

Client Story

Improving LiDAR simulation accuracy with physically correct synthetic data

CRON ΔI

CRON AI

Adaptive 3D data perception platform for autonomous machines

Cron AI is powering the autonomy revolution with senseEDGE™ – its robust, adaptive 3D data perception platform.

This unique plug and play, deep learning first 3D perception platform harnesses the power of edge efficient artificial intelligence to bring accuracy, universal performance and reduce lifetime costs across mobility and intelligent transport systems, smart spaces, security and robotics applications.



Cron AI's senseEDGE™

ANYVERSE

Hyperspectral synthetic data for advanced perception

Anyverse™ helps advanced perception companies improve their deep learning perception models to reduce their system's time to market applying new software 2.0 processes. Its synthetic data production platform allows them to provide high-fidelity, accurate and balanced datasets. Along with a data-driven iterative process, they can help you reach the required model performance.

With Anyverse™, developers can simulate any LiDAR sensor and help them decide which one will perform better with their perception system. No more complex and expensive experiments with real devices, Anyverse's ray tracing technology is good enough to complement and even replace them.

GENERATING THE RIGHT SENSOR-SPECIFIC DATA

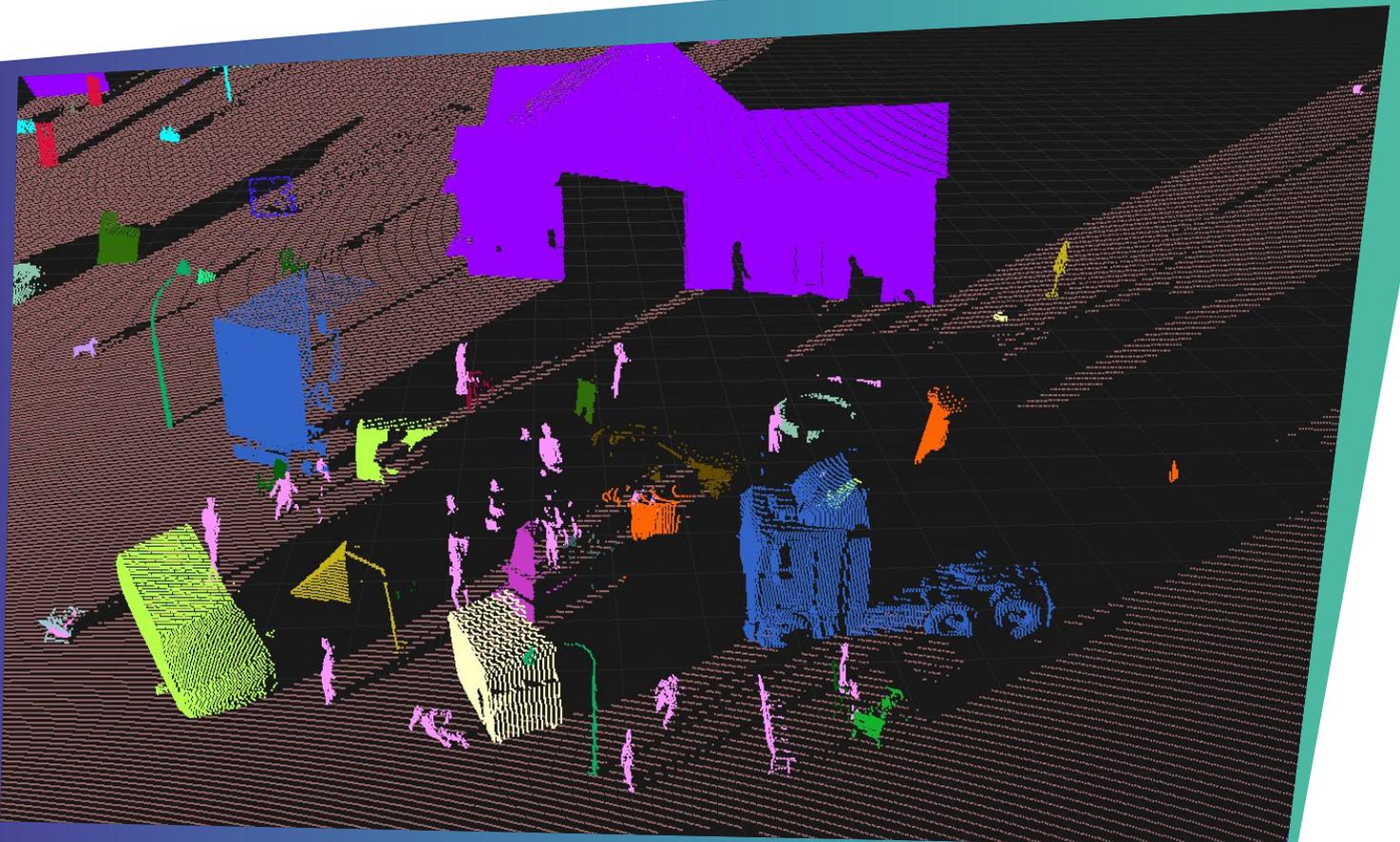
A strategic need

To excel in an ever-changing and competitive perception for the autonomous machines marketplace, Cron AI identified the need to use simulation as a cornerstone of their long-term data strategy. This is especially true for the many applications that demand perception accuracy in extremely diverse environments and sensor configurations.

Using deep learning at the core of their product, the Cron AI team continually faces the challenge of collecting truly diverse data for the wide range of intended applications.

Simulation allows them to overcome these limitations in the datasets, especially for many hard-to-find corner cases of object types, poses and distributions as well as to leverage perfectly labeled, complex object attributes that are impossible to annotate by hand.

It also provides them with unique opportunities to generate highly project specific data to scale for novel environments or sensor models before they have any access to them.



CRON AI & ANYVERSE PARTNERSHIP IN NUMBERS

+7,500,000 detectable objects in the dataset

+450,000 different point clouds in the dataset

+45,000 different images in the dataset

REAL-WORLD DATA vs SYNTHETIC DATA



Cron AI would've normally collected 1-2 sensors with real-world datasets

Synthetic data allows them to simulate millions of different high-fidelity sensor variations

Average object count with Cron AI real-world training datasets



VS



Average object count with the synthetic dataset

Usually, Cron AI could record 1, sometimes 2 synchronous sensors



VS



Cron AI simulated 9 synchronous sensors in the synthetic dataset



PHYSICALLY ACCURATE LiDAR SIMULATION

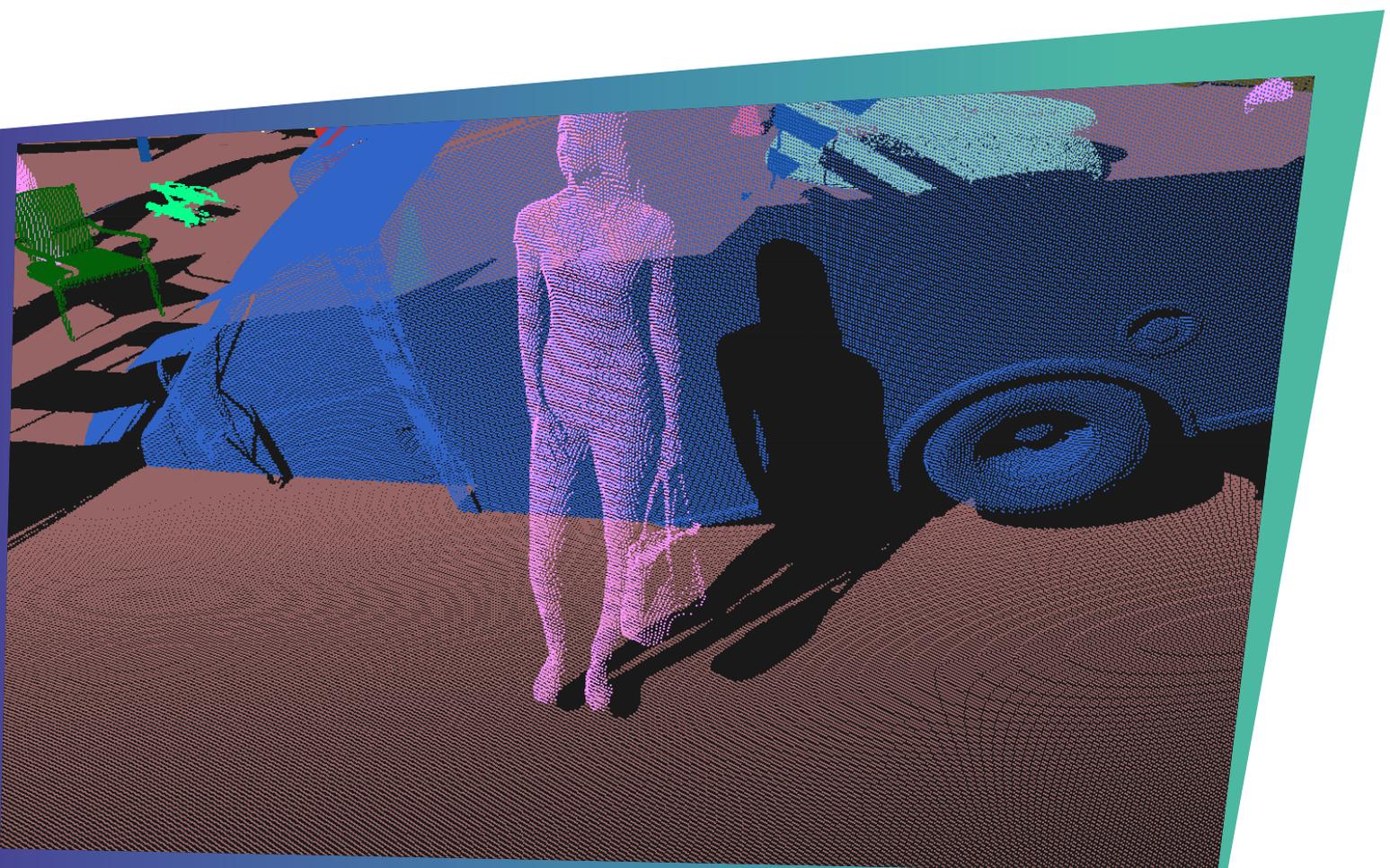
One step ahead

A physically plausible simulation of LiDAR is extremely hard to come by. Most solutions, when they exist at all, are severely limited in the types of physical effects that can be simulated in the LiDAR's light path. They are, therefore, severely limited in their usefulness to train deep learning models for real-world applications and adverse conditions.

Anyverse's hyperspectral path, tracing technology in conjunction with their detailed approach to object material mapping and simulation, is very different.

The simulation fidelity provided by Anyverse's technology facilitates Cron AI's proprietary post-processing pipeline to succeed in the creation of highly accurate simulations of light propagation.

This includes the full path from the emitter, back to the sensor's receiver including complex interactions of the light with geometry, materials and the atmosphere along its path. This fidelity is necessary for a physically plausible simulation of many common LiDAR measurement artifacts in all conditions, even when employing the extreme levels of randomization in Cron AI's simulation augmented training approach.



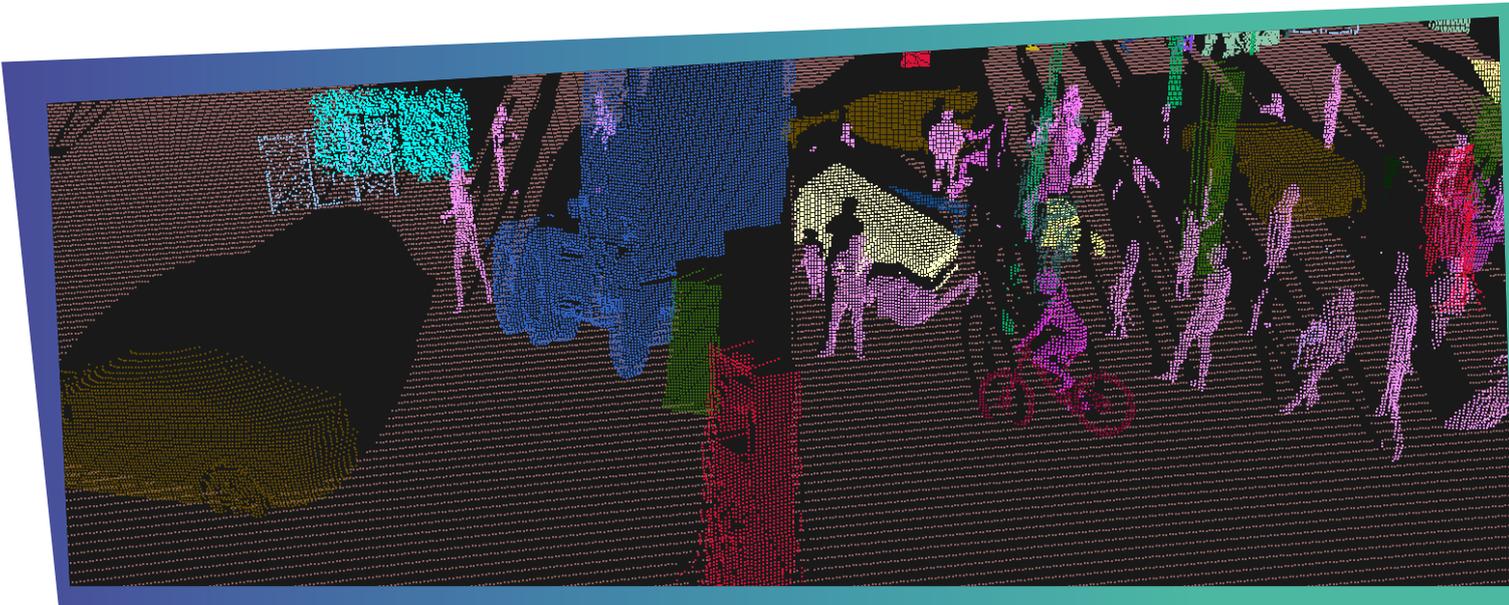
PROJECT OBJECTIVES

The primary aim of Cron AI's project is to use synthetic data to train the senseEDGE pipeline on as much diverse data as possible. Partnering it with Anyverse ensures that we have trained our neural networks on all possible corner cases that the real data may have missed.

For Cron AI synthetic data is not a replacement for real-world data, but an augmentation of the same. The adaptivity and contextual awareness of senseEDGE is based on being reliable, consistent and accurate - every time, which is extremely important for this synthetic data. The more varied the training data, the better equipped Cron AI will be to handle real-world situations.

In collaboration with Anyverse, Cron AI identified the following key objectives for this service-based project:

- Deliver pixel-accurate training data for the Cron AI sensorEDGE perception system
- Leverage synthetic data based on a generic LiDAR simulation providing point cloud images with ground truth
- Multiple layers of meta information for each measurement point to enable a deferred post-processing of sensor specific measurement artifacts
- (Additionally) simulate an RGB camera, in the same position as the LiDAR, producing spherical images to match the point clouds
- Randomly generate thousands of 3D scenarios with the placement of sensor riggings and positioning of objects of interest according to Cron AI project's specs



PROJECT CHALLENGES

Cron AI required a synthetic data partner which could have met the following challenges:

- LiDAR ultra-high resolution
- High number of objects of interest
- Tailored distribution of objects and sensors that required several iterations with the customer
- Dataset size (~2GB per sample)
- Tailored distribution of objects' poses

APPROACH & TECHNOLOGY

This project needed a synthetic dataset focused on the information provided by a LiDAR sensor.

- LiDAR and camera simulation
- Procedural scene generation using Anyverse API (python)
- Anyverse Hyperspectral Render
- Automatic data generation in the cloud (scale)

In addition to the LiDAR point cloud, a camera image with a spherical projection (that allowed the points in the cloud to be correlated with the colors of the camera image) was necessary.

SOLUTION

Anyverse designed a comprehensive dataset empowered by its synthetic data generation platform to meet Cron AI requirements. Synthetic as well as urban environments, with city structures and all the necessary elements (with multiple variations to bring it to life), including characters with random poses throughout the entire scene.

The object placement in the scene was key to the project. Cron AI was very conscious of this point, the reason why Anyverse Studio™ (Anyverse's platform module for developing scenarios) became critical, was due to its power to program, control, and customize the object placement in the scene.

Anyverse allowed them to control the positioning of each group of objects in each sample of the dataset, being able to control the quantity (for example from 2 to 5 groups of different objects), type (people, vegetation, benches or other furniture...), or size of these objects (buildings of different sizes), adding a minimum and a maximum number of objects, etc.

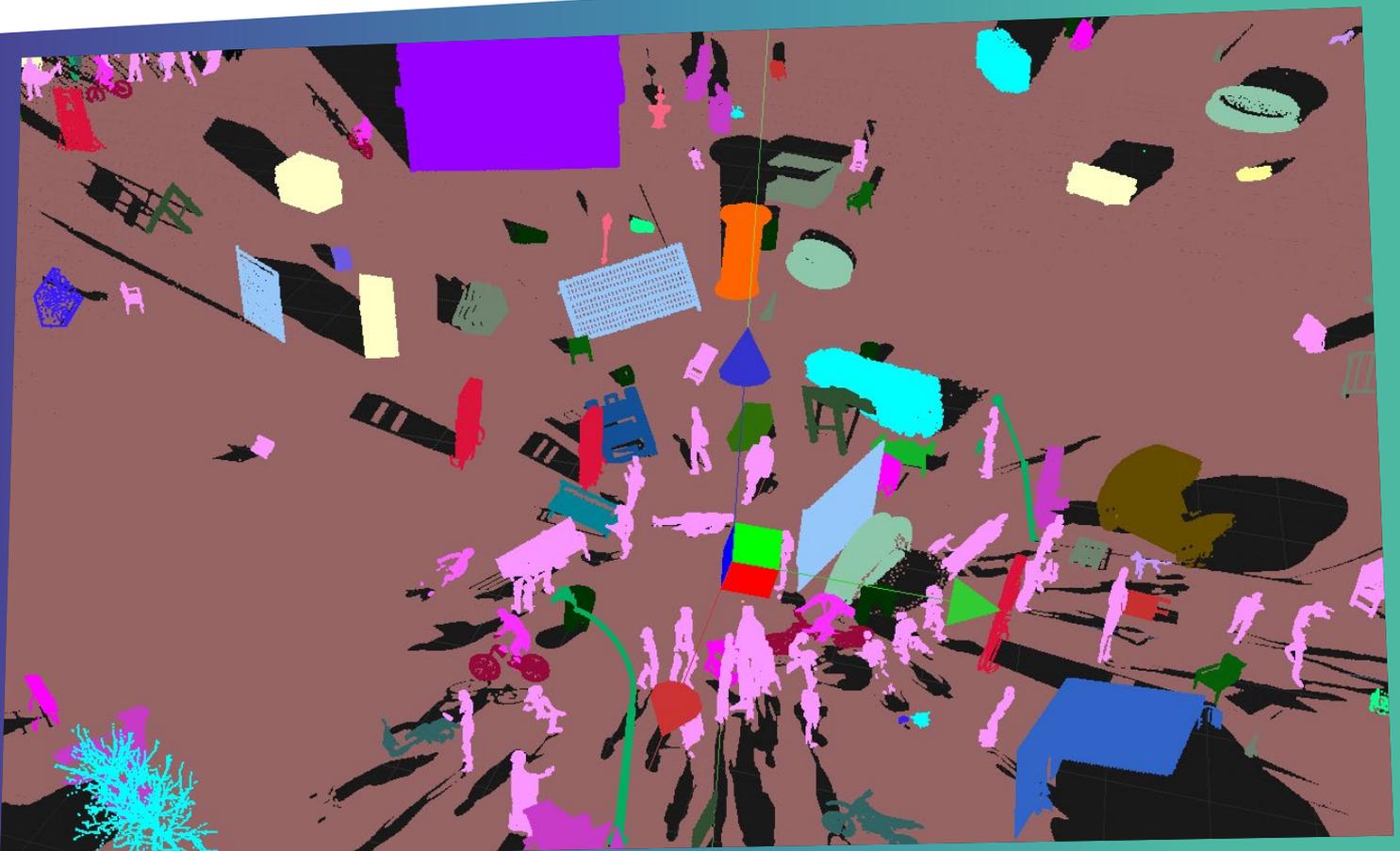


Cron AI and Anyverse agreed that this project should be efficient from a cost point of view, which was achieved through minimizing rendering costs by adding several groups of sensors to the scene (three groups of three LiDARs). A measure that turned out to be a resounding success, especially considering the technical difficulty due to the high resolution of the LiDAR model used in the project.

“The search for a LiDAR simulation technology partner truly fitting our needs was long and full of disappointments. Pretty pictures and perfect-looking point clouds do not equal good training data. We are very happy to have partnered with Anyverse, who understood these problems and were ready to pioneer LiDAR simulation for neural network training that truly works in the wild.”

Robert De Temple

Cron AI Principal Director, Engineering, Perception Software & Deep Learning



RESULTS

Cron AI was able to successfully train their system on millions of variations of physically plausible simulated scenarios with a strong diversification of scene and realistic sensor properties that are prohibitively hard or even impossible to collect or diversify in any other way.

Simulated data was the perfect solution to mitigate dataset biases and is, therefore, a key ingredient to achieving a reliable performance of the system in new locations, or hardware and environmental conditions.

Again, this turned out to be a very adaptive perception solution for Cron AI customers that does not break with data domain shifts due to new locations, hardware, and environment.

A PARTNERSHIP RISING

This first project was a huge success, Cron AI customers are excited with the simulation accuracy being provided to them. This is just the first chapter of the Cron AI and Anyverse partnership, so keep an eye on our social media, as we will soon be sharing the next chapter of this success story.

“We were very lucky to find Cron AI in the first place. It is precisely the kind of partner we are always looking for as they know very well what they want and understand why Anyverse’s solution is key to their success. They are pushing us to improve our LiDAR solution, and this will allow us to be unique in the simulation of these types of sensors. Thank you Cron AI”

Ángel Tena
Anyverse CTO

ANYVERSE

Anyverse is a scalable, cloud-based platform that can quickly synthesize highly accurate hyperspectral synthetic data, covering all potential scenarios and conditions, using a high-fidelity, physics-based simulation technology.

This allows system developers to accelerate their testing-training cycles and build more complete and accurate models in much less time, with lower costs.

CONNECT WITH US!



anyverse.ai



info@anyverse.ai



[linkedin.com/company/anyverse-ai](https://www.linkedin.com/company/anyverse-ai)



[@anyverse.ai](https://www.instagram.com/anyverse.ai)



medium.com/anyverse