

SYNTHETIC DATA CLOUD FOR IN-CABIN MONITORING SYSTEMS

Providing Solutions to Safety Features' Development Challenges Through Synthetic Data Cloud.

FUELING VISION AI WITH SYNTHETIC DATA

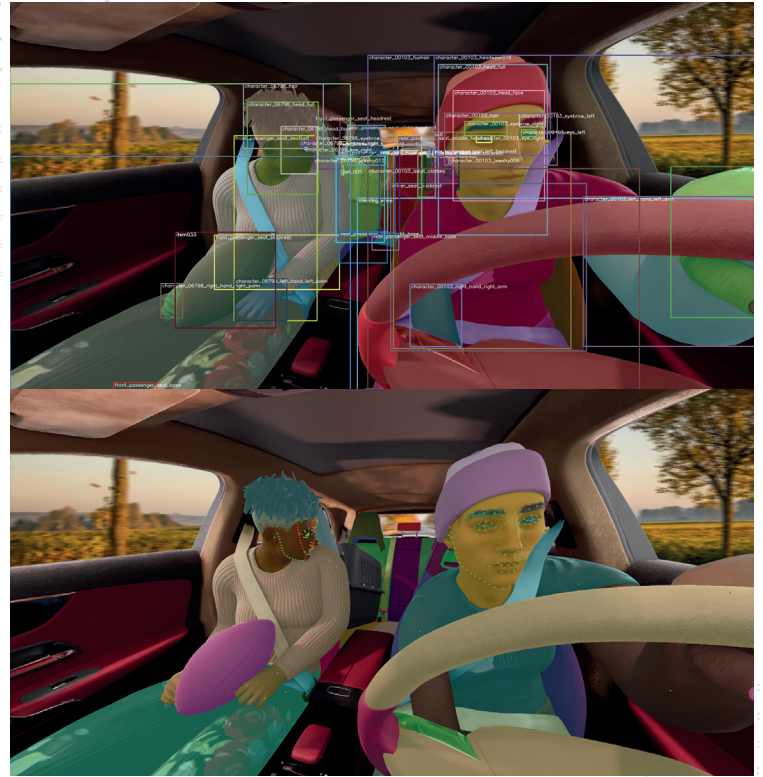
At SKY ENGINE AI we believe synthetic data is the future of Vision AI. Built by the data engineering team our Synthetic Data Cloud allows you to generate high-fidelity synthetic images and video sequences and empowers your AI models to reach new levels of performance.

Solve the most pressing challenges in Computer Vision—whether it's data scarcity, privacy requirements, or edge cases—and give your enterprise the competitive advantage of truly reliable visual recognition systems.

INCREASING REGULATORY PRESSURES FOR NEW SAFETY FEATURES

From 2026, in the EU all new in-cabin monitoring systems will need to detect complex behavioral patterns, such as drowsiness, based on visual data of the driver's face expression, head position, and eye movements. Occupant monitoring becomes mandatory in all new cars in the EU, as well, and the systems will additionally have to recognize child presence in

rear seats, as well as seatbelt usage (fastening and positioning). By 2030 Australia plans to fully align with the EU in their requirements for in-cabin monitoring for all new cars. In the US, The Hot Cars Act of 2021 requires safety measures in passenger cars to reduce injuries or deaths from heatstroke and other harms.



THE SOLUTION

SKY ENGINE AI SOLUTION FOR THE IN-CABIN MONITORING SYSTEMS' DEVELOPERS

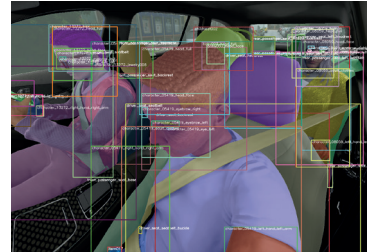
Synthetic Data Cloud

SKY ENGINE AI provides a comprehensive synthetic data generation platform with specifically designed solutions for in-cabin monitoring system development, addressing

the critical challenge of acquiring diverse, comprehensive training data while preserving privacy and reducing costs.

Platform Technology Stack Overview

- **Hyperspectral Ray Tracing:** Physically-based rendering optimized for modern GPU architectures
- **Multi-modal Support:** RGB, NIR, thermal imaging, and radar sensor simulation capabilities
- **Render Passes Dedicated to Deep Learning:** Generation of semantic masks, depth fields, 3D keypoints, and other ML-specific data
- **Deterministic Image Generation:** Generation of exactly the same image every time from the same setup—simplifies testing, comparison, and makes AI training trustworthy
- **Iterative Learning:** Step-by-step improvement of ML model outcomes through easy dataset parameter optimization and hassle-free generation of new images
- **Material & Animation Support:** Realistic look and natural movement thanks to using film-grade textures and motion data
- **GPU-level PyTorch Integration:** Direct rendering to neural network input structures without PCIe transfer overhead



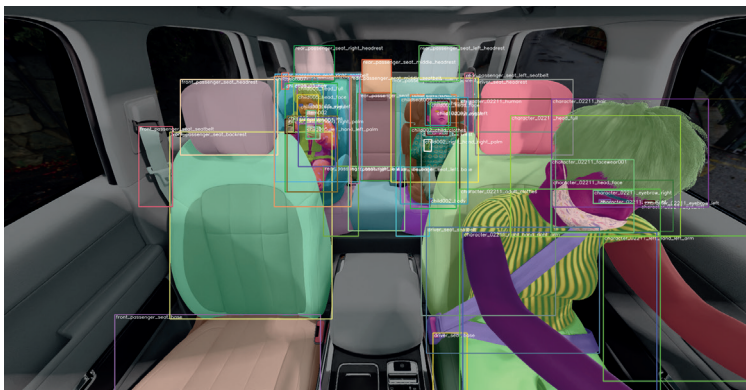
Features Required from 2026 in the EU

- Monitoring despite facial occlusion (e.g. eyewear, facial hair, masks, eyelash makeup, long fringe)
- Recognition of driver behaviors—transient, non-transient, and general (e.g. phone use, microsleep, vaping)
- Assessment of seatbelt routing
- Monitoring of occupant proximity to the airbag
- Child presence detection and monitoring

Challenges of Developing AI-Powered In-Cabin Monitoring Systems

- Acquiring diverse, comprehensive training data covering majority of possible scenarios
- Balancing cost and time constraints in developing robust in-car Vision AI systems
- Privacy concerns with collecting real-world driver monitoring data
- Creating systems that work reliably across different lighting conditions and vehicle interiors
- Testing and validating rare but critical edge cases (extreme drowsiness, distraction scenarios)





SKY ENGINE AI FEATURES FOR DMS

Synthetic Data Generation Capabilities

- Various lighting conditions (day/night, weather effects)
- Different car interiors and camera placements (e.g. dashboard or a-pillars)
- Various objects and accessories
- 216 unique adult identities
- 4-second animations at 24 frames per second
- 126 animation scenarios for adults overall
- 52 action units describing face expression for each adult occupant
- A predefined set of accessories (headwear, facewear, eyewear, and jewelry) for each adult identity

Vision AI Training Parameters

- **Modalities:** RGB, Near Infrared (NIR), Thermal, Radar
- **Camera Locations:** Center stack, rear-view mirror, left and right a-pillar, customizable
- **Human Models:** Diverse identities across age ranges with various accessories
- **Activities:** Head movements, body movements, hand gestures
- **Objects:** Child seats, handheld items, pet carriers, and more
- **Ground Truth:** Rich annotations including 3D key points, depth maps, semantic masks, as well as:
 - Bounding boxes for each segmented object.
 - Face bounding box.
 - Gaze vectors for each eye.
 - Head orientation.
 - Gender of each human occupant.

DMS Detection Capabilities

- Seatbelt status verification (e.g. buckled, not buckled)
- Drowsiness and distraction alerts
- Driver and occupant identification and state monitoring
- Gesture and activity recognition (e.g. eating, smoking)
- Object detection and tracking within the cabin (e.g. mobile phones, bags)
- Child and pet monitoring
- Short and long distraction
- Occupant presence and activity monitoring
- Head rotation and gaze vector estimation (owl-like and lizard-like movements)

KEY BENEFITS

BENEFITS OF USING SKY ENGINE AI SYNTHETIC DATA CLOUD



For Data Scientists & Vision AI Engineers

- Achieve the required model performance with the data your model needs.
- Automatic pixel-perfect labeling which saves time and effort.
- Full control over the data preparation and generation process.
- Expected AI model accuracy thanks to industry leading physically-based simulations.



For Engineering and Development Managers

- AWS, GCP, Azure or on premises* - flexible Platform hosting options.
- Full ownership of all generated data and zero privacy-related data issues.
- Independence provided by a driver-agnostic Platform compatible with major tech stacks and production pipelines.
- Compatibility with PyTorch, TensorFlow and other MLOps tools.



For C-Level Managers

- Reproducibility and reliability with tools that provide consistent and predictable results.
- Reduced data acquisition costs and timelines for AI models training and validation.
- Faster and smarter product development with datasets optimized for edge cases and high-risk scenarios.
- Optimization of vision AI models with physically-accurate, scalable datasets that are easy to iterate on and tune.

* This option is a non-standard configuration – contact the sales team to learn about its availability.