Technology

Enabling physical AI safety detection through high-fidelity warehouse video annotation



CASE STUDY

TP.ai Dataservices

BUSINESS CHALLENGES

Accelerating HPC for physical AI

A global leader in accelerated computing, the client develops advanced AI and High-Performance Computing (HPC) systems powering next-generation physical AI applications.
To enhance static camera-based warehouse safety models, the client required large-scale, precision-annotated visual datasets simulating operational incidents and safety hazards.

Inconsistent incident capture
Critical safety events were not recorded systematically, making datasets unreliable for training AI models.

Safety and compliance exposure
Unsafe forklift operations, pedestrian proximity risks, non-compliant traffic zones, and improper equipment handling increased operational liability.

Material handling instability
Incorrect load positioning and product damage scenarios were difficult to document accurately, limiting operational improvement efforts.

Root cause visibility
Without structured, time-based annotation, identifying patterns such as distraction, unsafe trajectory, or improper load placement was extremely difficult.

BUSINESS CHALLENGES

Training physical AI models to detect and prevent warehouse hazards.

Training physical Artificial Intelligence (AI) systems to detect and prevent warehouse hazards requires more than raw footage. It requires structured, precise, and high-fidelity visual datasets. To train next-generation physical AI systems, the client needed large-scale, precision-annotated visual datasets simulating real operational risks.

Inconsistent incident capture
Critical safety events were not recorded systematically, making datasets unreliable for training AI models.

Safety and compliance exposure
Unsafe forklift operations, pedestrian proximity risks, non-compliant traffic zones, and improper equipment handling increased operational liability.

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Root cause visibility
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SOLUTIONS IMPLEMENTED

End-to-end, human-in-the-loop physical AI data production framework.

We deployed a structured, end-to-end Human-in-the-Loop (HITL) physical AI data production framework. This included controlled warehouse simulation, synchronized multi-camera capture, frame-level precision annotation, and rigorous quality governance aligned to Graphics Processing Unit (GPU) and High-Performance Computing training (HPC) standards.

Controlled warehouse simulation
Instead of relying on unpredictable real-world incidents, we recreated realistic warehouse environments in a controlled setting. Using staged automated guided vehicle and pedestrian interactions, we intentionally simulated near-miss events, improper routing, and material handling risks. This allowed the safe reproduction of hazardous scenarios that are rare, dangerous, or difficult to capture in live operations.

Multi-camera synchronized capture
To support GPU-driven model training and cross-angle detection, we implemented synchronized multi-camera recording across the simulated environment. This provided high-resolution, high-fidelity footage visual datasets suitable for large-scale AI ingestion and advanced computing environment.

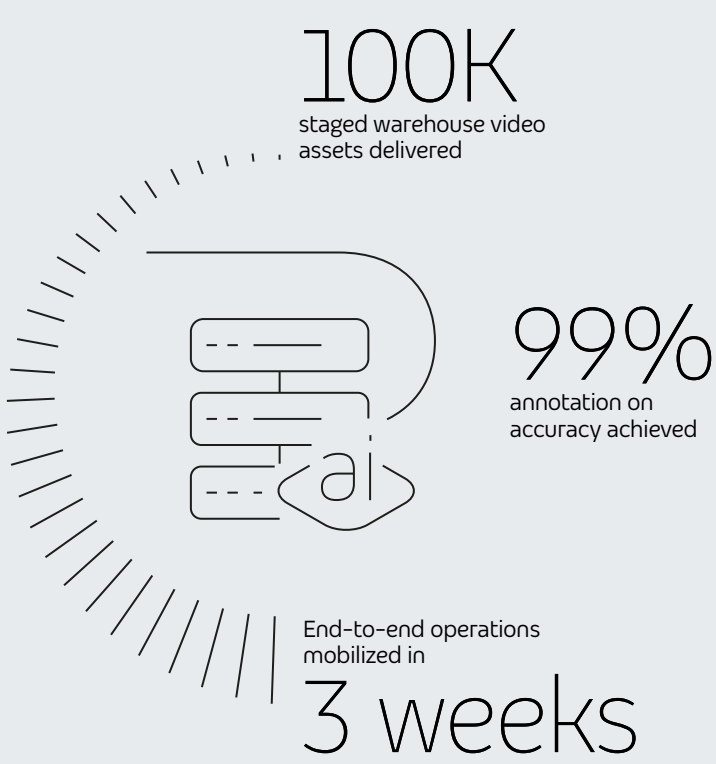
Human-in-the-loop quality governance
Before model ingestion, all annotated datasets underwent structured manual validation. Our quality control teams verified adherence to defined Standard Operating Procedures (SOP), ensuring annotation integrity, data consistency, and regulatory compliance. This governance layer preserved model training precision and protected downstream performance.

Precision temporal annotation
Video footage was annotated frame by frame with second-level temporal markers. Each object, movement, interaction, and unsafe behavior was precisely labeled. This granular annotation was critical for training models running on GPU and processed within HPC environments. The result enabled automated, real-time physical AI hazard detection.

REAL RESULTS

High-volume, high-precision dataset delivery

The high-fidelity, temporally precise dataset enhanced GPU-trained physical AI models for real-time incident detection and unsafe behavior identification. By transforming fragmented incident footage into structured, governed training data, the client accelerated physical AI deployment while strengthening operational safety and compliance.



TP.ai Dataservices establishes a strong foundation for effective and scalable enterprise AI end-to-end data services, designed and operated to improve AI performance through quality data, human expertise, and AI orchestration.

Contact us

to discover more about TP.ai Dataservices