



LMI TECHNOLOGIES

# FACTORYSMART® AI SOLUTIONS

FULL SERVICE AI & IOT POWERED INSPECTION SOLUTIONS  
FOR THE FACTORY

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# MACHINE LEARNING

## FOR THE MOST CHALLENGING PRODUCTION ENVIRONMENTS

The new FactorySmart® AI Solutions package from LMI provides you with a complete deep learning driven inspection service for your production line.

Unlike many rule-based systems that require you to develop your own model and neural network, we apply our specialized knowledge of deep learning models, neural networks, and AI infrastructure to develop and deploy a custom AI solution to solve your specific inspection application.

We start by identifying the right mix of vision hardware (sensors, cameras, processors) for your application. We then develop, deploy, and support the entire AI system—including data collection, augmentation, model design, model training, system implementation, scaling, and remote monitoring—to ensure your AI solution is operating at peak performance for the long term.

This is Service-Oriented Architecture (SoA) technology at its best. And what you get is a custom AI solution you can trust to deliver results.

### WHY FACTORYSMART® AI

#### **Accurate, Robust, and Flexible AI Classification**

We train models from images collected under a variety of ambient conditions. These models typically achieve >98% accuracy and can be expanded to support new classes after installation.

#### **Absolute Data Protection**

Our support for on-premises data collection capability and strict adherence to the highest standards in cybersecurity gives you the confidence that your data is 100% secure.

#### **Superhuman Grading for Maximum Productivity**

Our AI solutions automate product grading across your manufacturing process and allow you to dramatically improve yield and reduce operating expenses.

#### **Defect Detection for Reduced Dark Yield**

We use proven deep learning models to train on readily available “good” data and accurately detect anomalies during runtime, preventing embarrassing and costly defects from being shipped to customers

#### **Lifecycle Support, Enhancement, and Maintenance**

We provide remote model retraining and system performance monitoring after deployment for the lifetime of the system. This approach minimizes system cost and allows for pipeline optimization after initial implementation, as well as rapid adaptation to new production equipment or environment changes.



# OUR COMPETITIVE EDGE

## A COMPLETE AI-DRIVEN INSPECTION SOLUTION

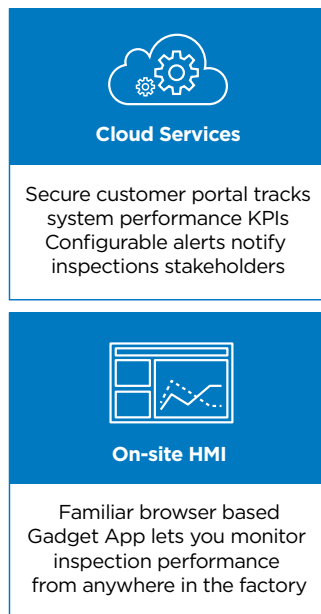
Our FactorySmart® AI Solutions Group provides friendly and cost-efficient development, testing, deployment, and lifecycle support of a **full-suite custom AI-based solution** for inline inspection and optimization applications where manual and rule-based approaches fall short.



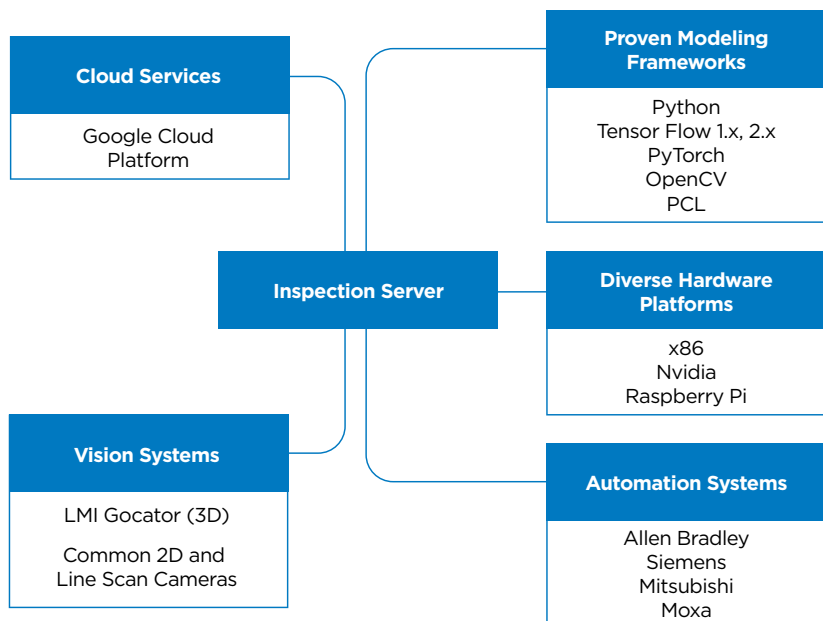
This robust AI solution is designed for the unique needs of your factory, and leverages integrated deep learning, dedicated edge devices, and IIoT/5G connected cloud services to introduce the transformative power of Machine Learning into your production line.

### The System Architecture

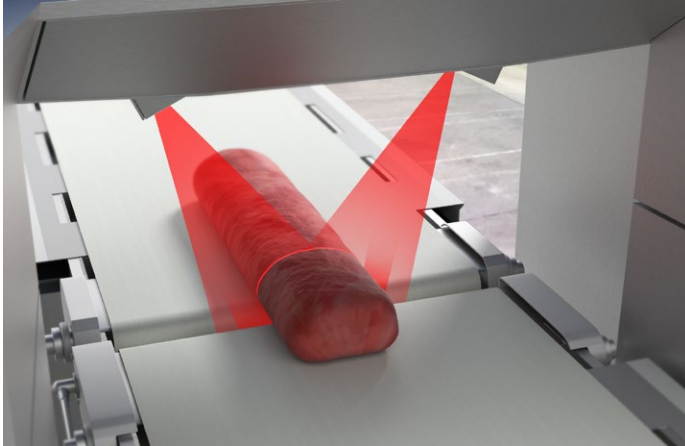
#### User Experience



#### System Description

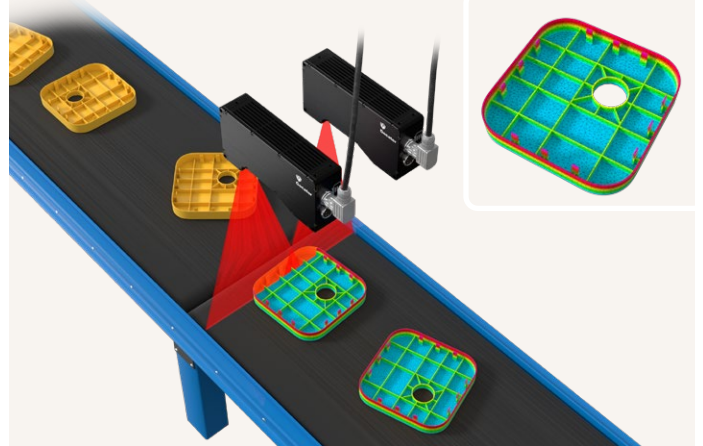


# EXAMPLE INDUSTRIES



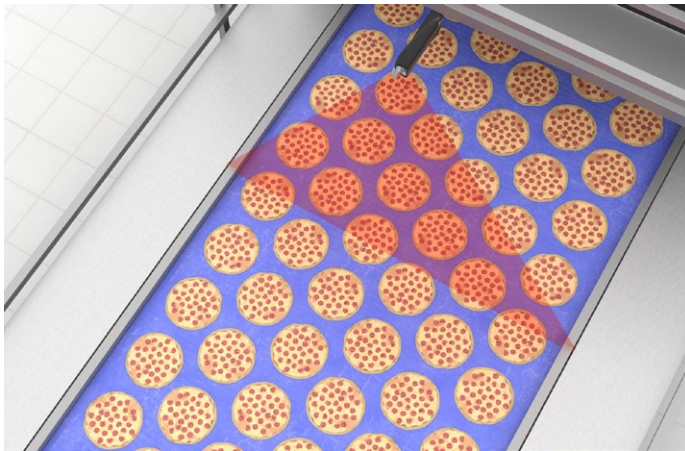
## MEAT PROCESSING

Automated inspection maximizes yield and minimizes operating expenses in meat packing factories. We expand on-site support teams with world class software and AI engineers.



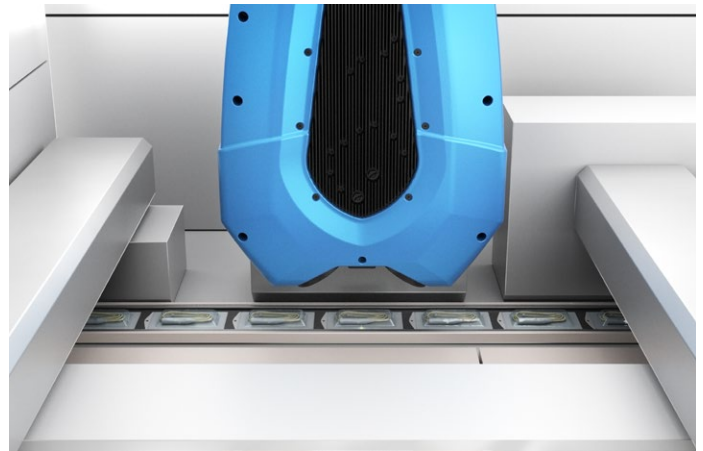
## CONSUMER PRODUCT

100% inspection reduces field failures, and object detectors trained using 3D point clouds find short shot defects in injection molded plastic parts.



## FOOD AND BEVERAGE

Multi-stage pipeline uses both object detectors and anomaly detectors to identify specific and unclassified defects and eliminate costly dark yield in high volume production lines. Over time, unclassified defects are added to specific defects to improve defect root cause tracking.



## LIFE SCIENCES

Flexible model, hardware, and automation integration options work with existing inspection systems. State of the art imaging and AI models detect multiple defects on scientific glass.

# THE ENGAGEMENT WORKFLOW

1

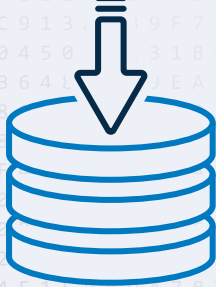


## QUALIFICATION

You know your needs best. We work with you to scope the problem and solution.

- ✓ We evaluate your technical requirements and project scale to map out next steps

2

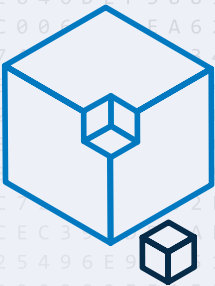


## DATA COLLECTION

High volume manufacturing generates tons of data. We start seeing results by sampling just a few hours worth of data.

- ✓ We provide unintrusive and 100% secure onsite system setup and high-efficiency data collection (3D point cloud, 2D intensity, and .png) from your production line

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## INITIAL MODEL/FEASIBILITY

We apply standard CNN-based models to prototype solutions to fit your inspection challenge.

- ✓ We develop an optimized model prototype and provide you with a detailed feasibility report for you to validate

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## SYSTEM AND MODEL DESIGN

This is where we start to modify off-the-shelf models and pipelines to deliver peak performance.

- ✓ We then develop a system blueprint and custom data pipelines that can include one to multiple models, depending your inspection requirements

# THE ENGAGEMENT WORKFLOW

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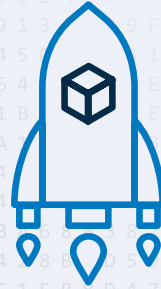


## MODEL TRAINING

We train, test, fine-tune then extract the most precise model for deployment.

- ✓ We take care of all data labelling and training to develop an accurate, reliable model that meets your throughput needs
- ✓ We test run each model to evaluate performance and accuracy of results
- ✓ We hone the model based on pilot performance data to ensure the most accurate and repeatable results upon deployment

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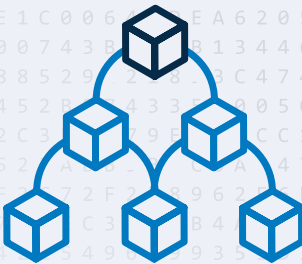


## DEPLOYMENT

In just a matter of weeks, we can commission a production inspection system.

- ✓ We deploy a complete AI solution into your factory floor—including vision systems, automation systems, inspection edge device with onboard custom Human Machine Interface (HMI), proven modeling frameworks, cloud-based data services and more

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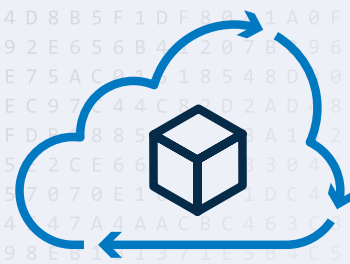


## SCALE

We benefit from transfer and fleet learning. And so will you. You see significant savings by replicating the first inspection.

- ✓ We provide inspection systems that easily scale up to handle high volume applications

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## LIFECYCLE SUPPORT

Analyze inspection data on your customer portal, or wait for an alert. We've got you covered.

- ✓ We provide dedicated remote monitoring of model and system performance in order to continuously evolve your AI solution to meet changing production requirements

# EXAMPLE APPLICATIONS

## WHY FACTORYSMART® AI IS RIGHT FOR YOU

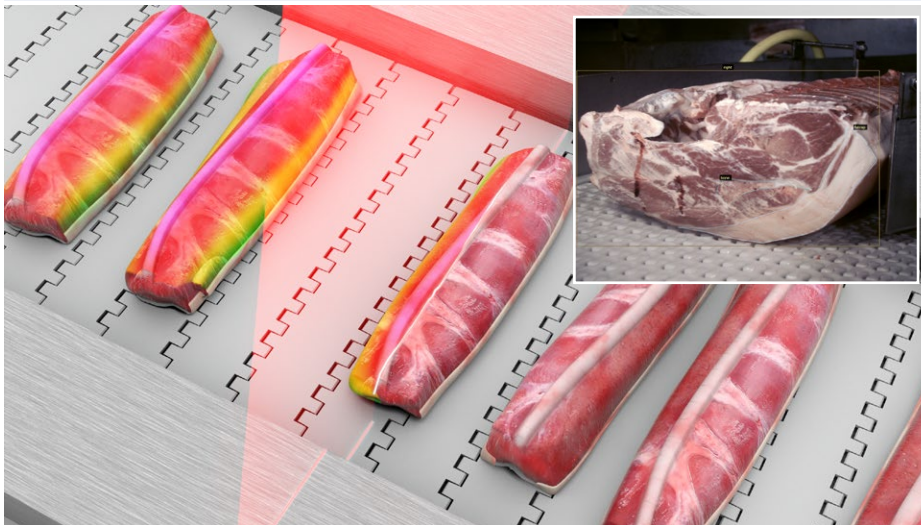
### Loin Sort



### AI Methodology

- AI model performs inline classification of left side or right side pork loins traveling on a high-speed conveyor
- Acquires image and processes based on height, minimum area, gap between samples, and max length
- Outputs sort decision to downstream machinery

### Loin Pull Grading

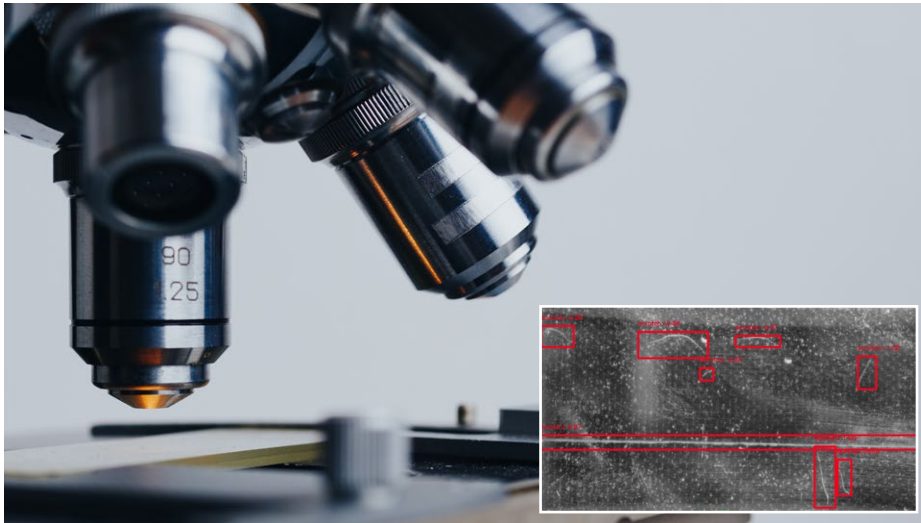


### AI Methodology

- Object detector AI model locates middle region of loin
- AI segmentation model locates fatcap and shoulder bone
- Vision tools extract Figure of Merit (FOM) from fatcap mask beneath bone
- Loin grade reported to external controller for cut profile setting
- Outputs four signals to downstream automated slicer

# EXAMPLE APPLICATIONS

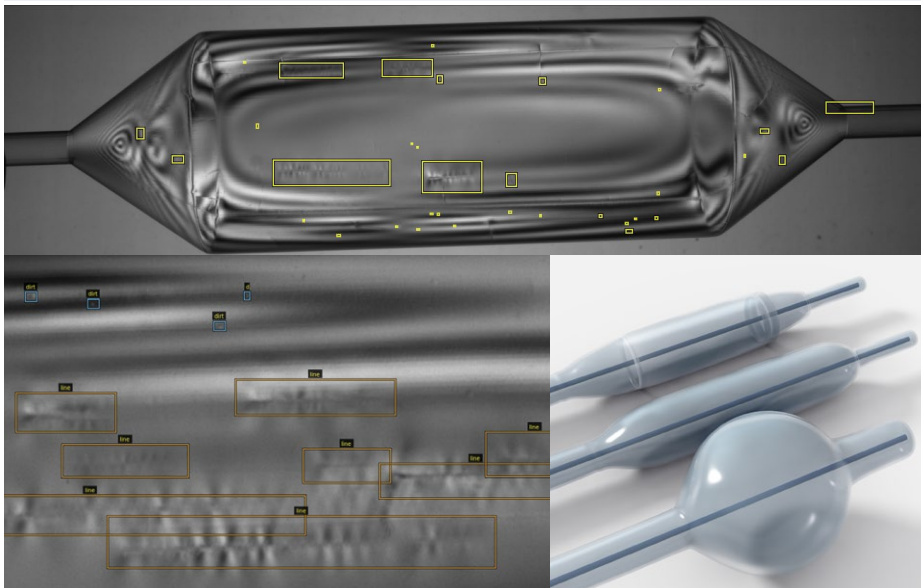
## Scientific Glass Defect Inspection



### AI Methodology

- Inspection system finds defects on scientific glass slides
- AI object detection models locate defects such as: corner chip, edge chip, and scratch
- Separate AI classification model determines clean slide Pass/Fail

## Medical Balloon Inspection



### AI Methodology

- Inspection system finds 18 different defects on 10-50 different balloon types
- High precision imaging with rear illumination and specialty polarizing and columnizing
- AI object detection model identifies defects and compares defect type and size to handbook specifications

# EXAMPLE APPLICATIONS

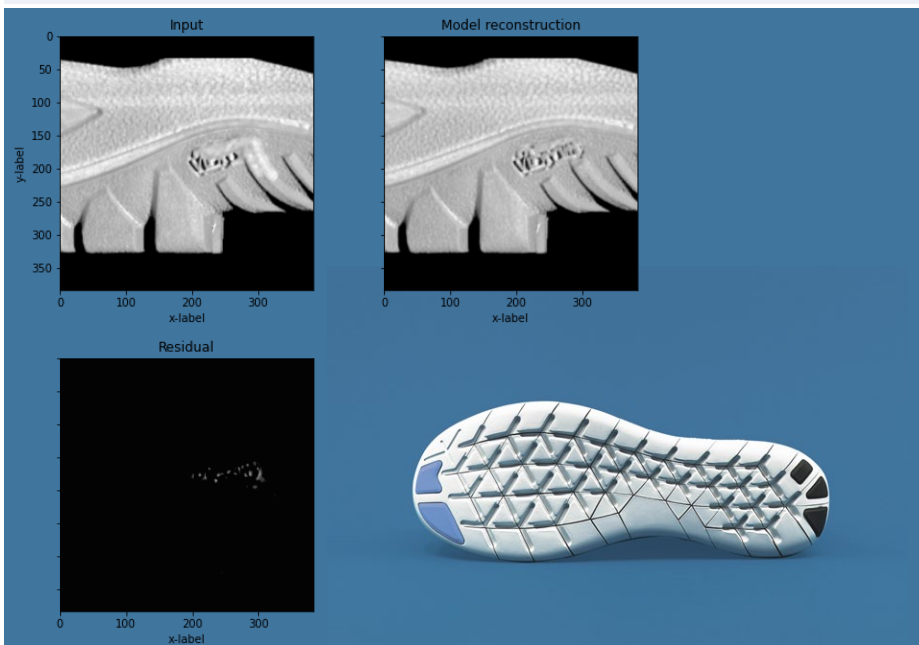
## Sausage Defect Inspection



### AI Methodology

- Inspection system to detect hotdog/sausage casing defects
- Area-scan or Gocator® 3D smart sensor for data collection
- AI Object detector model identifies sausages and defects

## Shoe Sole Inspection

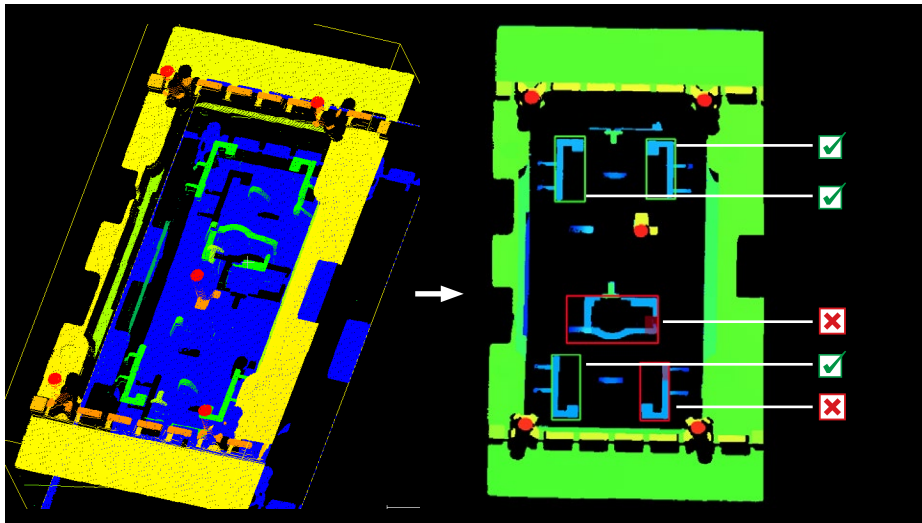


### AI Methodology

- Inspection system to detect mold size, shape, and any manufacturing defects
- Gocator® 3D smart sensor for data collection
- AI object detector focuses on key features
- AI anomaly detector trained on good images identifies defects

# EXAMPLE APPLICATIONS

## Short Shot Inspection

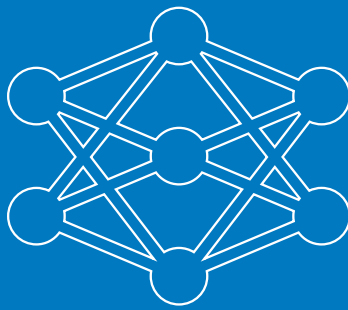


## AI Methodology

- Robot pulls part assembly from injection molding machine and scans parts over dual Gocator® sensor imaging system
- Inspection system acquires and processes the 3D point clouds
- Converts 3D point cloud to height map
- Object detection model locates bracket, socket, and short shot
- Sends Ethernet/IP Signal to downstream automation to scrap defective parts



- ✓ Advanced AI models for solving difficult classification, defect/object detection, and semantic segmentation challenges
- ✓ Easy integration with industry standard cameras and automation systems
- ✓ Simple browser based UIs for onsite configuration and performance monitoring
- ✓ Last mile integration services for minimizing capital and operating expenditure
- ✓ Remote support and performance dashboards
- ✓ Configurable alerts for KPI monitoring



## FactorySmart® AI Solutions

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### AMERICAS

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### ASIA PACIFIC

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