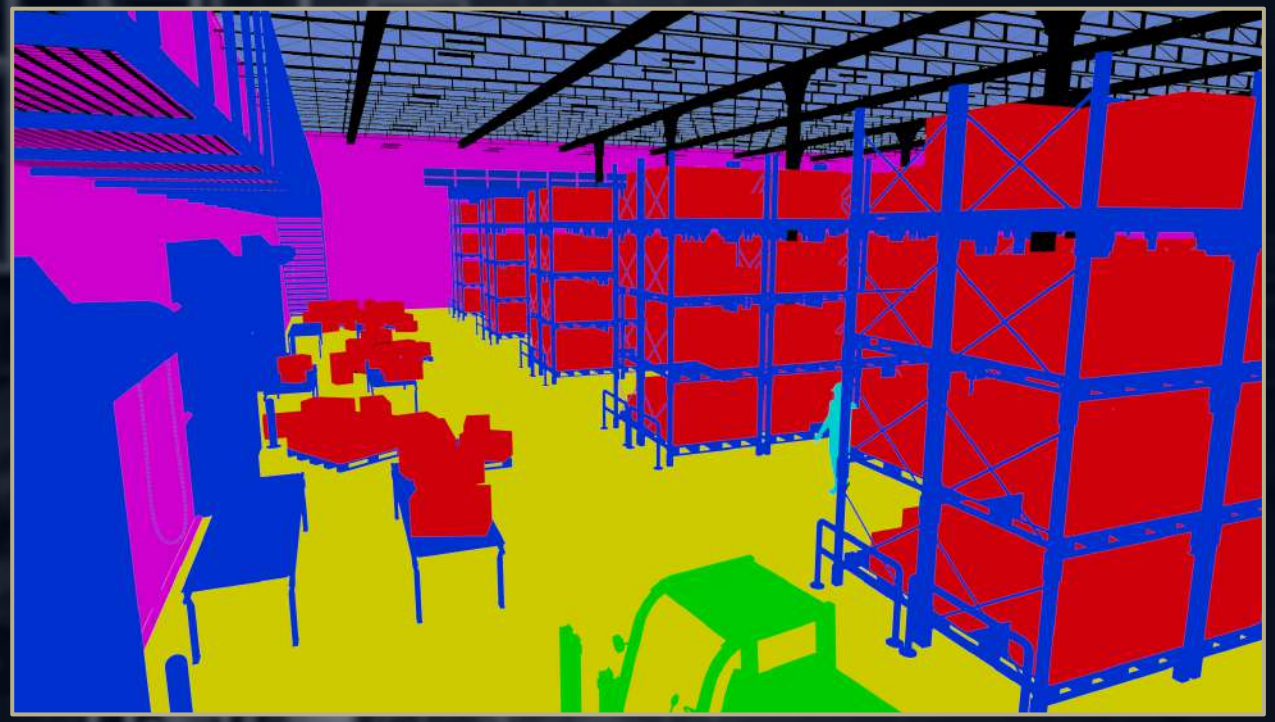
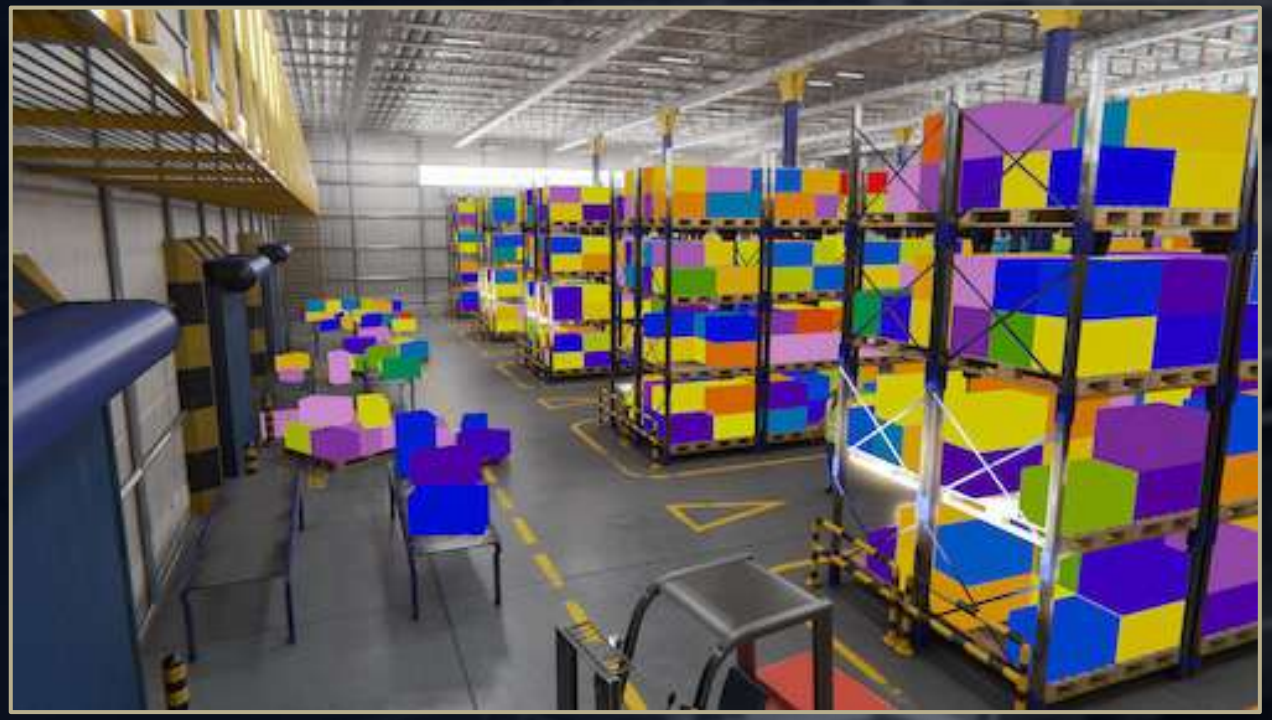
Instance and semantic segmentatio

Ground Truth



Semantic segmentation map



Instance segmentation map

Instance and semantic segmentation

Procedural warehouse
Scene definition

GEOMETRY REASONING

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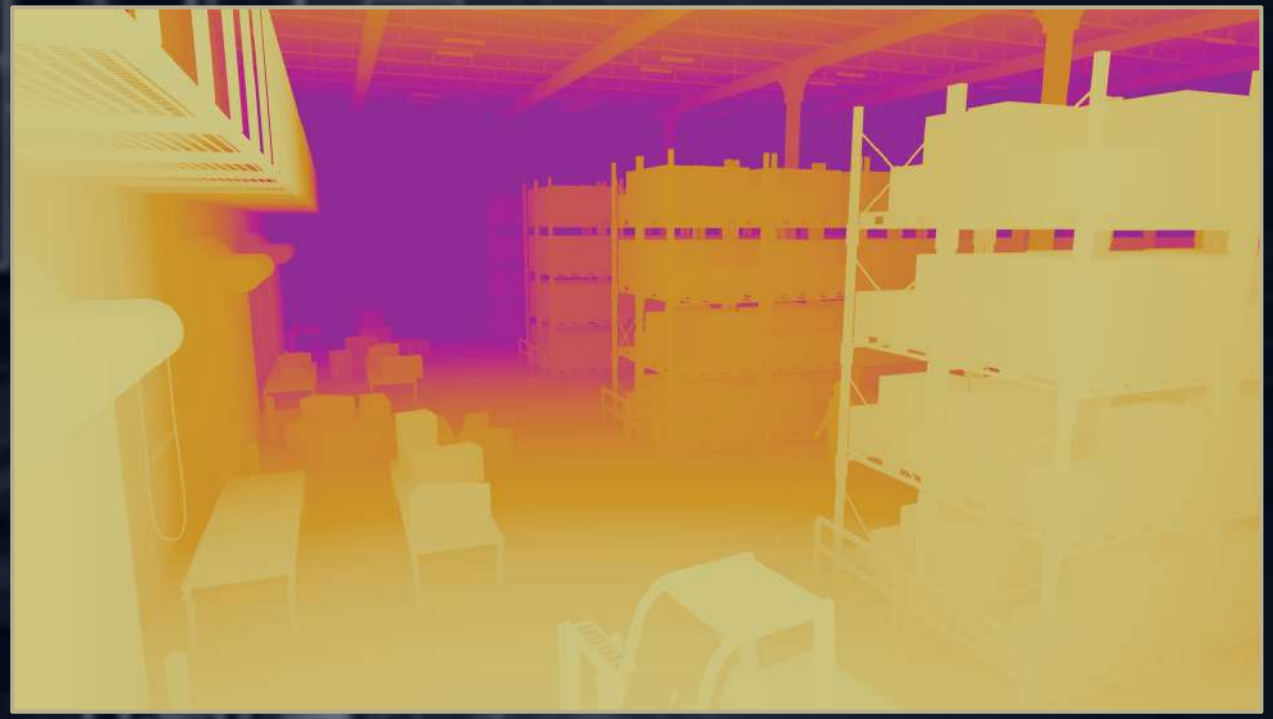
Geometry reasoning



Depth map

3D bounding boxes

GEOMETRY REASONING

Procedural warehouse
Scene definition

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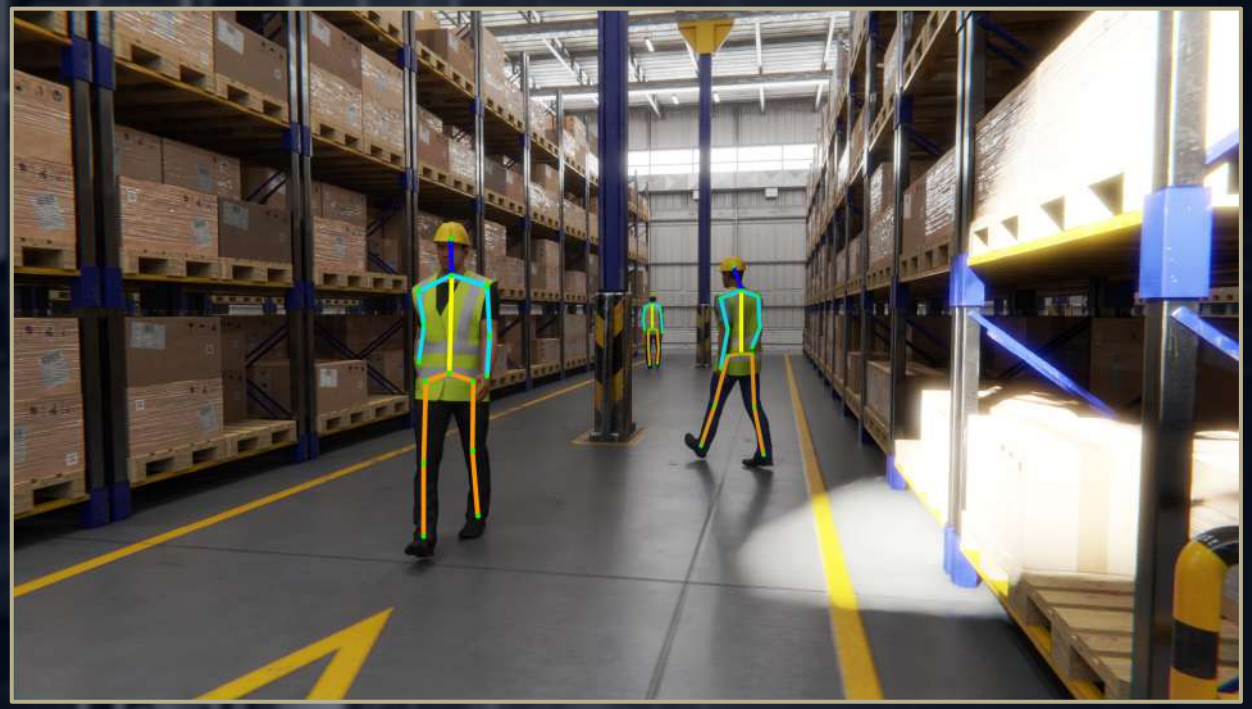
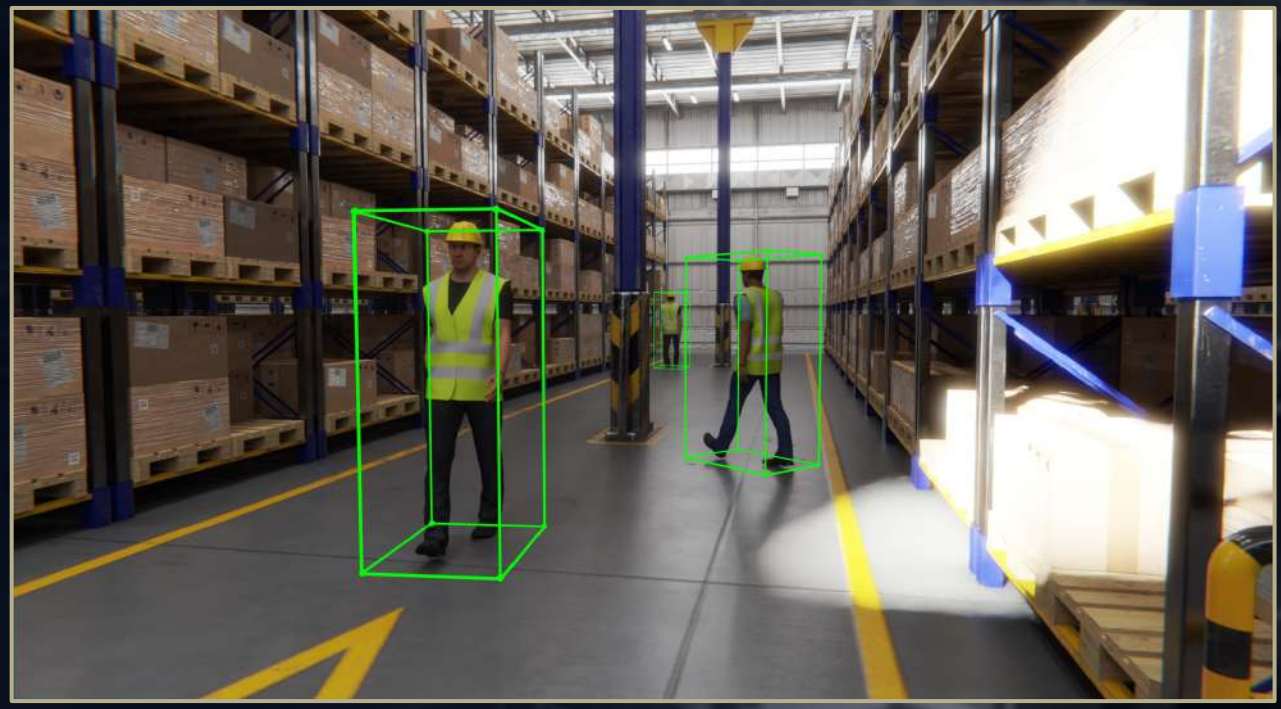
Results



Real motion capture recordings attached to human avatars, 3D key point system



3D bounding boxes with visibility scores

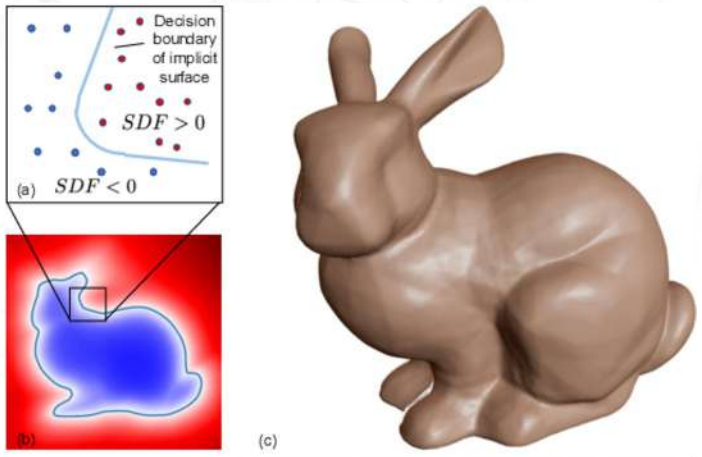
3D Generative AI
for Medical Imaging

Implicit surfaces - Signed Distance Functions

A signed distance function is a continuous function that, for a given spatial point, outputs the point's distance to the closest surface, whose sign encodes whether the point is inside (negative) or outside (positive) of the watertight surface:

$$\mathbf{SDF}(x) = s : x \in \mathbb{R}^3, s \in \mathbb{R}$$

The underlying surface is implicitly represented by the isosurface of SDF(.) = 0. A view of this implicit surface can be rendered through raycasting or rasterization of a mesh obtained with, for example, Marching Cubes.



Example of rendering parameterized SDF 3D representation with ray marching

Reference: https://www.shadertoy.com/view/ld3Gz2

Fig. 3 - (a) depiction of the underlying implicit surface (b) 2D cross-section of the signed distance field, (c) rendered 3D surface recovered from SDF = 0 [9]

Solution overview

- Discrete Latent Space

Similar to IM-NET we used voxelized geometry representation as input to the 3D CNN feature generator - encoder (see Figure below) and the standard for AE or VQ-VAE approaches - the reconstruction decoder - was substituted with implicit decoder (the decoder aimed to approximate implicit function). The main differences to the IM-NET are:

We used TSDF (Truncated Signed Distance Field) as a voxelized form of the 3D shapes in train dataset as an input to the encoder

Thereafter, the implicit function we have learned is Signed Distance Function VQ-VAE or VQ-VAE2 was used to obtain discrete latent space

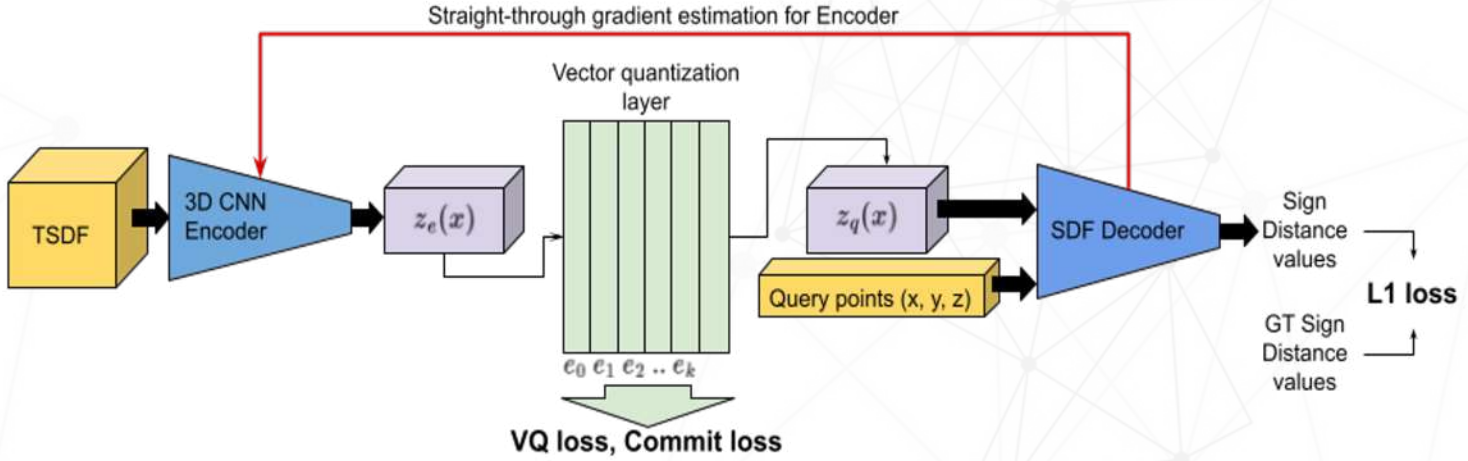


Fig. 10 - Solution overview on stage 1 - training discrete latent space.

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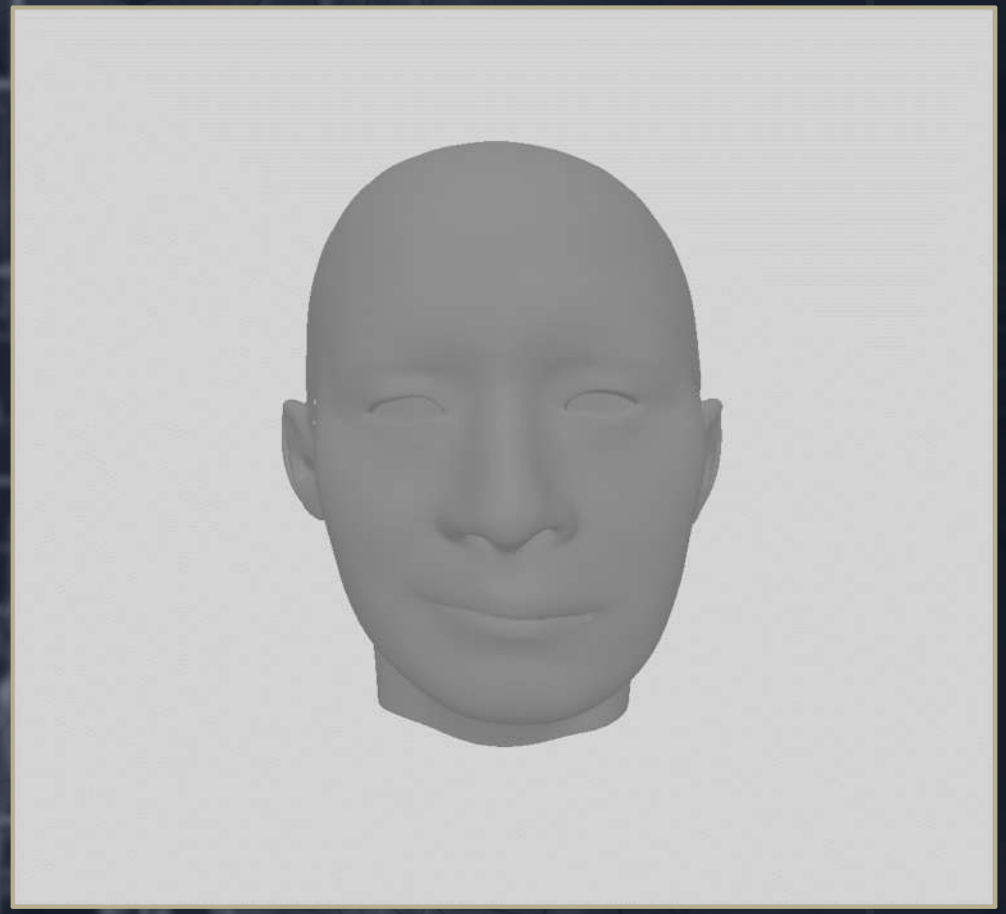
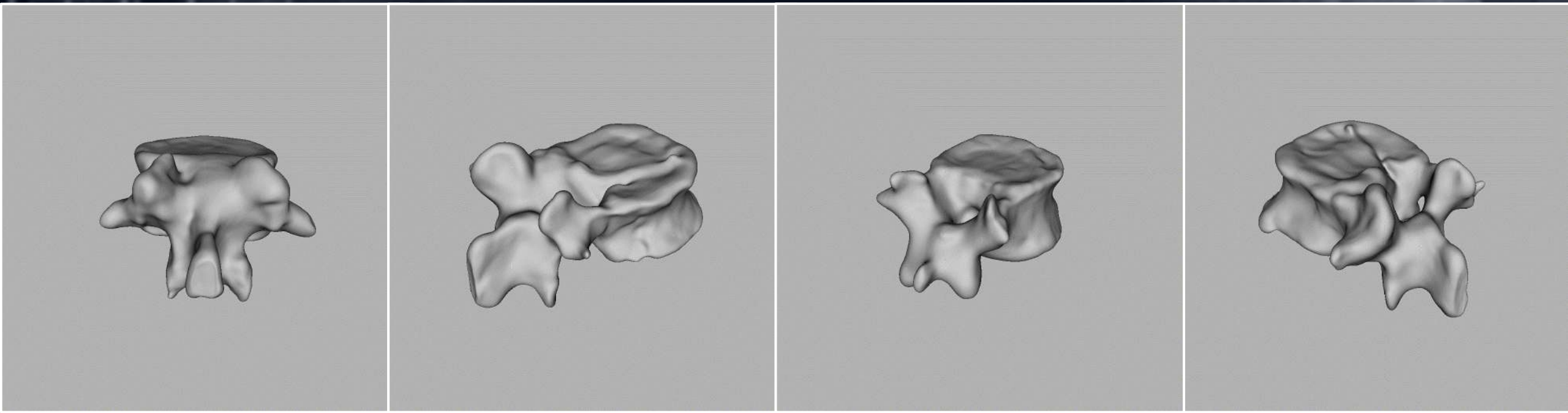
3D Generative AI
for Medical Imaging

TECHNOLOGY INTRODUCTION

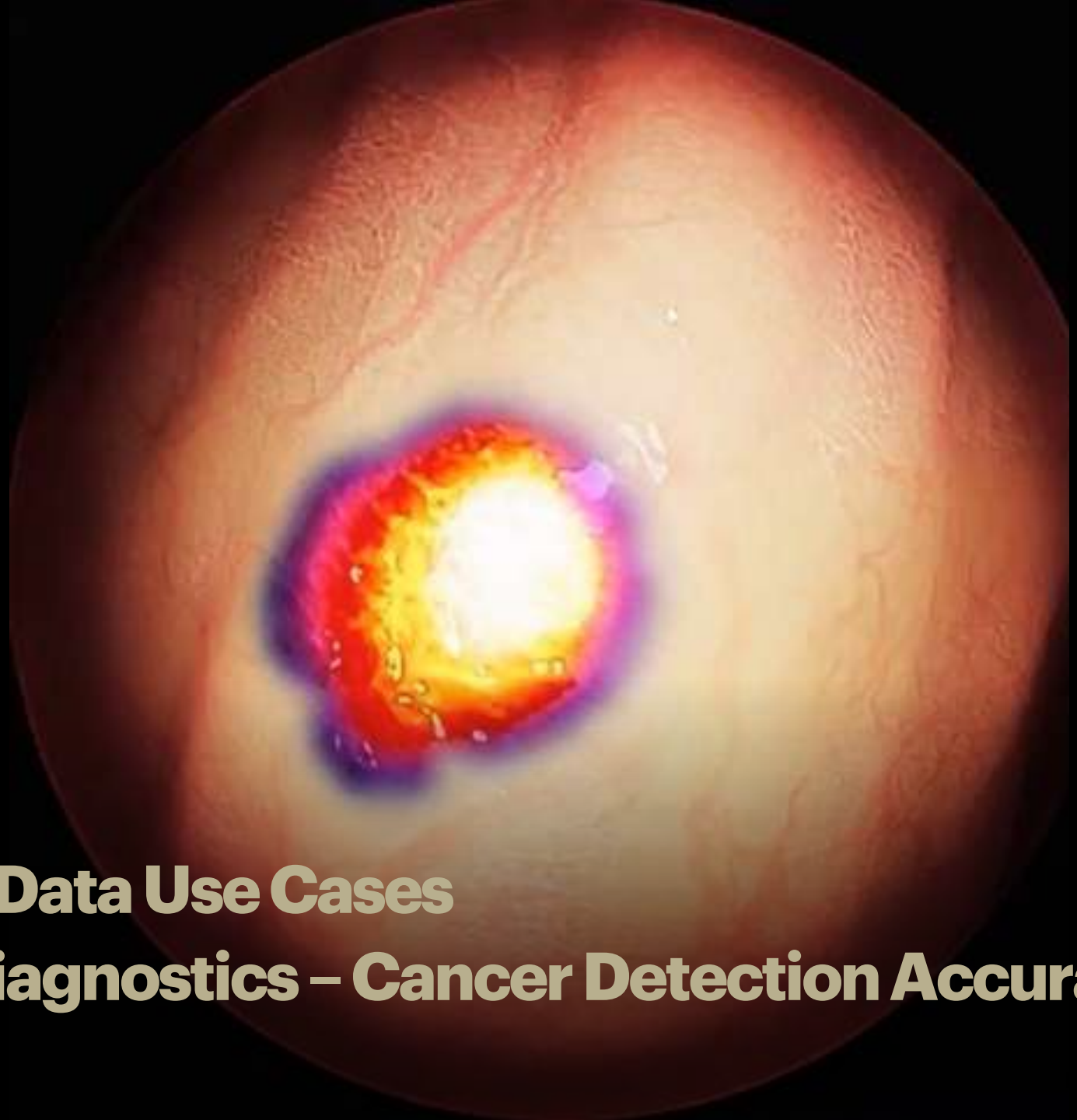


VQ-VAE and VQ-VAE2 Linear interpolations between quantized latent vectors

3D Generative AI
for Medical Imaging



Results – Lumbar vertebrae



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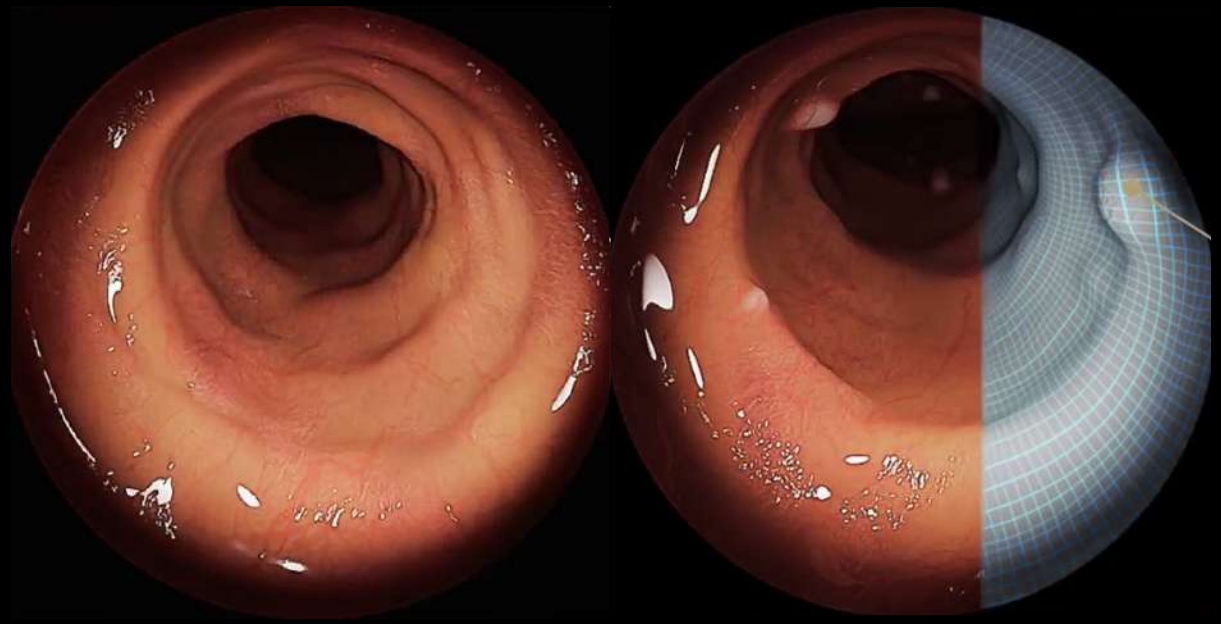
Synthetic Data Use Cases
Medical Diagnostics – Cancer Detection Accuracy Boost

Solutions | Healthcare - Synthetic Endoscopy data for Cancer Differentiation



Synthetic Data (intestines and lesions) samples

Classification results achieved during acceptance tests performed by the Customer for a detection of two types of lesions:

Our results on Synthetic Data:

Recall: **95%**

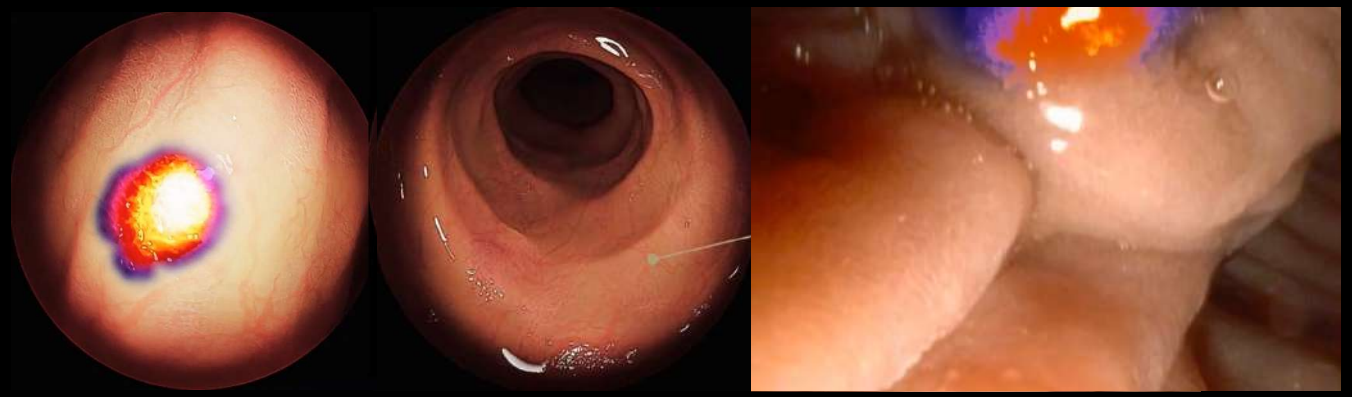
Precision: **94%**

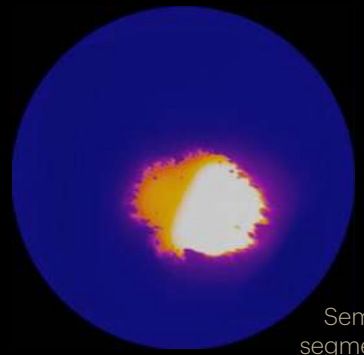
Real data results:

Recall: **85%**

Precision: **83%**

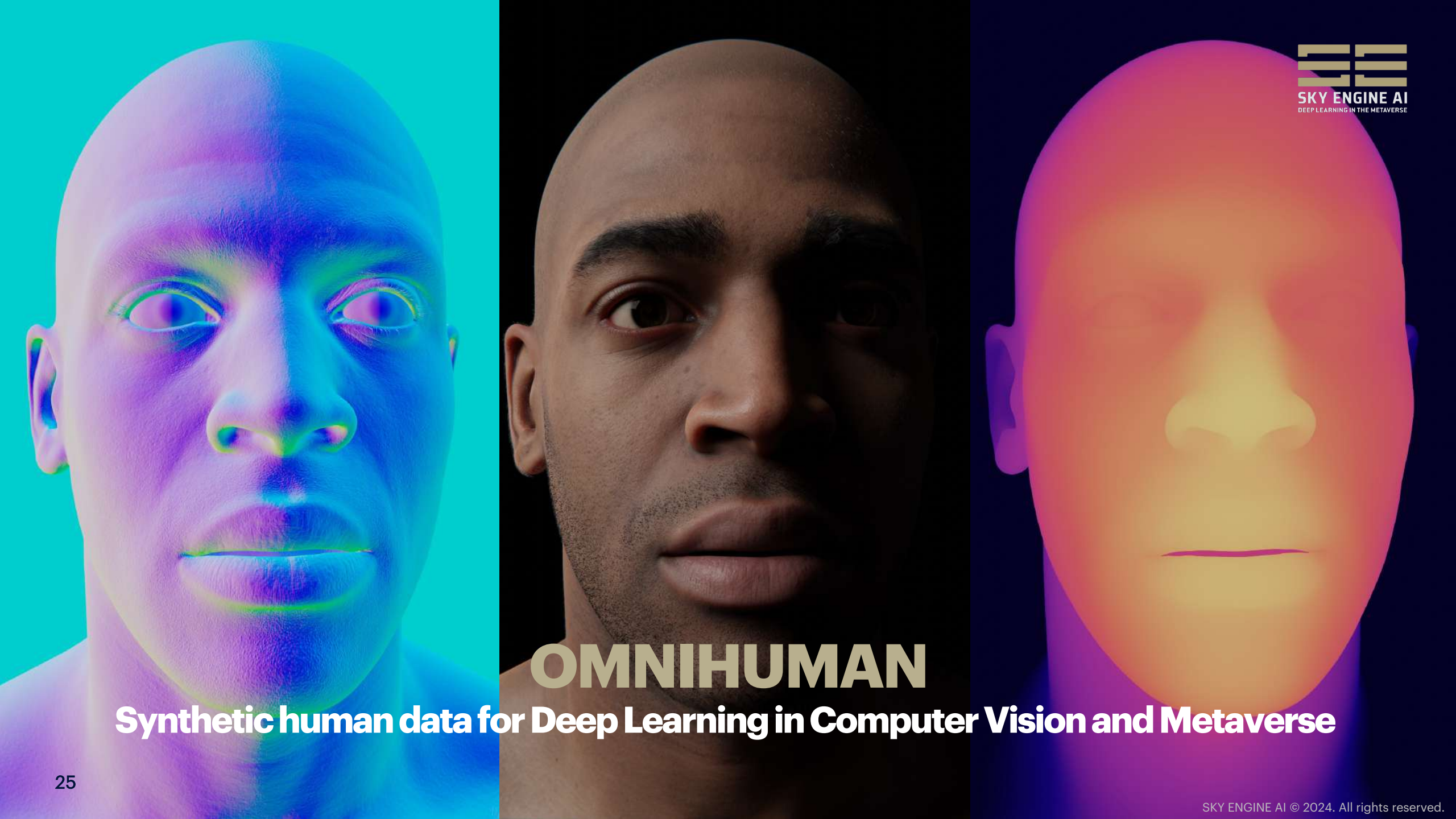
Real-time Polyp Differentiation – NICE Type-1





Semantic segmentation

- Broad range of simulated endoscopy modalities: colonoscopy, capsules, hysteroscopy, etc.
- Photo-realistic simulations of gastrointestinal tract synthetic tissues
- Camera parameters and lighting conditions recreated
- Different lesion types can be reproduced
- 3D semantic labels
- Intestines motion can be included
- 3D Video clips can be generated
- Avoid privacy issue when obtaining training data



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OMNIHUMAN

Synthetic human data for Deep Learning in Computer Vision and Metaverse

Synthetic Humans in Context

Omnihuman created in the SKY ENGINE AI Synthetic Data Cloud

SKY ENGINE AI
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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

Solutions | Omnihuman – Generative humans

- 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

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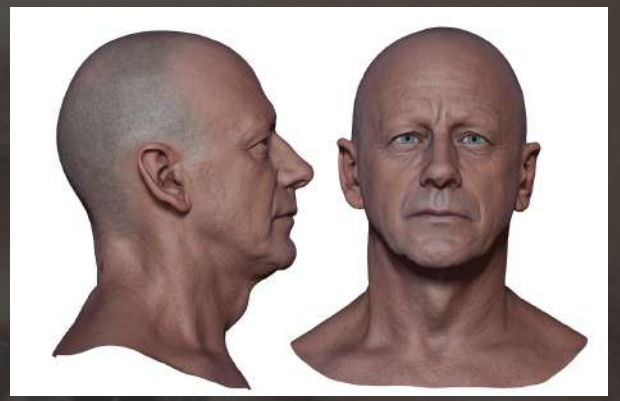

Generative ageing

Solutions | Omnihuman – Generative humans

- Facial expressions according to facial action coding system (FACS)
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- Generative skin
- High quality, multi-layer rendering & subsurface scattering
- Generative ageing
- 3D keypoints and motion capture support

Solutions | Omnihuman – Generative humans

- Human eye
- synthetic data

- Eyes of different iris color, pupil dilatation, redness

- Eye gaze (horizontal, vertical)

Solutions | Omnihuman – Generative humans for the Vision AI

- Omnihumans – visible light (RGB) and Near infrared (NIR) of different gender, age, ethinicity;
- Different mimics and emotional state: neutral, sad, happy, angry, disgusted, etc.
- Head pose (pitch, yaw, roll)
- Varying hair, and/or facial hair
- Varying eye brows (color, length, density)
- Facial expressions according to facial action coding system (FACS)
- Varying background and lighting
- Accessories included

Solutions | Omnihuman – Generative humans for the Vision AI

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SKY ENGINE AI
SYNTHETIC DATA CLOUD FOR VISION AI

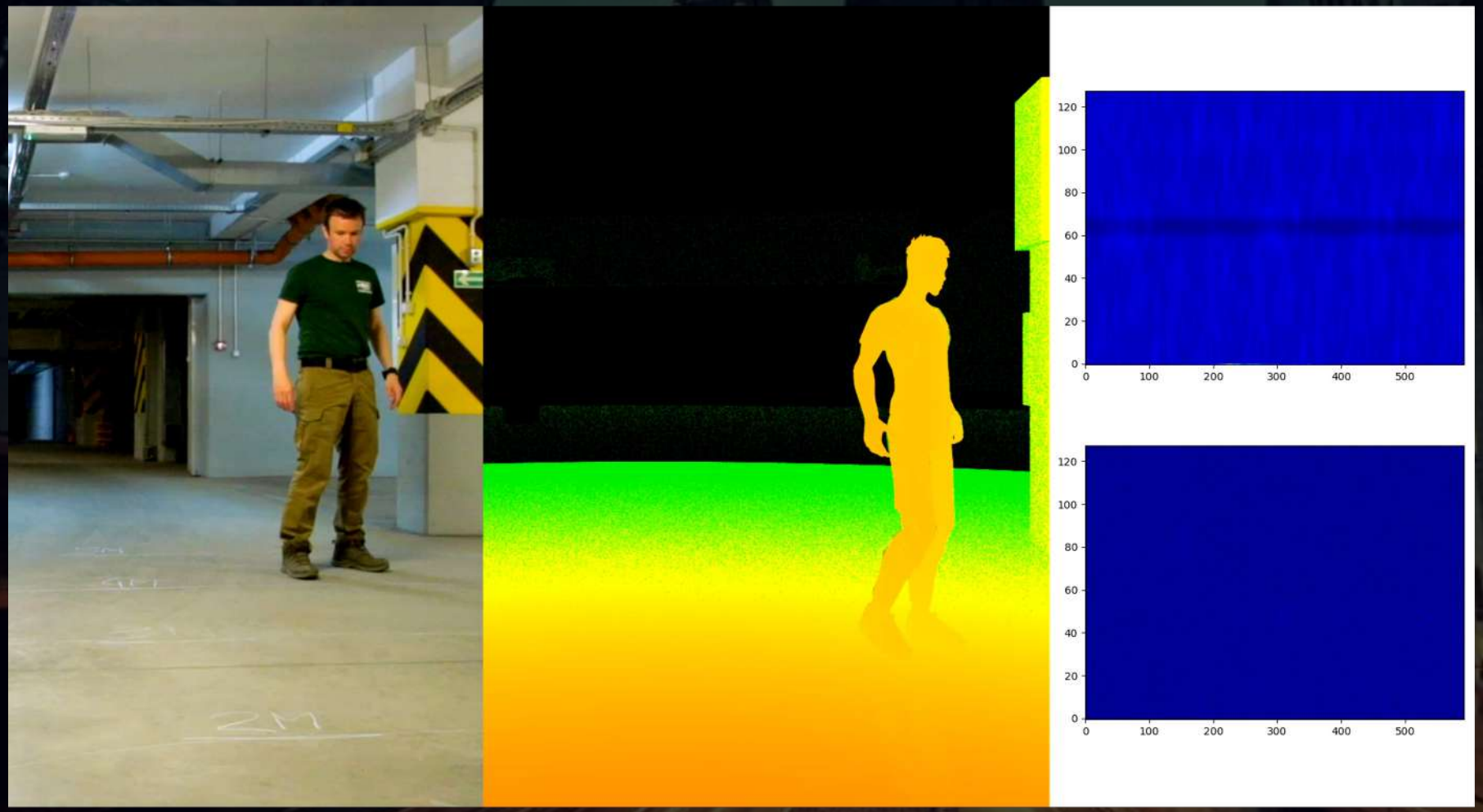
Synthetic faces dataset – Features

Number of images	3 000 000 of high quality images of human faces
Resolution	512 x 512 pixels
Modality	VIS, NIR (50/50 split)
Total dataset volume	4.26 TB
Available annotations	Face bounding box
	Gaze vectors (for each eye)
	Head orientation
	Gender
	Expression – 30 labels
	Skin tone – 11 categories
	Ethnicity – African, Arabic, Asian, Caucasian, Hispanic, Indian)
	Age – 5 ranges: 18-25, 25-35, 35-45, 45-60, 60+
	Segmentation mask with specified regions – neck, body, eyes (pupil, sclera, iris; left and right), ears (left and right), nose, hair, facial hair, lips (upper, lower), mouth interior, eyebrows (left, right), accessories (eyewear, headwear, earrings, necklace, face wear, eyebrow piercing, nose piercing, lip piercing, earbuds, bead)

Synthetic faces dataset – Features

Available annotations	Landmarks: 68 landmarks consistent with iBUG-68 and additionally pupil landmarks (70 landmarks in total); each landmark has specified location (2D image space, 3D camera space, 3D world space) and visibility
	Depth map
Scene variety	15 000 identities, 100 unique frames per identity (1.5 million unique frames in total)
	Complex skin texture randomization (pores, imperfections, scars, makeup, moles, acne, wrinkles, lip color, and more)
	Randomized textures of hair, eyes and accessories
	Randomized lighting
	Randomized background
	Randomized hairstyles
	Randomized BMI
	Randomization constraints preserving ID consistency
	Controlled scene complexity for each ID (from non-obstructed face looking directly at the camera to various head orientations with obstructing accessories).

Solutions | Radars and lidars simulations



Depth maps

- Precise simulation of Ultra Wide Band sensors including micro doppler effect,
- Support for human motion capture recordings,
- Sensor fusion – combination of visual and UWB data,
- Training AI models for human detection, positioning, identification and action recognition.

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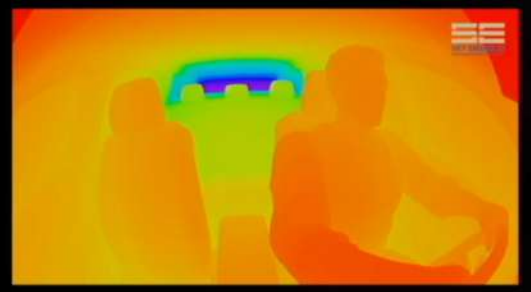
DEEP LEARNING IN THE METAVERSE

Automotive Synthetic Data In-cabin Monitoring



SKY ENGINE AI
DEEP LEARNING IN VIRTUAL REALITY

IN-CABIN MONITORING SYNTHETIC DATA

SKYENGINE.AI – SYNTHETIC DATA CLOUD FOR VISION AI

SKY ENGINE AI
DEEP LEARNING IN THE METAVERSE

Car interior light on, extra light in the interior from passing cars

Next generation synthetic data
Lighting conditions

In the SKY ENGINE AI, we have developed a complete toolchain of components for generating synthetic environments such as cars of different models/makes, objects and external environments, and any genuine interior may be replicated to help our customers creating the AI models faster.

We employ procedural object geometries and materials arrangement with various randomized factors, such as camera angles, lighting, daytime and external surroundings with customised items that can be introduced to the scene.

Illumination

Illumination variation introduced to the synthetic data simulated and generated in the SKY ENGINE AI cloud:

Light sources
Point light and spotlight light sources with energy dissipation modelling are supported.

Environment lights
Both image and HDR environment lights are supported.

Emissive objects
Light sources with custom geometry (defined in mesh) and surface luminance (defined in material).

Gaze estimation package and Facial landmarks

SKY ENGINE AI Synthetic Data Cloud supports multiple ground truth types including 3D facial landmarks (key points) according to a given specification.

Also, gaze vectors can be obtained for drowsiness, distraction estimation or personalization. These ground truths are available for imagery data generated in different modalities (i.e. RGB (visible light), NIR, etc.).

Violent, angry, expressive, tension, yelling

Driver and occupant state emotions, drowsiness, distraction, and more

In-cabin monitoring systems capable of detecting driver and occupant state, i.e. drowsiness, emotions or distraction can have their vision AI models trained on synthetic data with dense 3D key points and rich ground truth.

Synthetic, but yet very realistic humans have been created, for the job of simulating the driver and the occupant behaviour in the car, performing several activities that may also be prohibited by law (depending on the country and regulatory).

Distracted, phone calling, hands off the wheel

Driver and occupant state emotions, drowsiness, distraction, and more

These should be accurately detected by any modern monitoring system like the DMS.

The synthetic humans were created along with the entire car interior and context under changing outside environment conditions to preserve the impact they have on a trained vision AI models.

Driver’s activities and interactions

Driver and occupants can handle hundreds of different objects in the simulations, including but not limited to cups, bags, smoking devices, food, keys, mobile phones, tablets, cigarettes, drinks, books, etc. Any larger objects that can be placed on the car seats can be included, such as handbags, boxes, grocery bags, laptops, sport equipment, children toys, blankets, and more.

Changing weather conditions, time of the day can be introduced into the simulated scene including common variations like cloud cover, rain, haze, snow, dust or sunny day for any exterior environments i.e. urban or countryside.

Gestures recognition setup

Gestures simulation for i.e. hands on wheel monitoring, indications, pose estimation, objects handling, touching controls and panels, etc. Includes detailed 3D skeleton of hand, palm and fingers.

Can serve hand/palm pose estimation models, or spatiotemporal model operating on extracted position of joints.

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Baby, toddler, younger child on board with harness

Children at different age and with variety of settings can be simulated in child seats of numerous models/makes and carrying out several activities like playing toys, using phone or tablet, eating, reading, drinking including gestures and more.

Simulated synthetic data can serve 3D pose estimation with dense child skeleton annotations, activity tracking with spatiotemporal action classification models operating on extracted position of joints. Seat belts in child seats can be separately simulated with their annotations.

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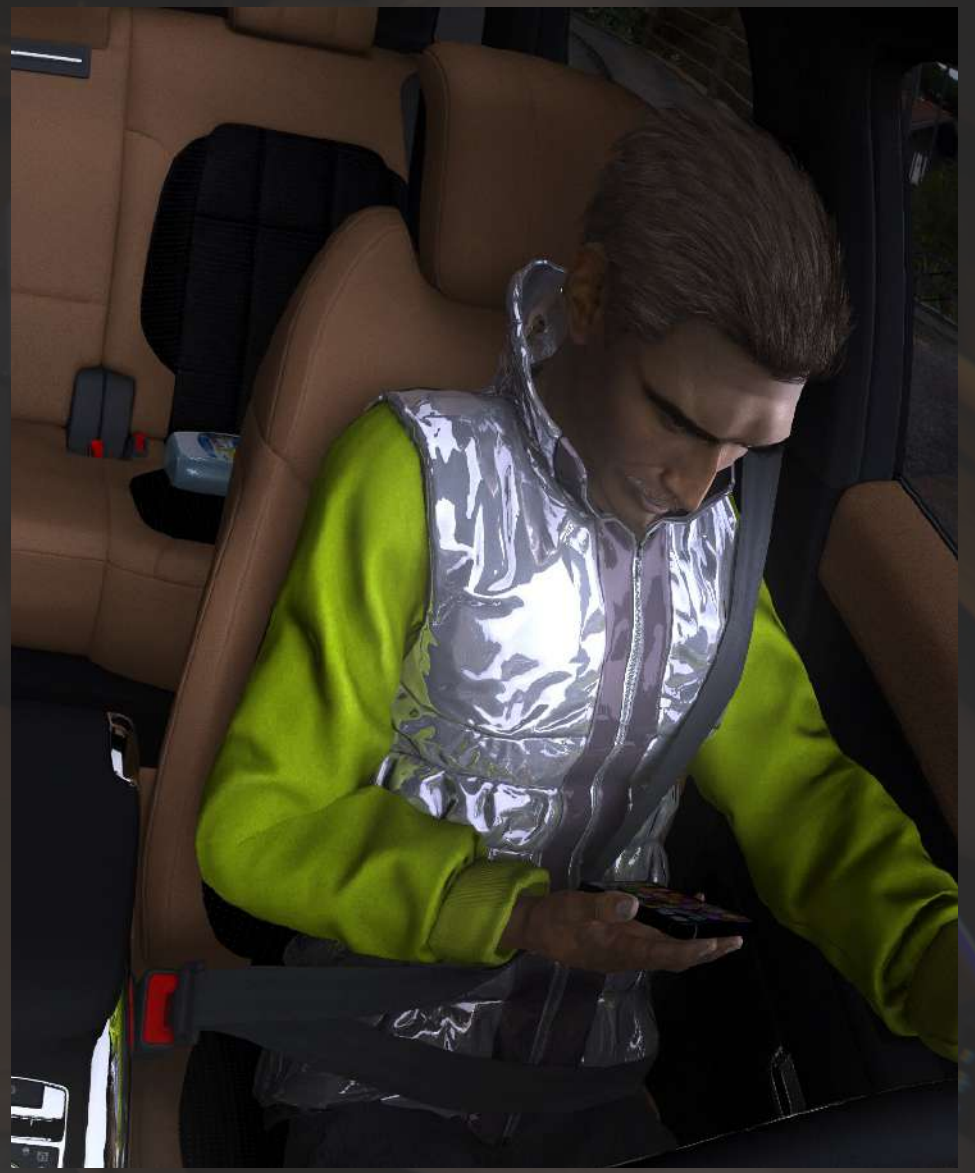
Keep your seat belts fastened

SKY ENGINE AI provides simulated seat belts and their status (on, off, incorrectly fastened) for driver and occupants including children in child seats with separate harness.

Available in numerous realizations, adaptive to human's geometry using generative simulation for perfect body fit including driver/occupant activities.



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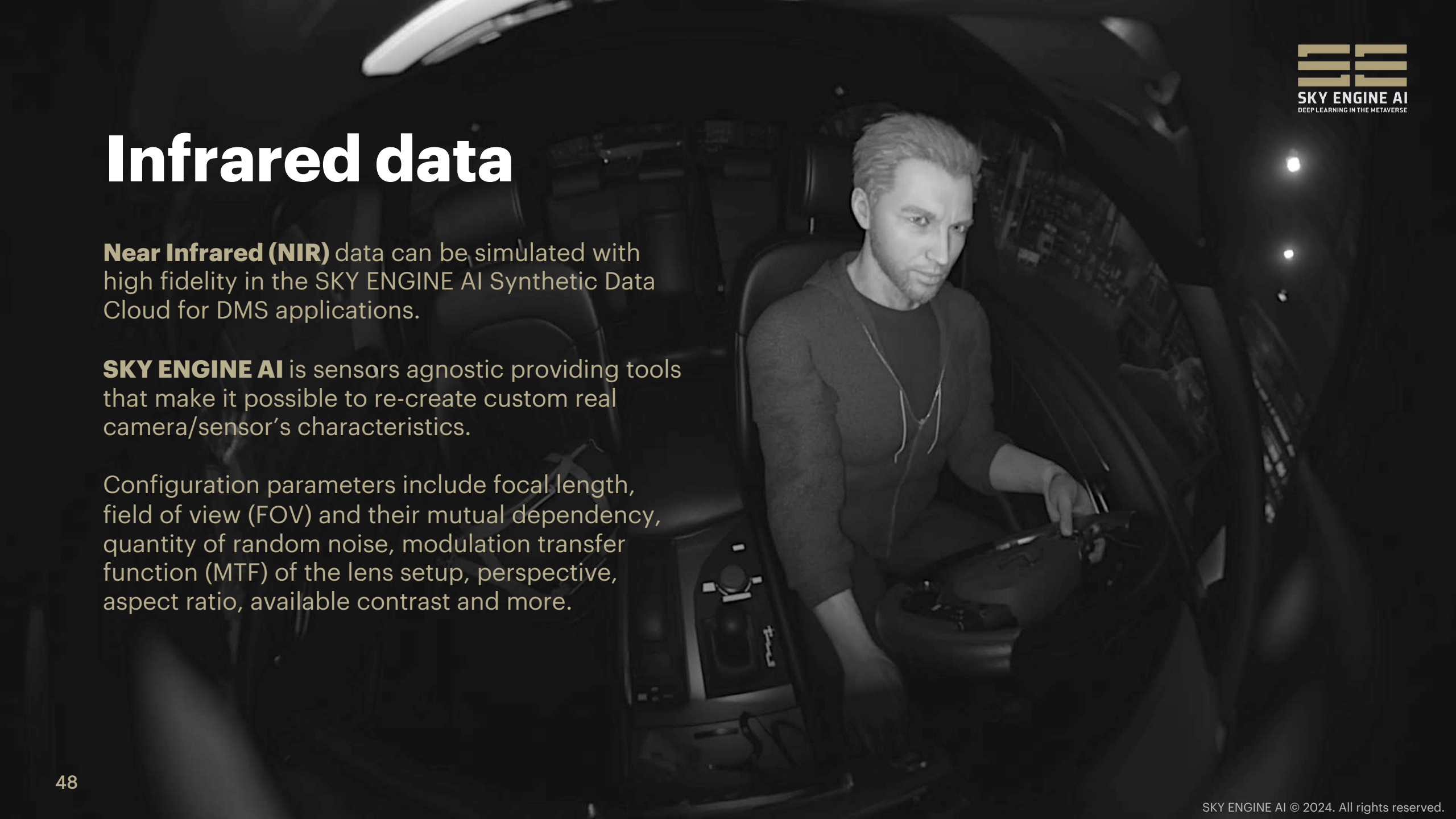
Multi-modality support, custom camera/sensor and pixel-perfect ground truth

Datasets can be simulated and generated in different modalities including Visible light (RGB sensors); Near infrared (NIR); Radars; Lidars and more (i.e. X-rays, UWB, etc.).



Infrared data

Near Infrared (NIR) data can be simulated with high fidelity in the SKY ENGINE AI Synthetic Data Cloud for DMS applications.

SKY ENGINE AI is sensors agnostic providing tools that make it possible to re-create custom real camera/sensor's characteristics.

Configuration parameters include focal length, field of view (FOV) and their mutual dependency, quantity of random noise, modulation transfer function (MTF) of the lens setup, perspective, aspect ratio, available contrast and more.

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ADVANCING ARTIFICIAL INTELLIGENCE

SKY ENGINE AI Synthetic Data Cloud – Features matrix 1/3

Modality	**Visible light, RGB sensors**
	Near infrared (NIR)
	Thermal vision[1]
	Radars[2]
Camera Location	**Centre stack**
	Rear mirror
External Environment	**Ambient light balanced across time of the day.**
	External scene i.e. urban, countryside, seaside, woods, highway. Random (broad coverage).
Human Models	**Identities (incl. height, body mass, appearance); Gender: Male & Female across broad range of age (in years). Includes baby & children, young adults, mature adults and elderly.**
	Clothes
	Headwear
	Eyewear (spectacles, IR benign sunglasses, IR blocking sunglasses).
	Face mask

1. Specifically requested sensor characteristics support may require additional development, testing & validation vs. hardware device.
2. Ultra-wide band radars native support; specifically requested sensor characteristics support may require additional development, testing and validation against hardware device

SKY ENGINE AI Synthetic Data Cloud – Features matrix 2/3

Cabin	Car interiors / Cabins of different car models/makes
	Front seat configuration – fixed setting; adjusted position / recline
	Rear seat configuration – fixed setting
	Harness simulated adaptive to human's geometry incl. motion: fasten, not fasten, incorrectly fastened
	Whole cabin empty
	Front Driver Seat Occupancy – Human
	Front Passenger Seat Occupancy – Human, Child seat (empty, baby, toddler), Objects, Pets, Carriers
	2nd row Seats Occupancy – Human, Child seat (empty, baby, toddler), Objects, Pets, Carriers
Objects Placed in Cabin[3]	Child seats of different types: rear facing baby capsules, forward facing seats with integrated harness, booster seats (using vehicle harness), backless booster seat. Placed on front and rear car seats.
	Items (i.e. books, phones, headphones, smoking devices, cigarettes, CDs, food, drinks, wallet, keys, camera, documents, pets, animal carriers – on seats and visible cabin locations.
	Additional items (bulky) – handbags, boxes, grocery bags, laptops, tablets, sport equipment, child equipment & toys, blankets, clothes – on seats.

3. Large coverage of object appearances (texture, colour, appearance in NIR) with shape deformations.

SKY ENGINE AI Synthetic Data Cloud – Features matrix 3/3

Hand Held Objects[3]	Steering wheel (driver only)
	Phones, smoking devices/cigarette, food, drinks
	Other objects (keys, wallet, book, CDs, walkman, camera, documents, laptops, tablets, and more)
Gestures	Waving, pointing, indicating, expressive, thumbs up, the finger, angry clenched fist, clap hands, Okay, peace sign, biker wave, eyelid pull, fig sign, facepalm, finger gun, horn sign, V sign
	Two hands on/off the wheel
	One hand on the other steering wheel's element (not external wheel), second hand elsewhere
	Scratching, touching panels, hand motions
Activities	Head movements, i.e. upright, normal pose, look around & in mirrors, turn, tilt, react to dazzling light, blinking, yawning, crying, laughing, closing eyes, interacting with occupants, sudden movements.
	Body movements, i.e. sitting upright, slouching, lean, turn towards rear seat, use headrest, turn, tilt.
Ground truth	Metadata on humans, objects, seat configurations, seat occupancy by object, human, a child seat, or not occupied. Metadata on seat belts fastened with annotations. Child seat type and occupancy by human, object or empty. Metadata on head and body pose, objects held by hand, and hand activity.

3. Large coverage of object appearances (texture, colour, appearance in NIR) with shape deformations.

SKY ENGINE AI Synthetic Data Cloud – Scene Parameters

SKY ENGINE AI Synthetic Data Cloud offers efficient solution for simulating data in several modalities including ground truth generation of any kind as yet outlined, 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.

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

- Rendered image resolution and ray tracing quality.
- Scene textures resolution: full, reduced for space/time optimization.
- Scene textures parameters: car interior materials, patterns, colours.
- Background environmental maps type: urban, countryside, unusual, changing weather, etc.
- Environmental light intensity and conditions and its influence on the car interior lighting: light source, time of the day.
- 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, thermal camera, radar, ultra-wide band.
- Camera position and orientation: like rear view mirror, console.
- Camera randomization ranges: X, Y, Z, roll, pitch, yaw.
- Sensor intrinsic settings: real sensor characteristics can be introduced, as for sensors mounted in the car.
- 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 i.e. adults, children on child seats, empty child seats, child on seat, pets, pet cages, 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, looking behind, gazing around, changing pose, gestures, and more.
- Driver and occupant state: distraction, drowsiness, different emotional states (i.e. neutral, angry, happy, violent, 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).

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.

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**

SKY ENGINE AI
DEEP LEARNING IN THE METAVERSE

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.

The Edge AI and Vision Alliance is a partnership of ~100 leading edge AI and vision technology and services suppliers, and solutions providers

The Alliance provides high-quality technical educational resources for product developers

Register for updates at www.edge-ai-vision.com

The Alliance enables edge AI and vision technology providers to grow their businesses through leads, partnerships, and insights

For membership, email us: membership@edge-ai-vision.com

Join us at the Embedded Vision Summit
May 20-22, 2025—Santa Clara, California

The only industry event focused on practical techniques and technologies for system and application creators

- *"Awesome! I was very inspired!"*
- *"Fantastic. Learned a lot and met great people."*
- *"Wonderful speakers and informative exhibits!"*

Summit highlights:

- **Inspiring keynotes** by leading innovators
- High-quality, practical **technical, business and product talks**
- Exciting **demos**, **tutorials** and **expert bars** of the latest applications and technologies

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