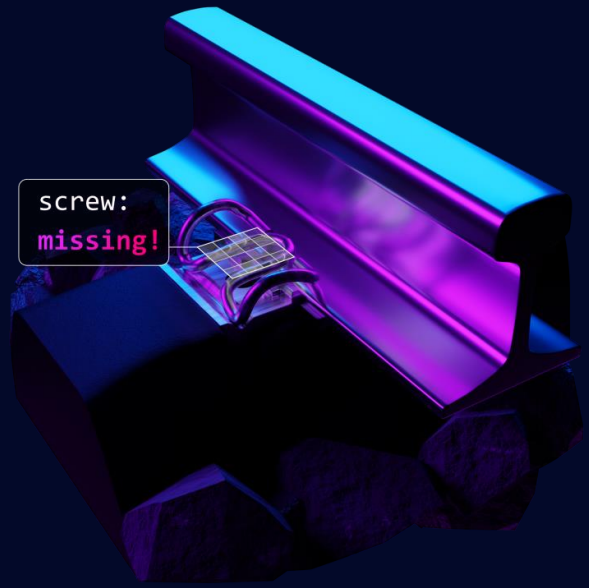
Unlock the Future of Railway Inspection

ex-nihilo

- Generate Synthetic Data for Highly Accurate Railway Defect Detection
- All-in-One Solutions for Defect Detection, from Data Generation to Model Training
- Train AI to Detect any Defects like Fractured or Missing Components. No Real-world Data Needed



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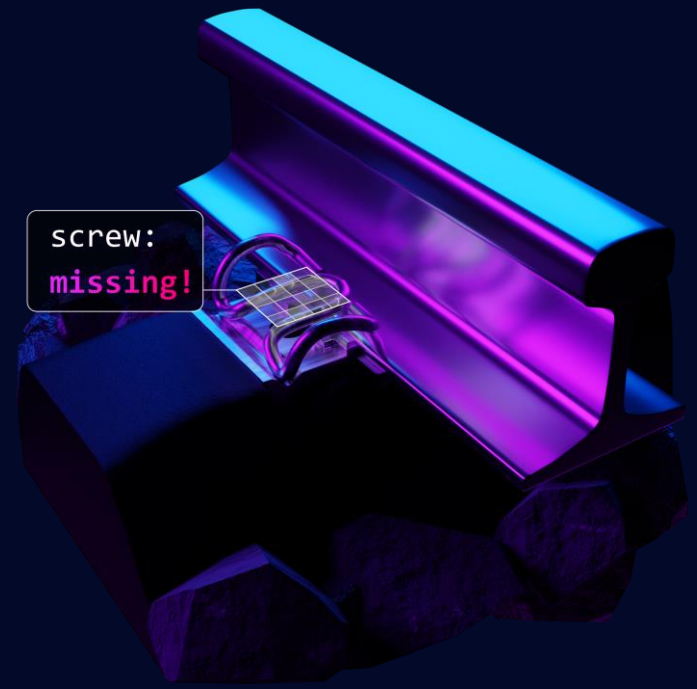

We unlock unique opportunities

Example

As a railway infrastructure company, I want to detect

- missing
- fractured
- misaligned

tension clamps on image data.

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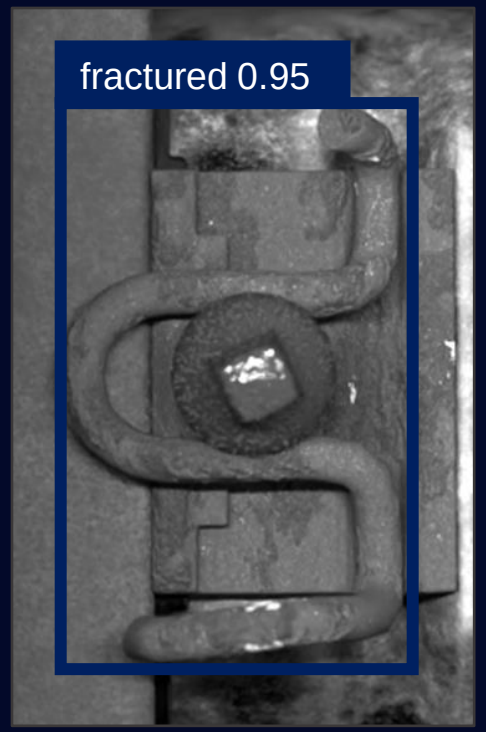

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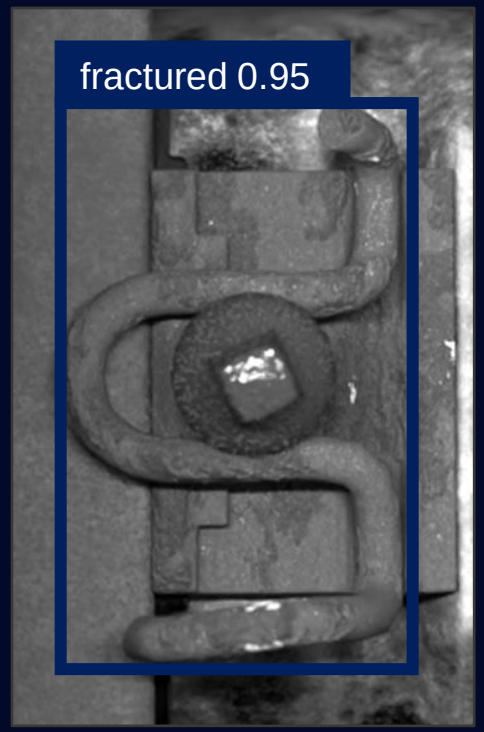

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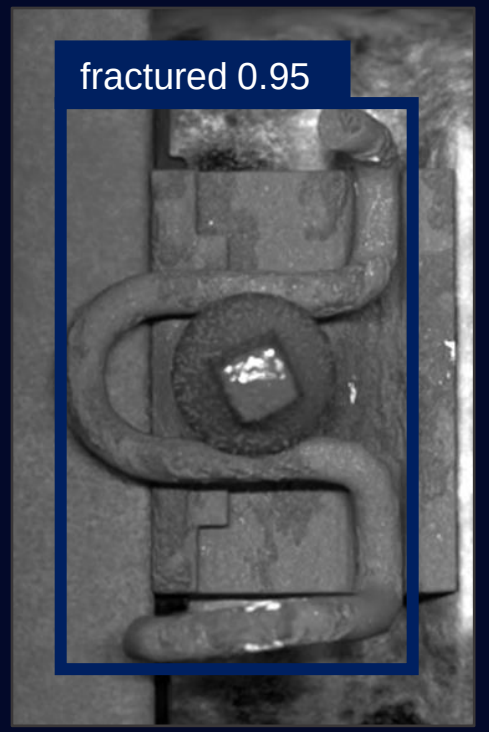
- Unlocated
- Take time to find & annotate



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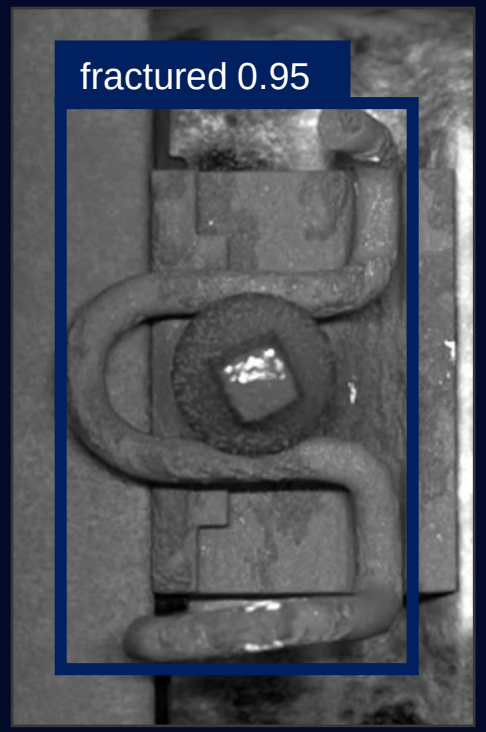

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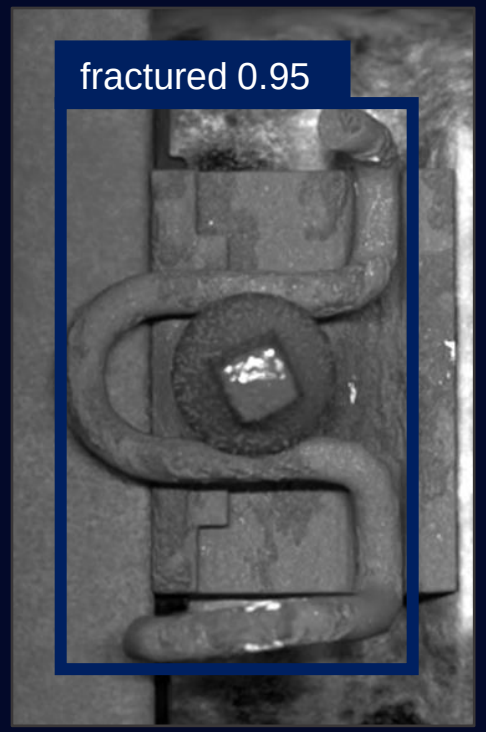

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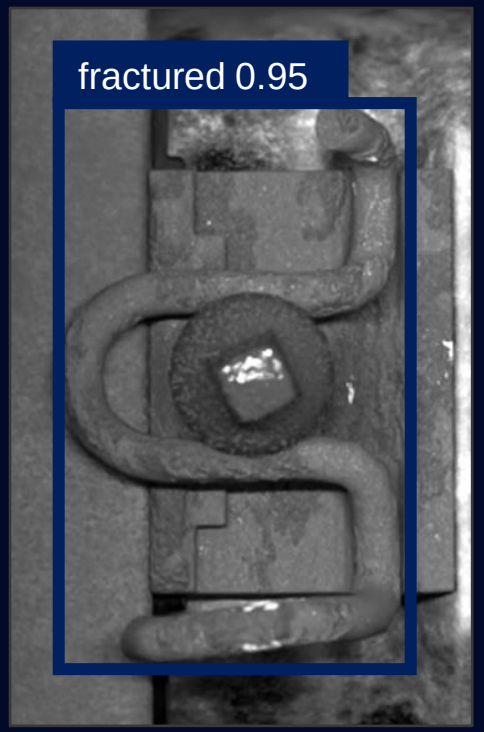

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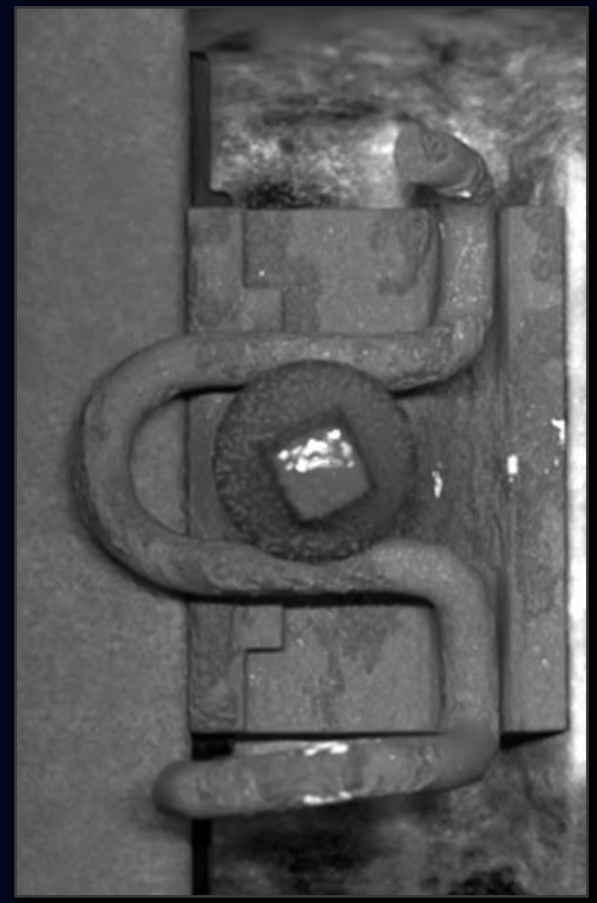


Synthetic image by ex-nihilo

Synthetic Training Data

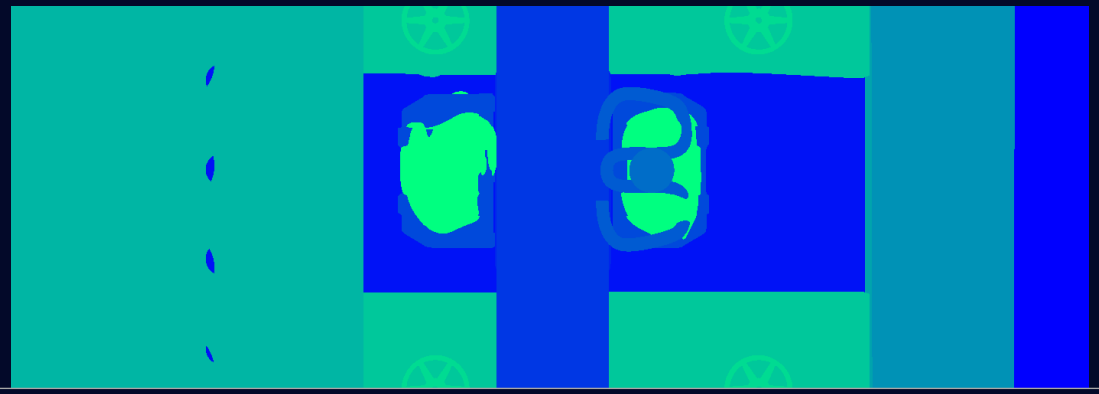
Synthetic Training Data

Fixed Track “feste Fahrbahn PORR”

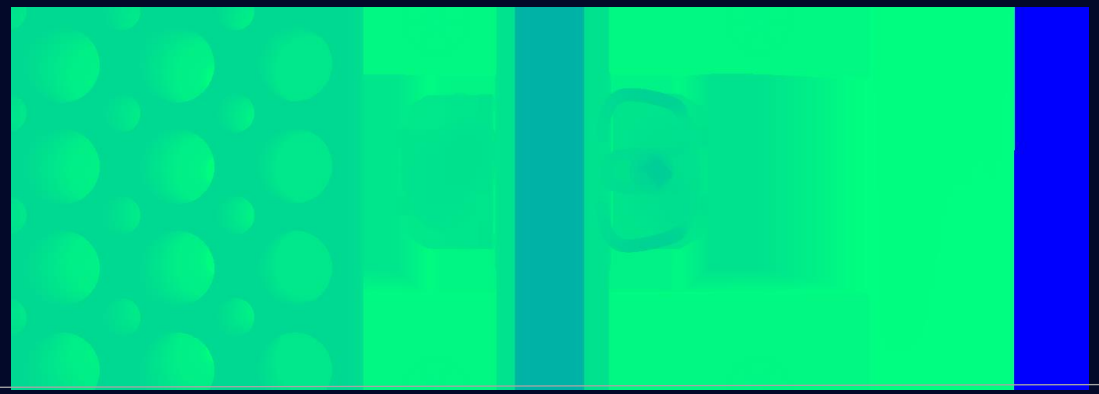
„W-Oberbau”

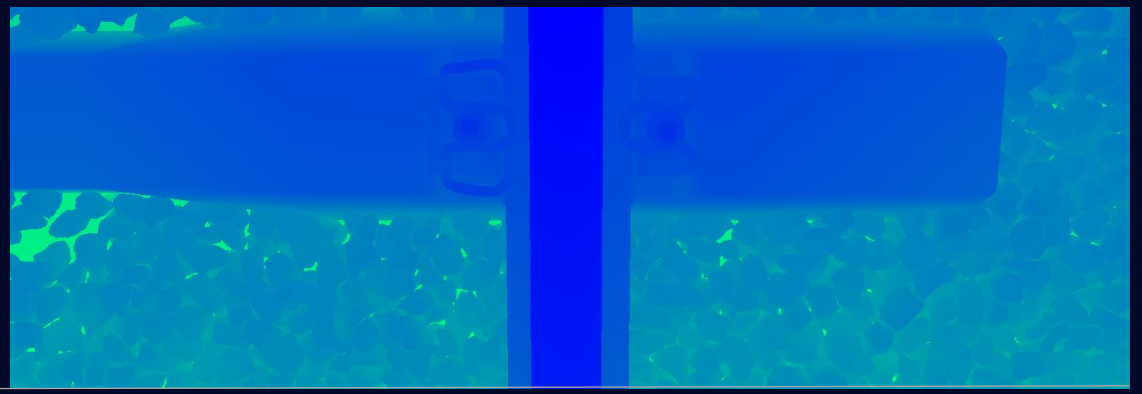
gray

panoptic



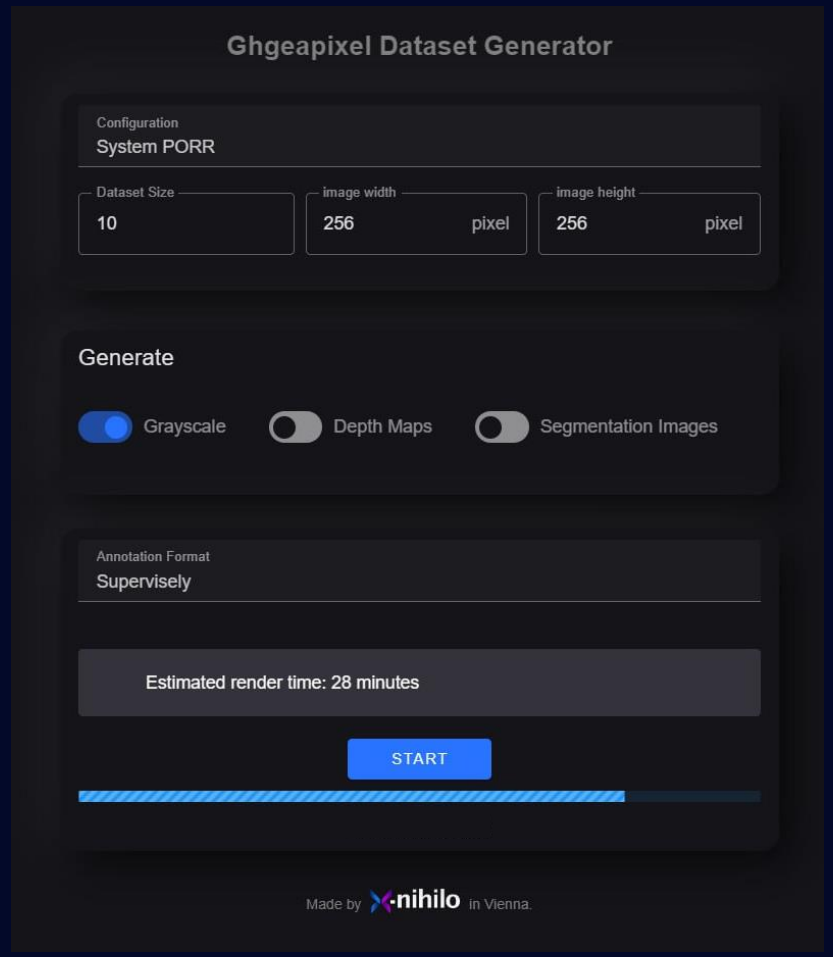
depth

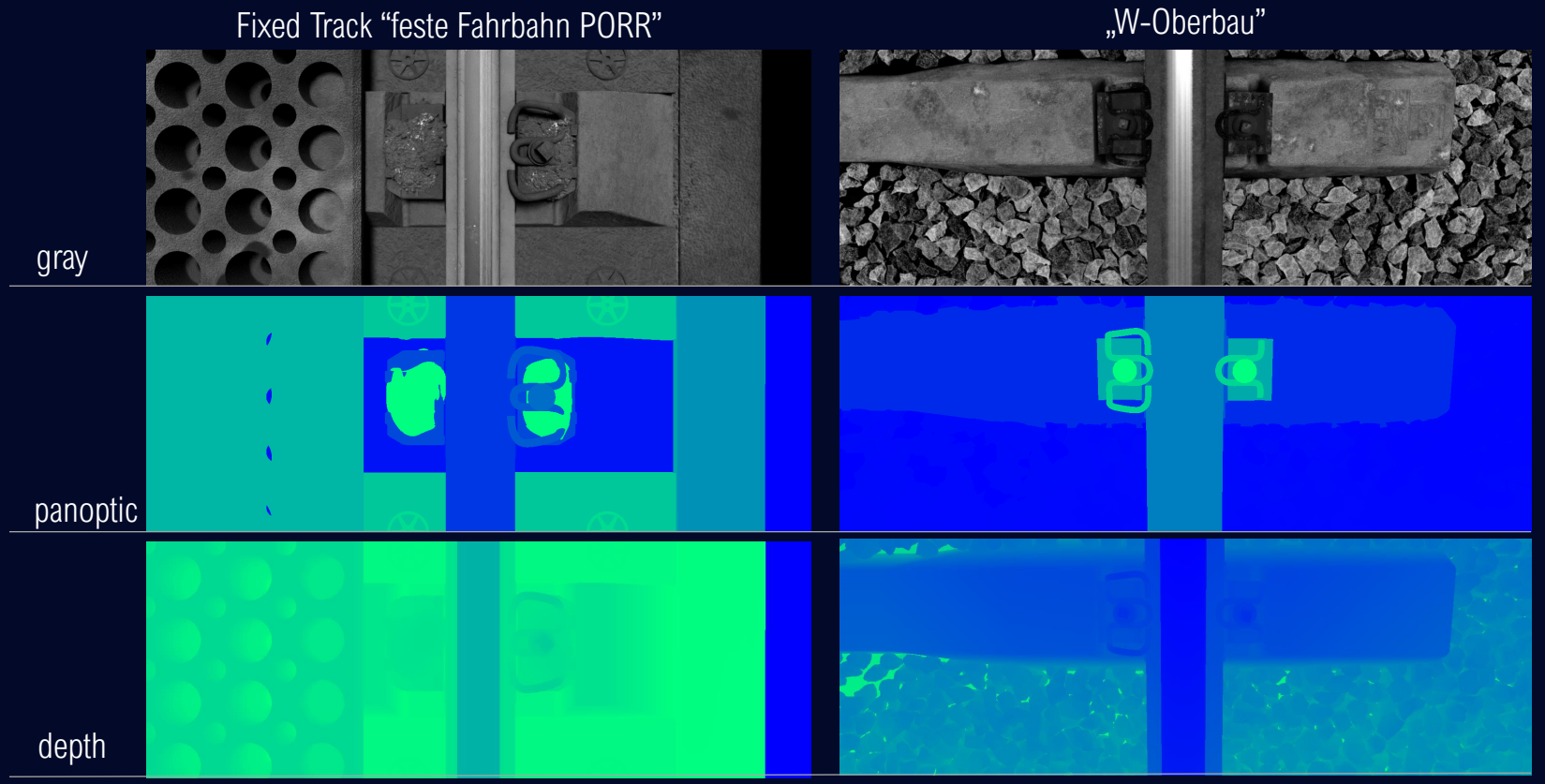




Synthetic Training Data

In-House Software “Ghegapixel”

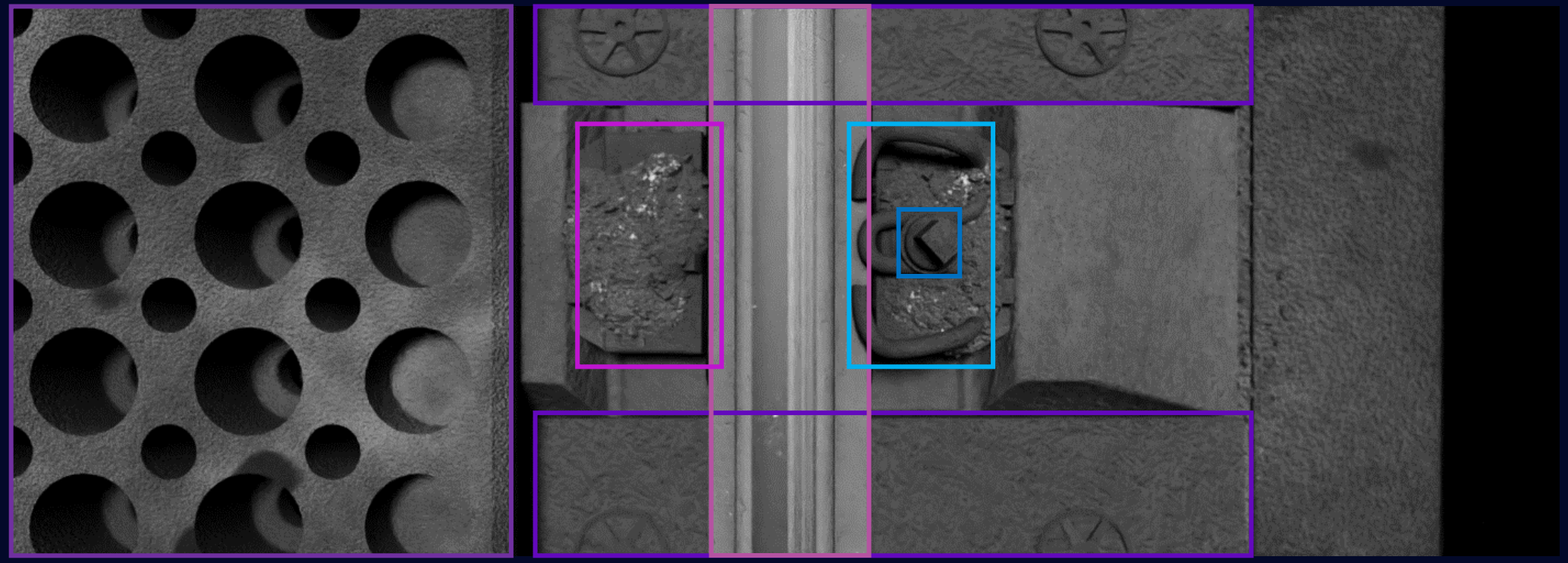




Synthetic Training Data

Synthetic Training Data

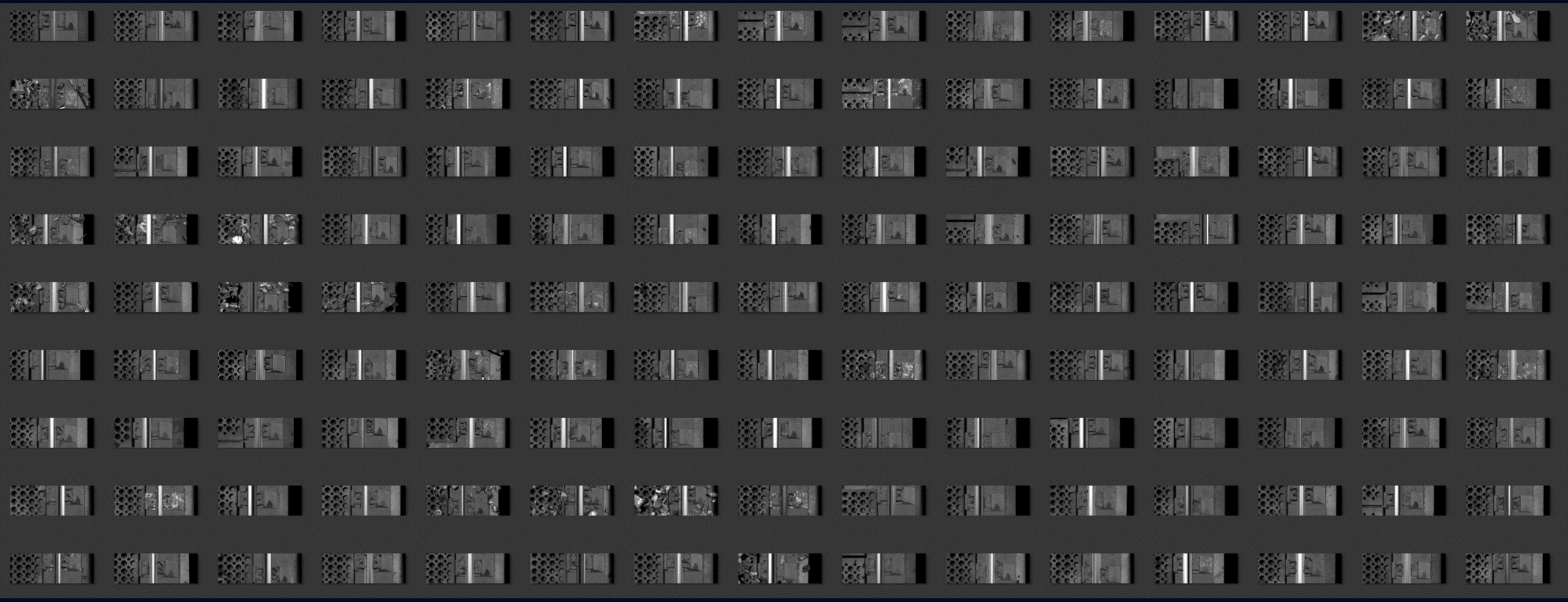
We can create any annotation of any object you like
With any metadata (rotation, placement, attributes like dirty, etc.) you want



In any Format you need (YOLO, MS-COCO, Supervisely, etc.)

Synthetic Training Data

Any dataset size you wish



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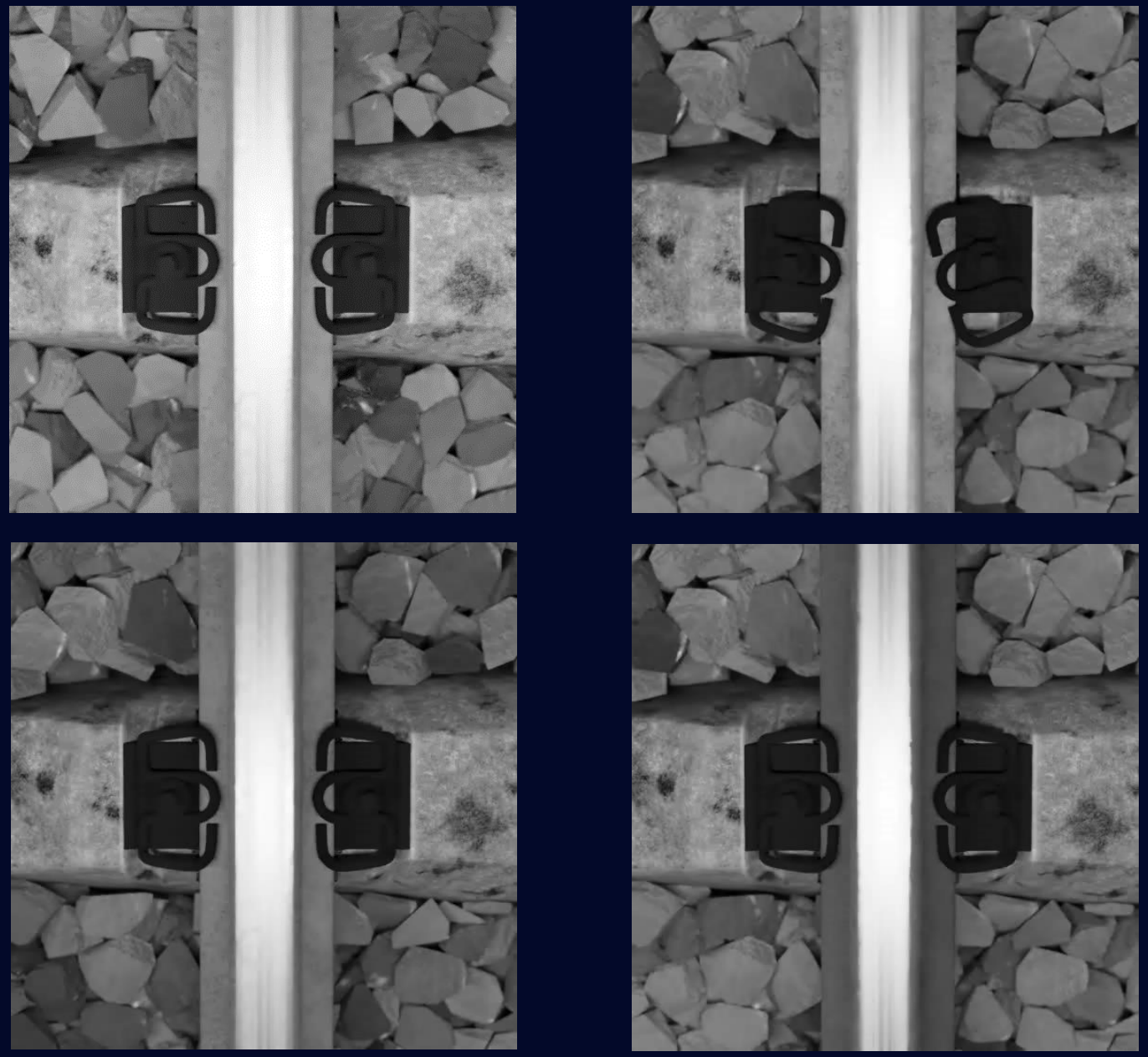


Railway Specific Parameters (just a few)

- Gradation curve of track ballast (Schotter Sieblinie, Körnung)
- Track curve Radius
- Sinusoidal cart motion
- Cart length, Bogie placement, etc.
- Polished rail head

General Parameters (just a few)

- Dirt, Trash, Rust, Moisture, etc.
- Defects, Missing, Misaligned, Fractured components, etc.

This system allows us to achieve unprecedented levels of accuracy in detection models.

ex-nihilo

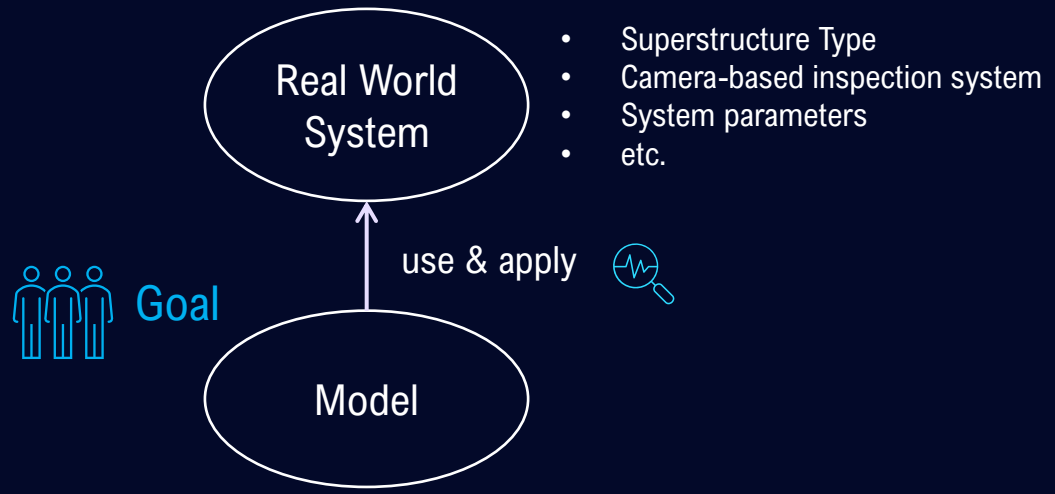
How
The ex-nihilo Process

The ex-nihilo Process

Real World System

- Superstructure Type
- Camera-based inspection system
- System parameters
- etc.

The ex-nihilo Process



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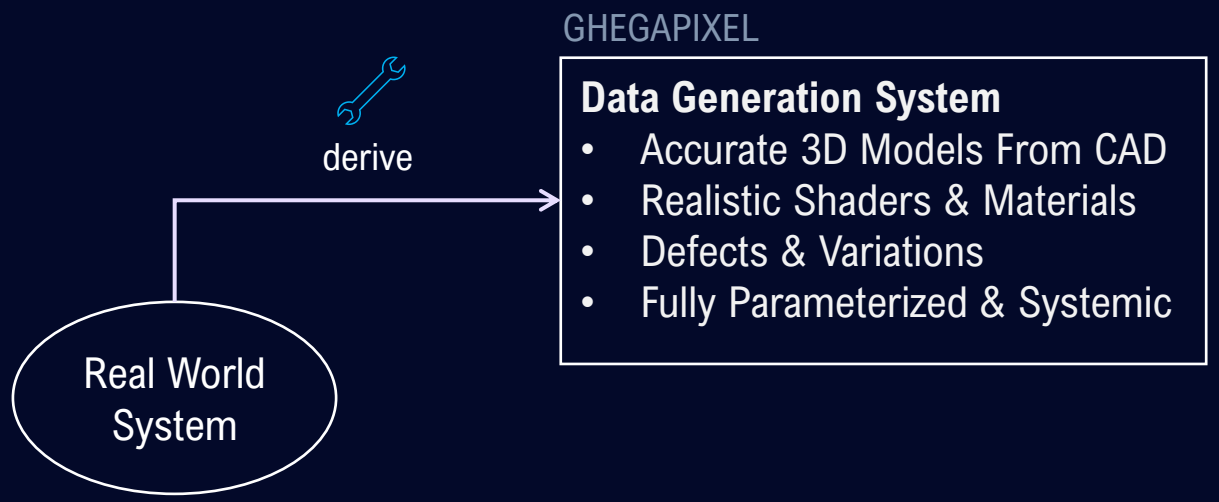

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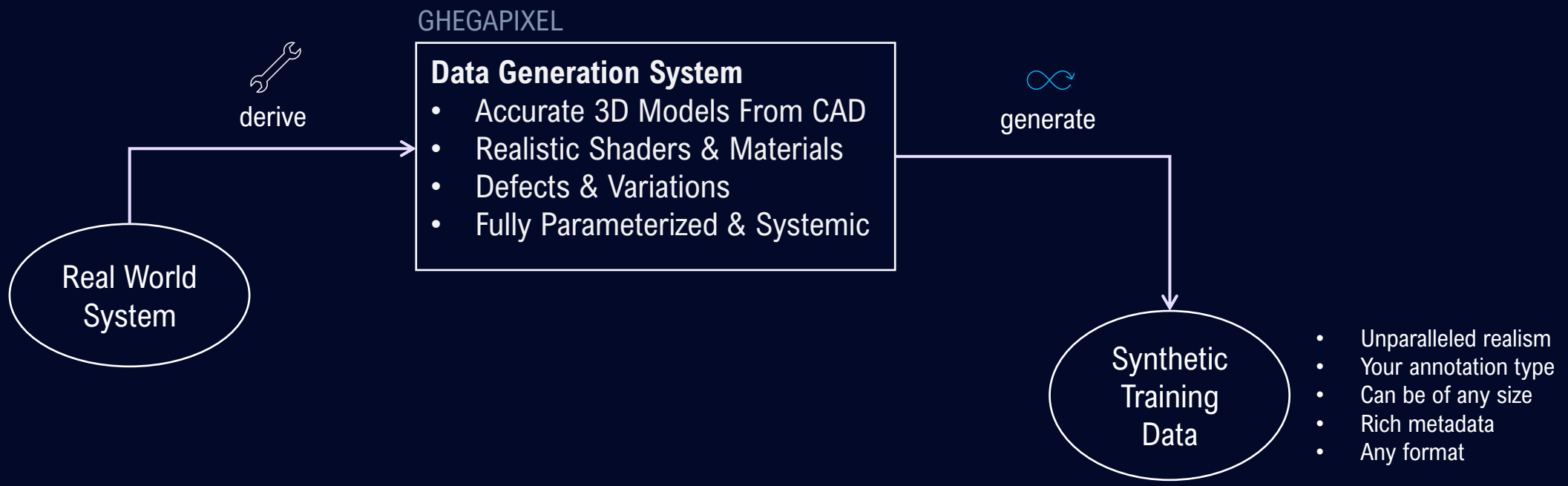

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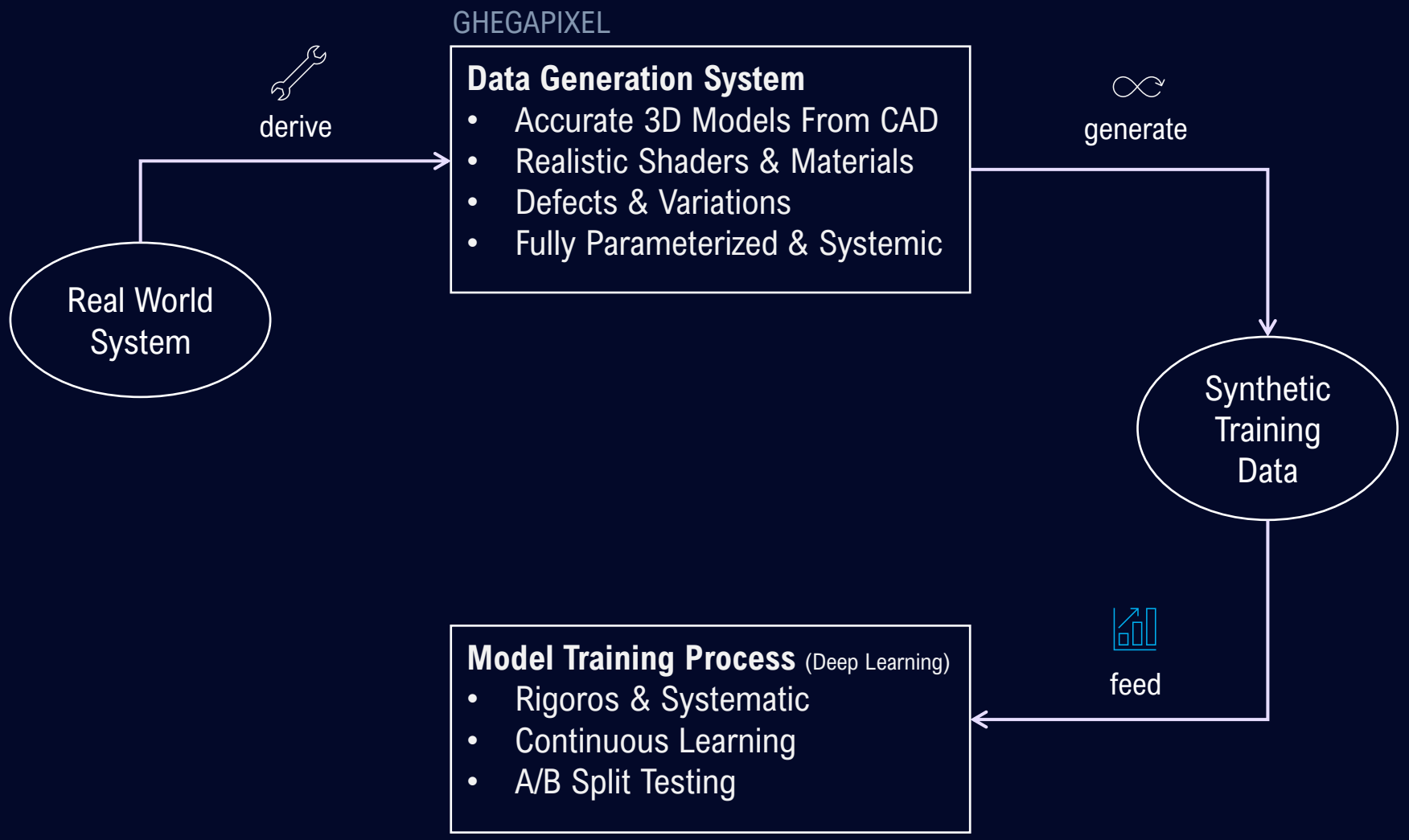

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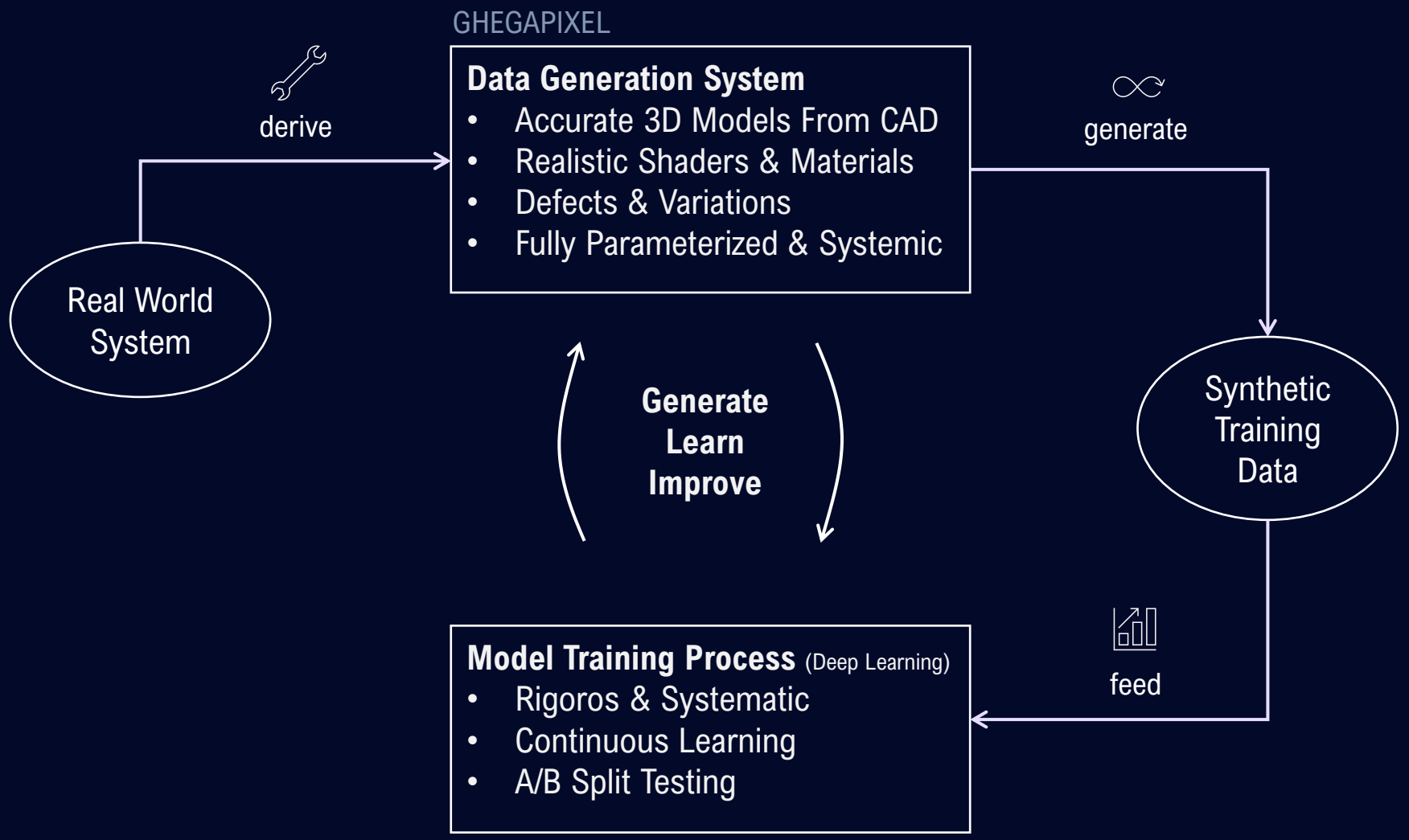

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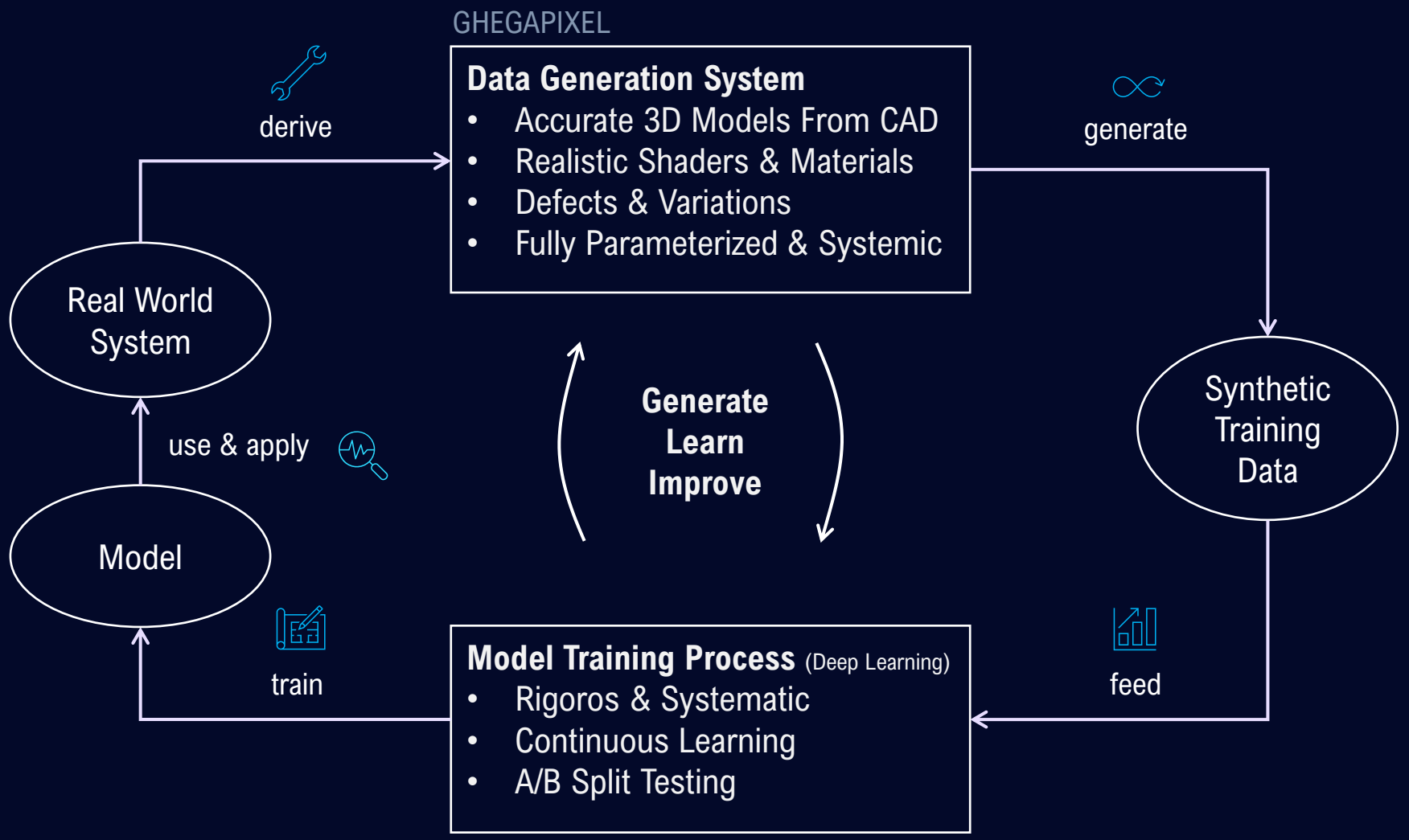

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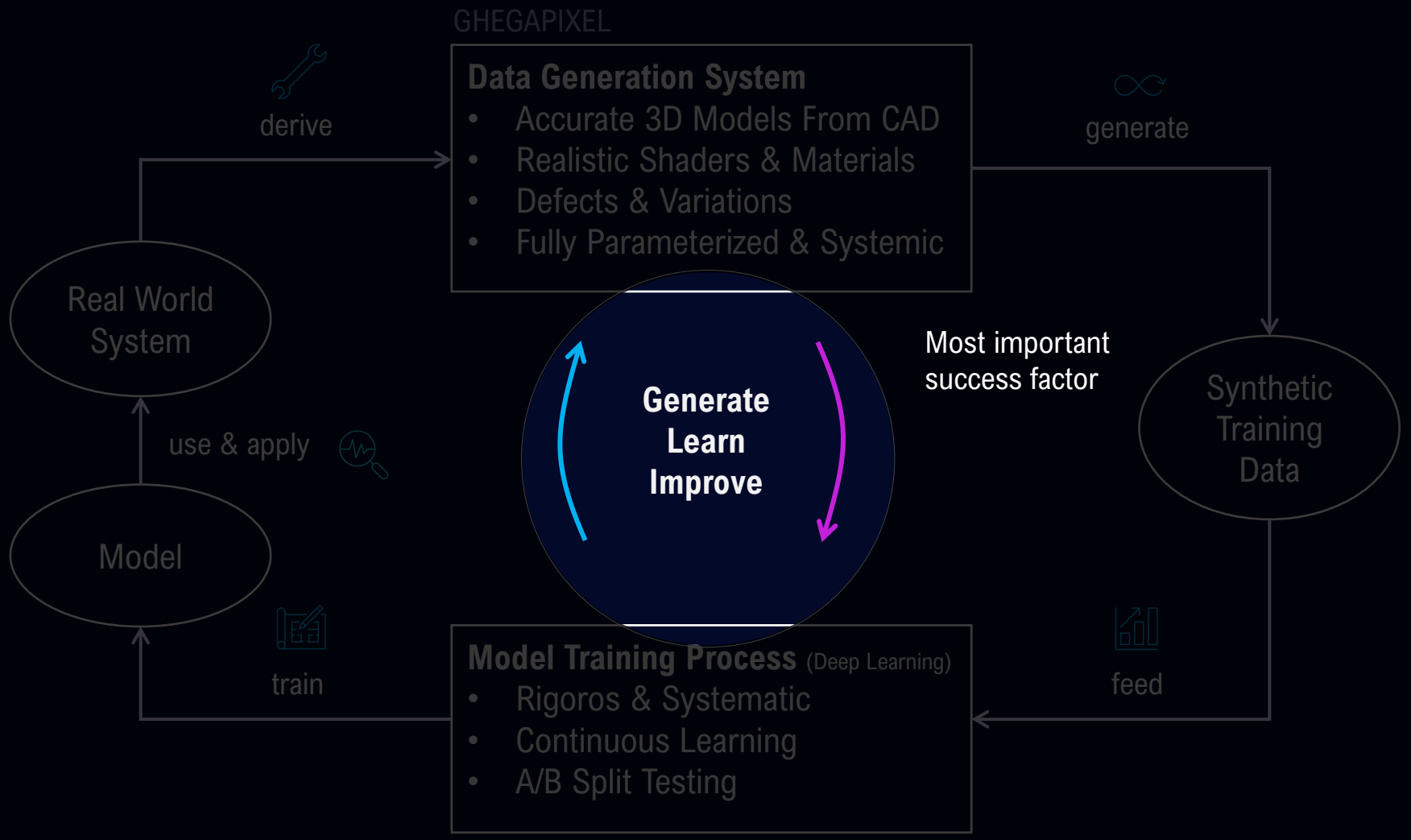

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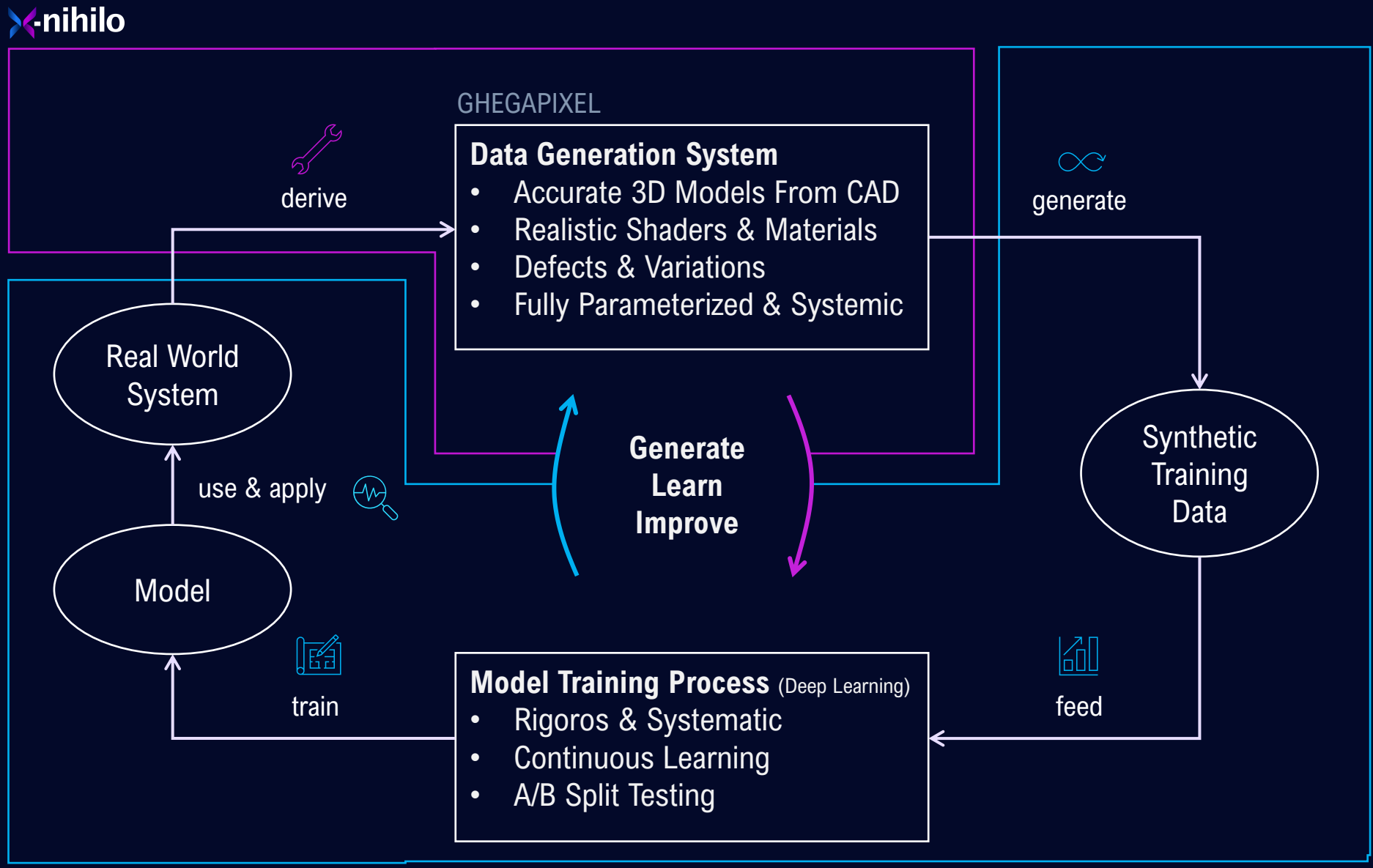

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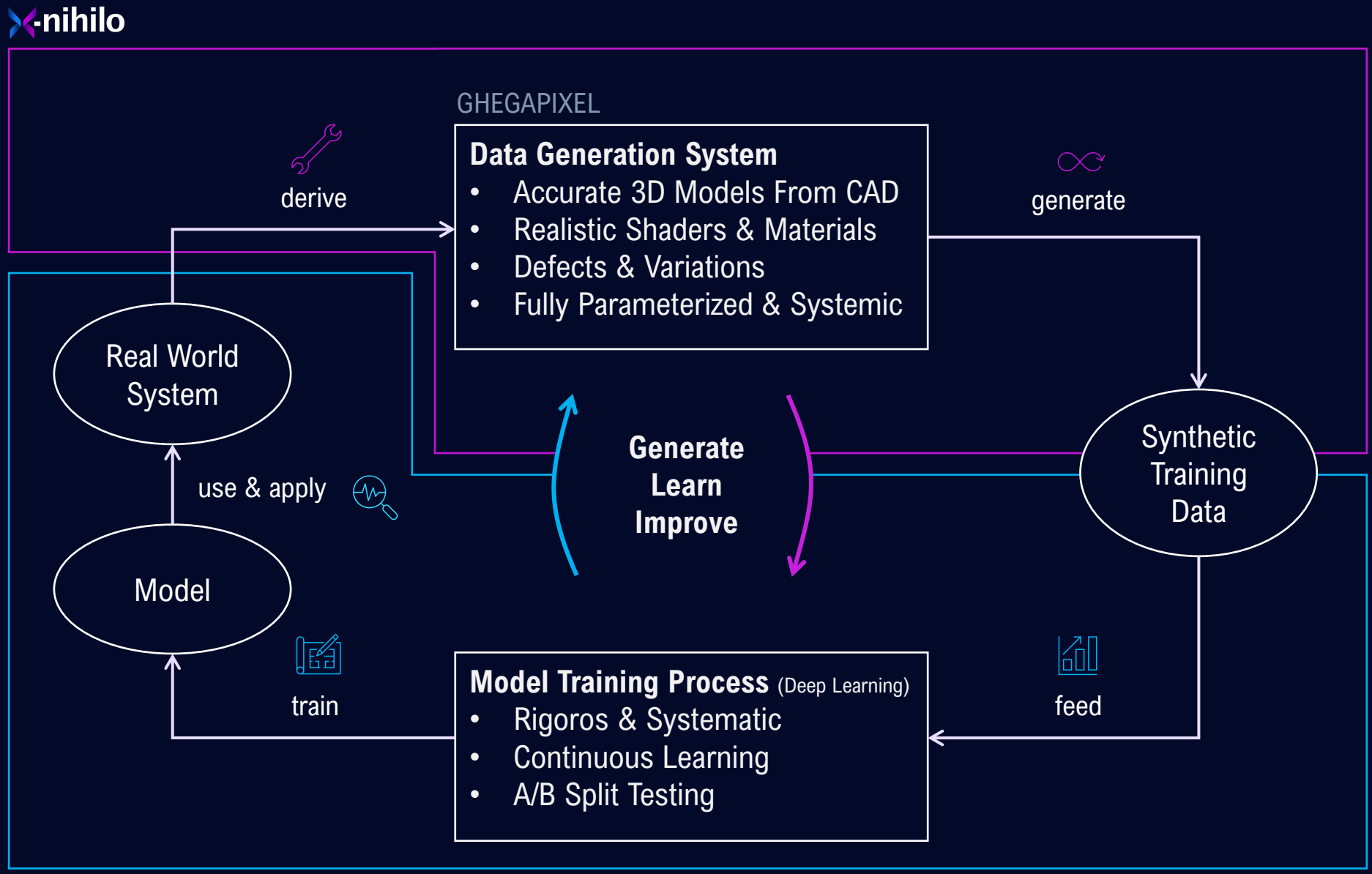

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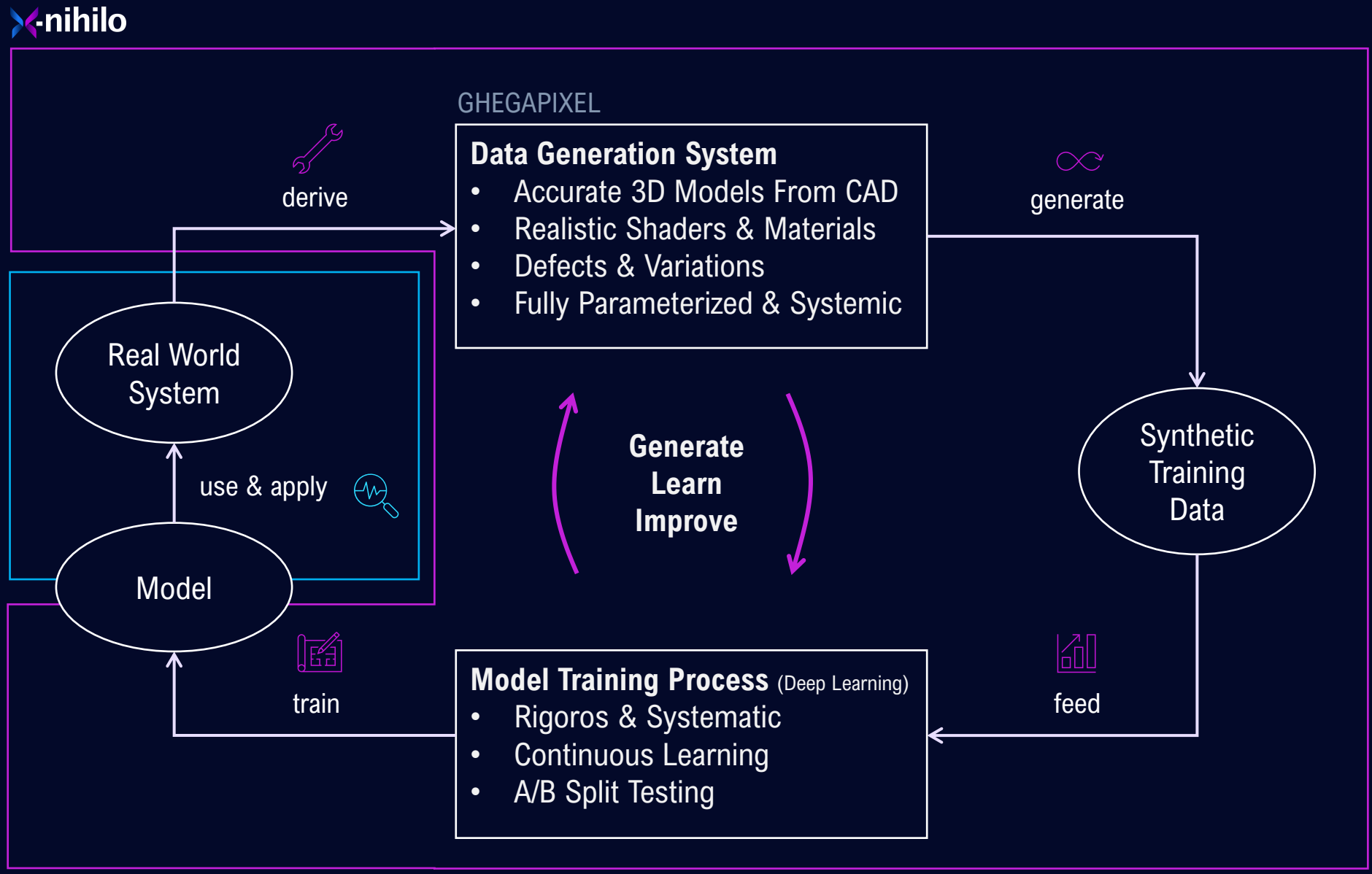

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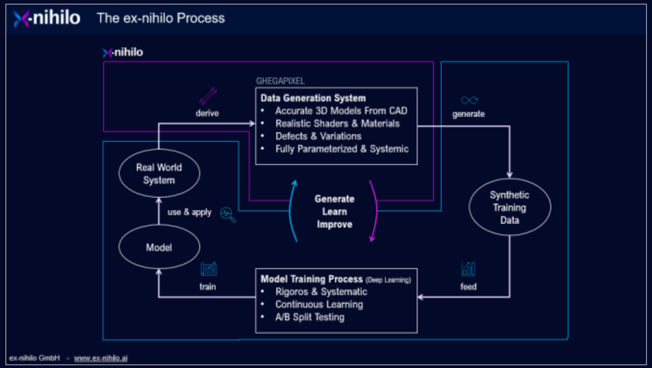

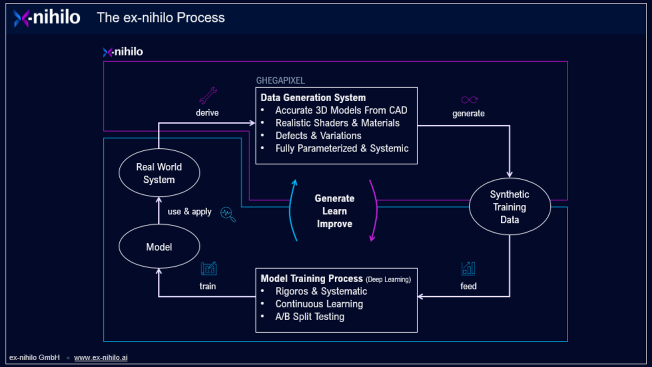

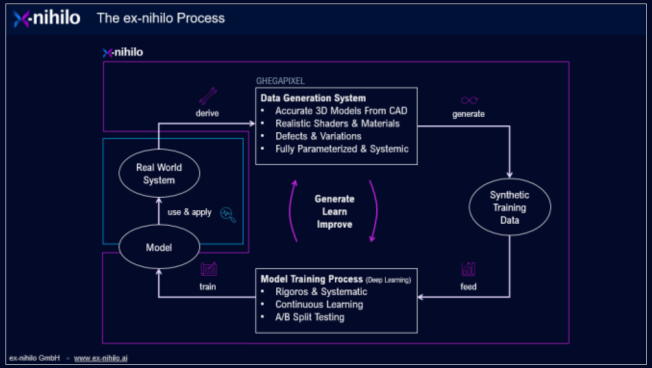

No Matter Which We Chose

All artifacts (Training Data, Metadata, Annotation, Models, Reports, etc.) can always be delivered by ex-nihilo to you

We will aso make sure our results are reproducible by you

ex-nihilo needs Access to

All relevant CAD Drawings for Creating 3D Representations of the Track Structure	Reference Data Representing Real-World Component Appearances by the Imaging System	System Parameters of the Imaging System Used to Capture the Images (Resolution, Focal Length, Placement, etc.)

Possible Project

Project Costs are Influenced by

Complexity of the imaging system that needs to be modeled

Diversity of the Superstructure Type and Tracks that shall be modelled

Number and Complexity of Defects to be modelled

Additional Deliverables (Software, Custom NN-Model Architecture, Statistical Analysis Reports, etc.)

NO Influence on the Project Costs have

The Amount of Training Data needed

The Number of Generate → Learn → Improve - Iterations

Simple Project

- ✓ Little to Medium Adaptions to Ghegapixel
  - Shaders and Materials can be reused
  - Standard Defect Type (missing, fractured, misaligned)
  - New Superstructure Type to be modeled
  - Modeled Imaging System needs small adaptions
- ✓ Off The Shelve NN-Model
  - An existing NN-Architecture (e.g. YOLOv8) is sufficient
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Demonstrate the viability of the ex-nihilo process by solving detection tasks using synthetic training data. Through experimentation and validation, this phase confirms that the concept is not only feasible but also lays the foundation for further development.

Phase 2 **Deep Refinement** 4-6 months

Here ex-nihilo commits to a deep refinement process. Building upon Phase 1, this stage focuses on making substantial improvements to the data generation. The goal is to tackle special problems and address **a wide array of edge cases**. This phase aims to elevate the solution's robustness and adaptability to even more real-world challenges.

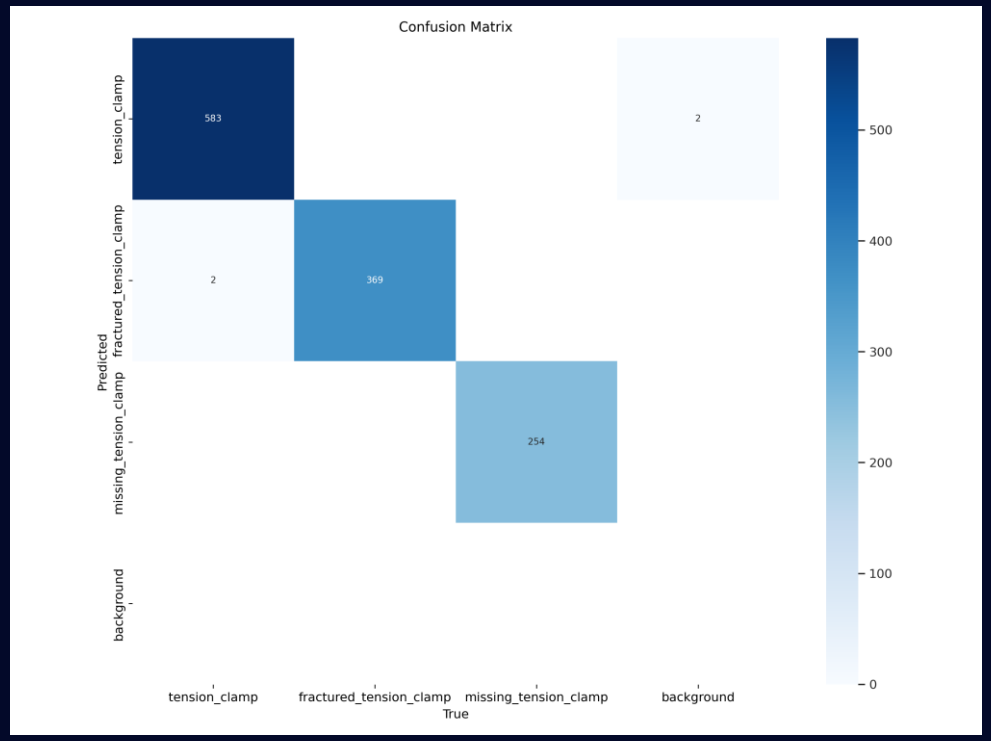
Why it Works

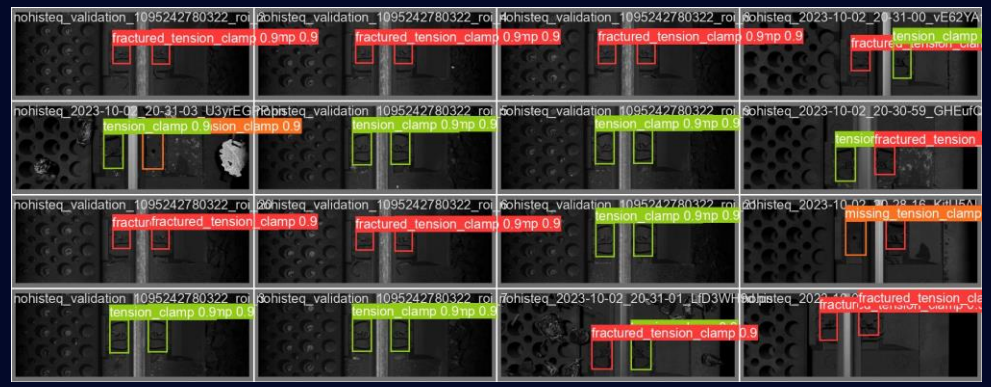
Why it Works

Let's look at a model trained by ex-nihilo

Why it Works

Real & Synthetic mixed





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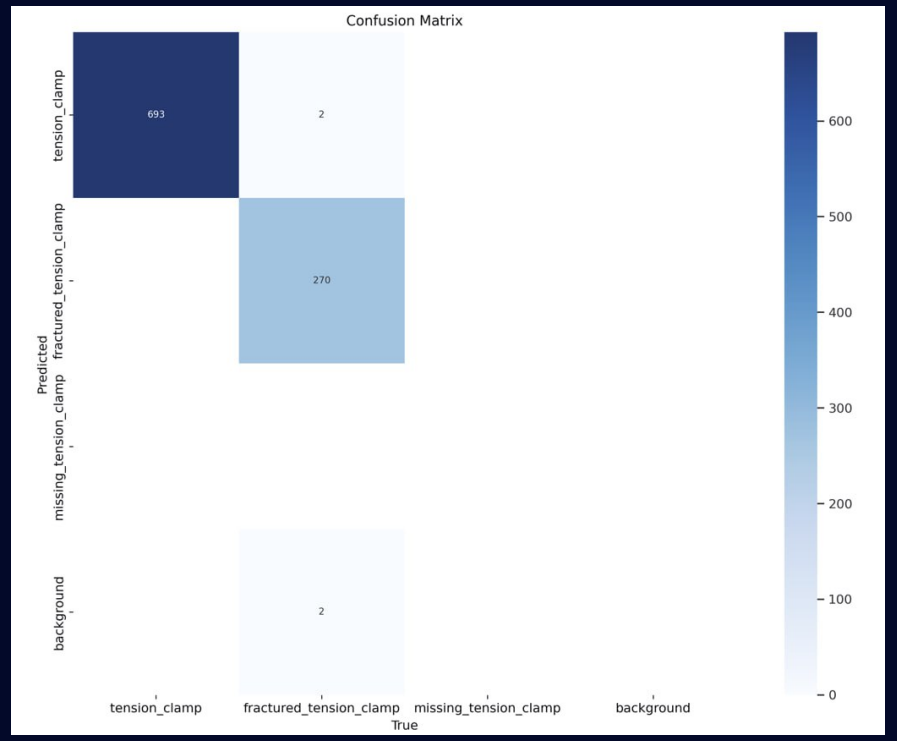

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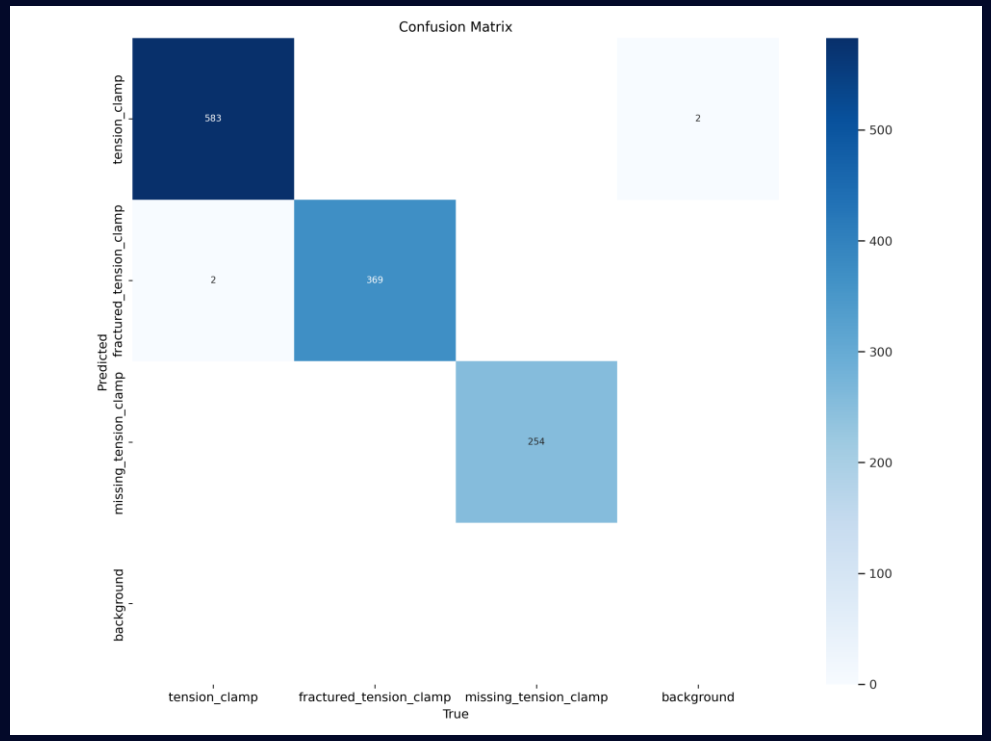

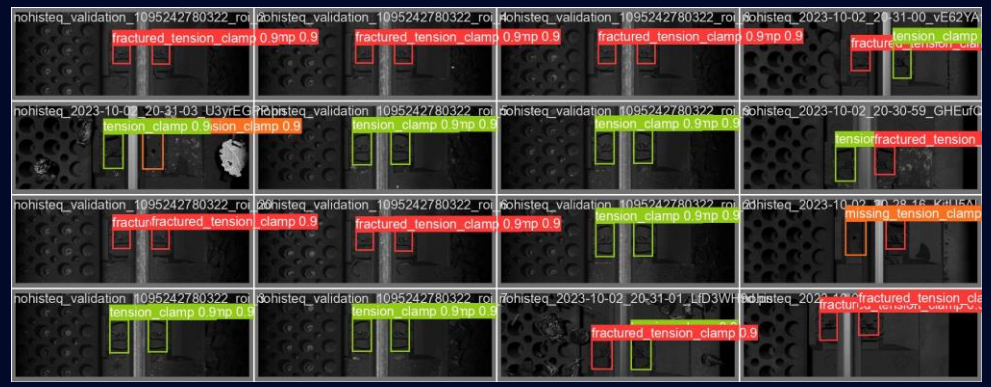

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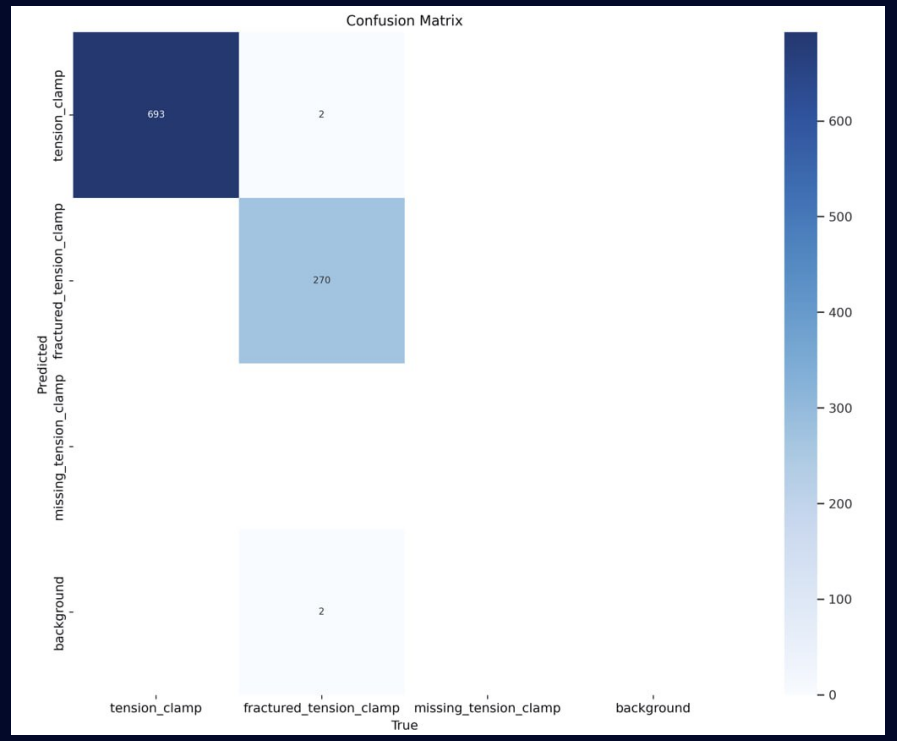

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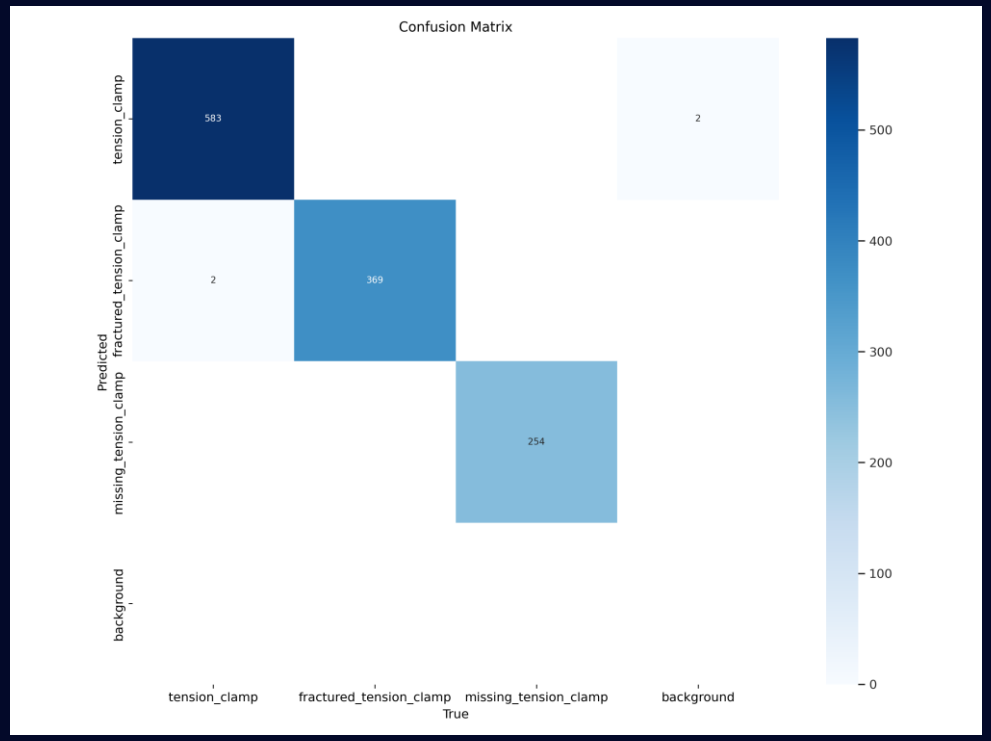

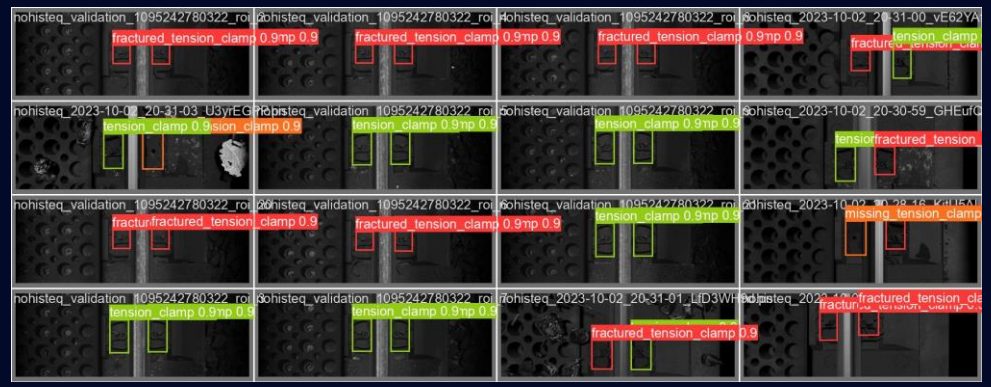

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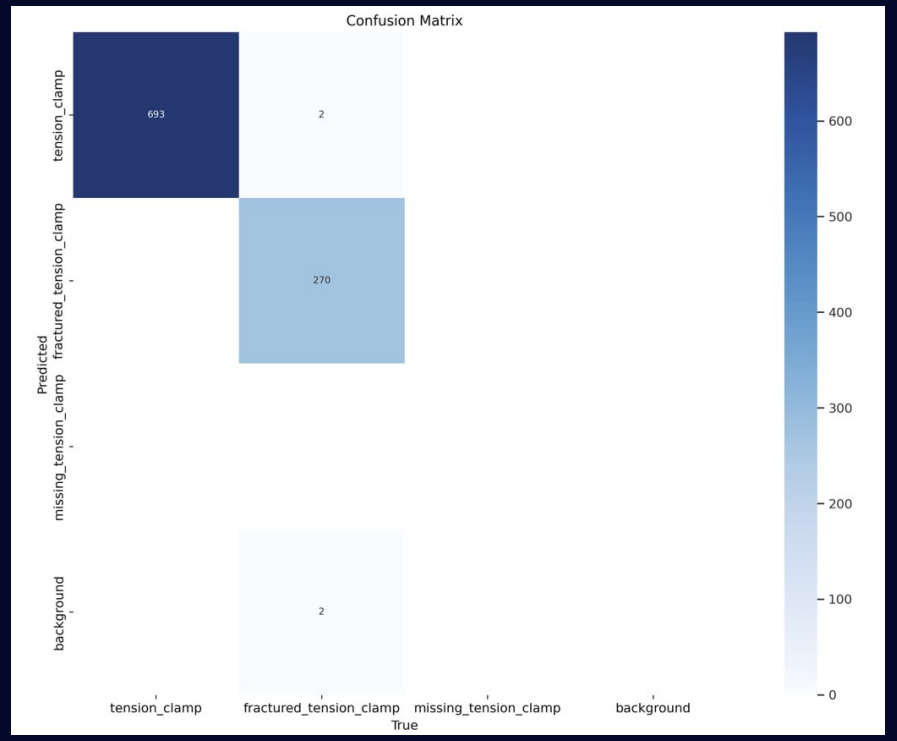

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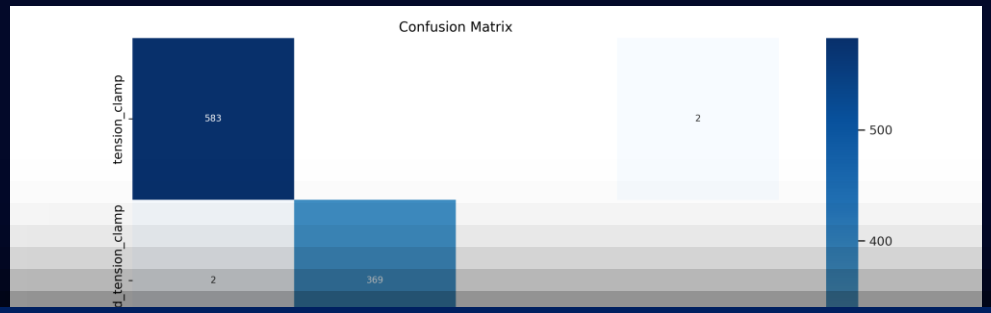

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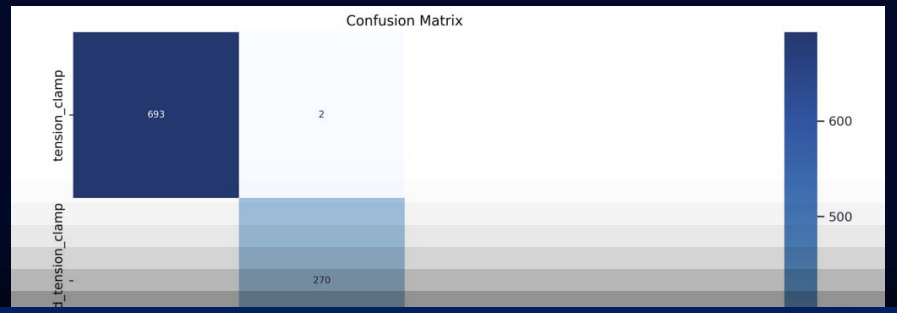

Trained On Synthetic Data Only

This model trained exclusively on synthetic data is the most accurate model for detecting fractured and missing tension clamps ever tested by our customer.

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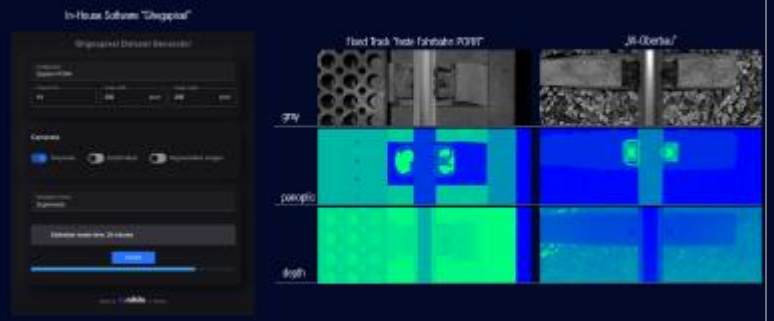

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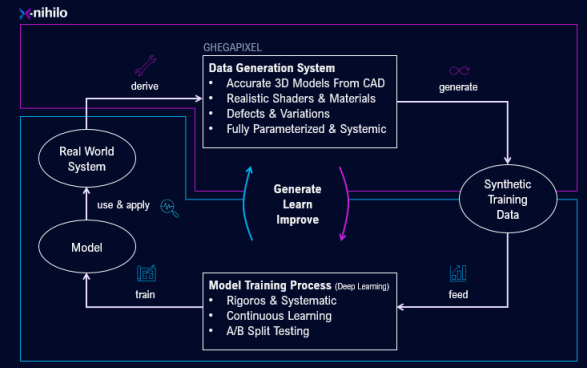
The ex-nihilo Process



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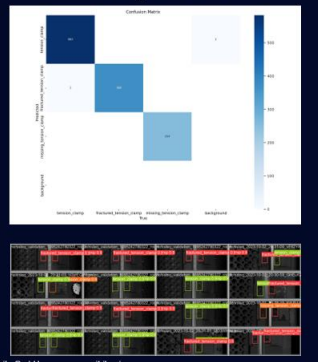
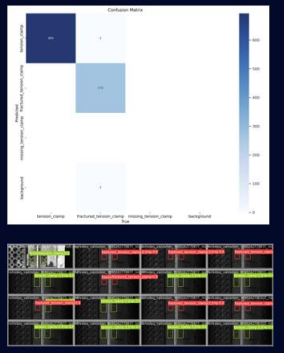


Real only (no missing)



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