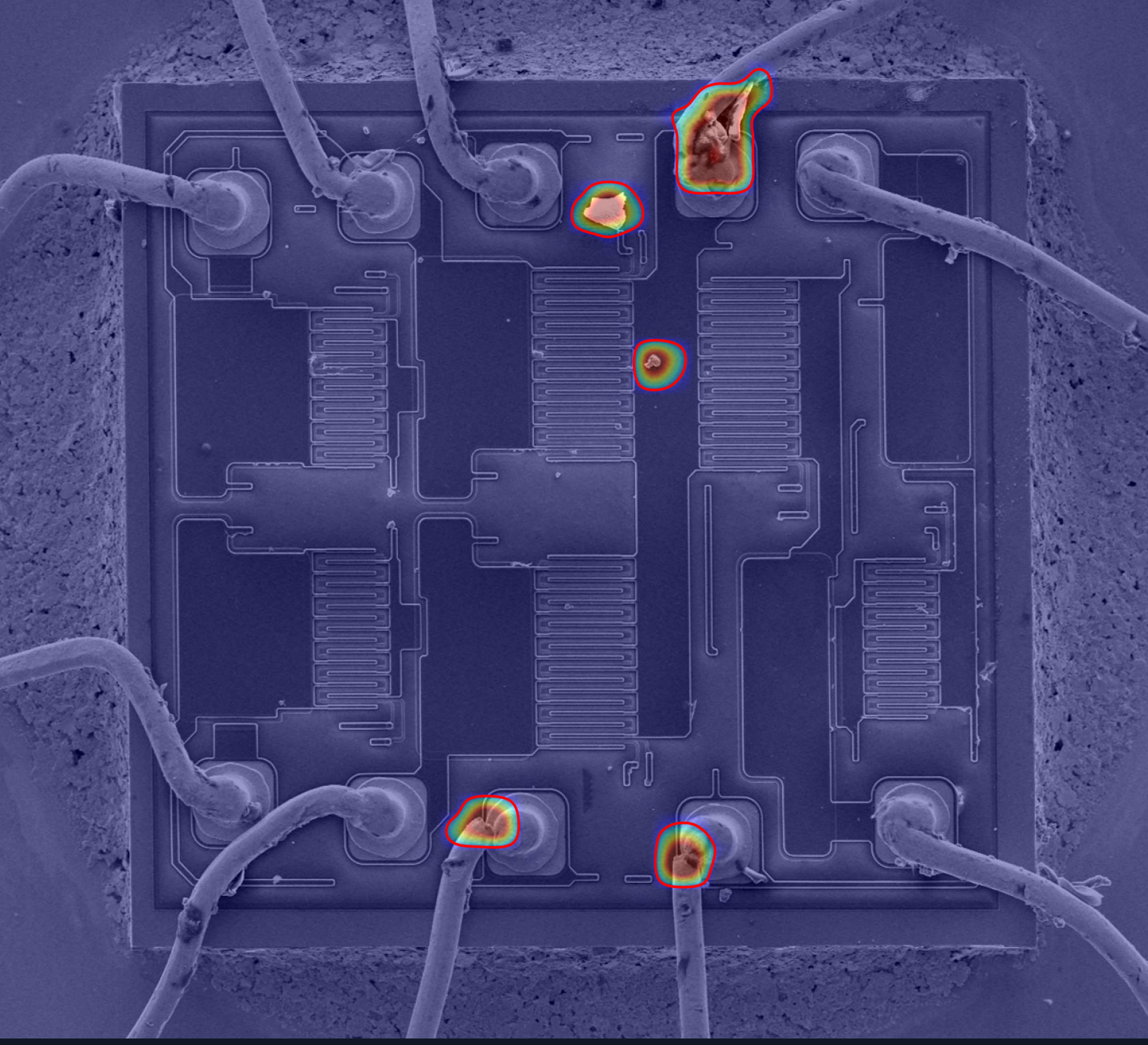


Stop unseen defects from halting your production.

Detect 100% of excursions in your manufacturing or maintenance processes. Our AI platform helps you reduce downtime and increase yield.

ANOMALY TDA
A DATAREFINER COMPANY

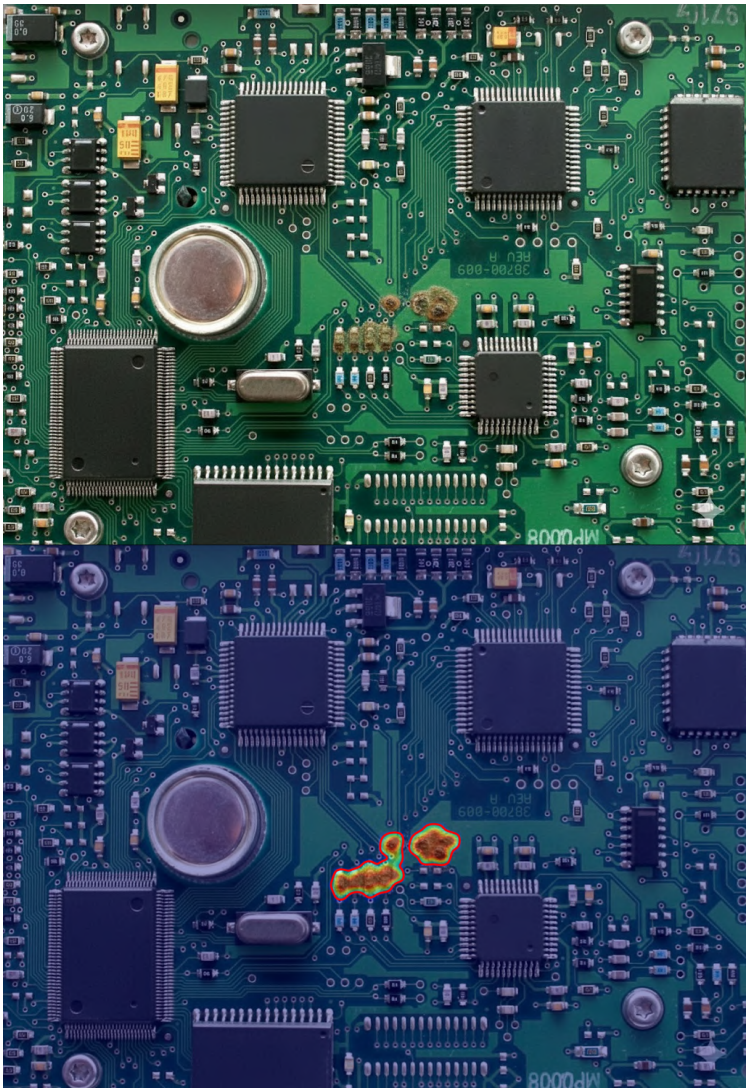
THE PROBLEM WE SOLVE

What Slips Through Supervised Detection Costs You

Traditional object detection systems require extensive labelled datasets and still miss rare or unknown defect types.

In contrast, unsupervised visual anomaly detection **approach learns quality standards directly from the live production line**, adapting to real conditions instead of fixed training samples.

It **identifies both frequent and low-occurrence anomalies** within seconds, eliminating weeks of manual training and enabling continuous, self-improving inspection throughout the manufacturing process.



Trusted by

intel

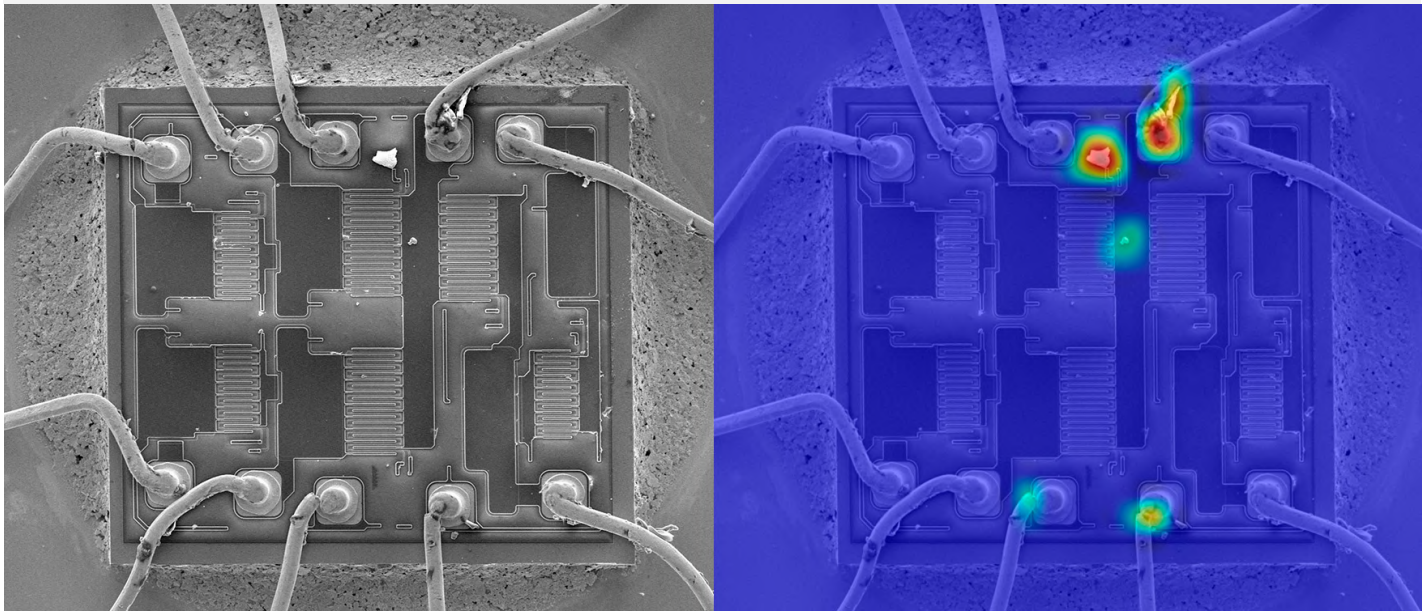
Rolls-Royce

skywater

DAIMLER

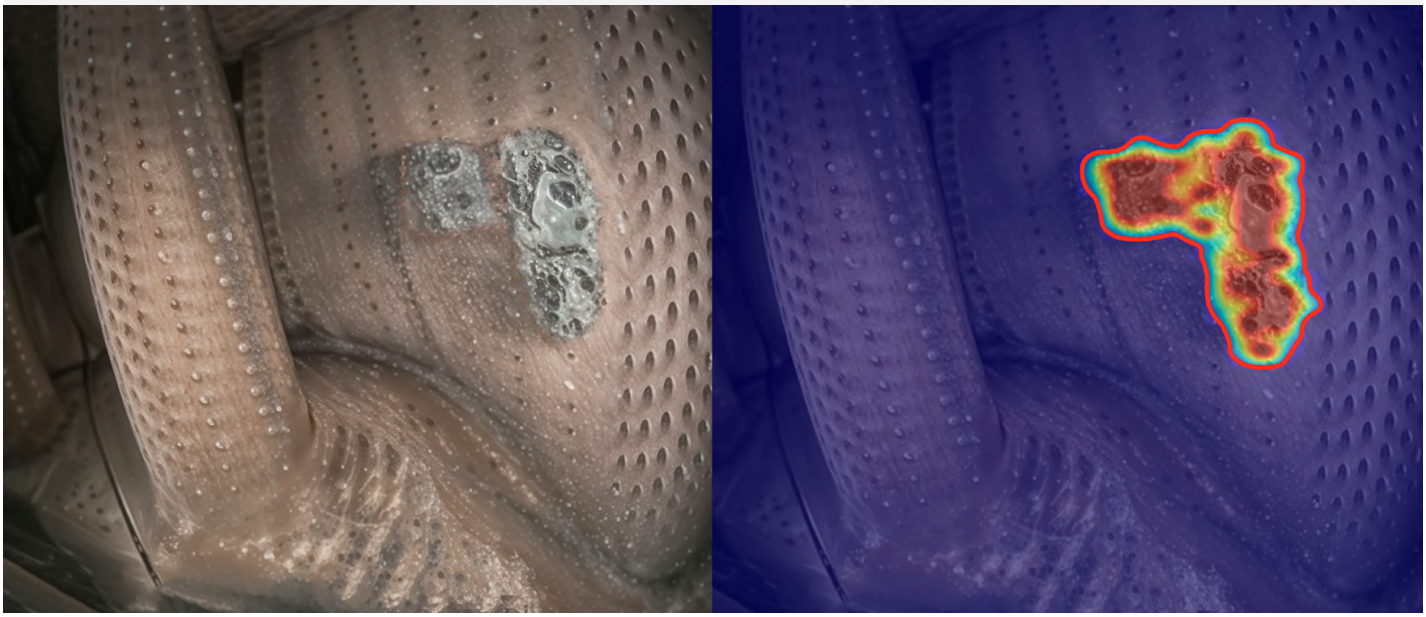
SEM Image Analysis for Chip Production (Intel Corp)

For Intel, AnomalyTDA provides **unsupervised image detection** for real-time analysis of Scanning Electron Microscope (SEM) images. This approach is superior for **catching subtle, previously unseen defects** (like microfractures or contamination) that supervised systems miss. New anomalies can be immediately labelled, and multi-class classification enables proactive process control. The result: fewer escapes, higher yields, and a resilient production line. AnomalyTDA is leveraged for a **vast number of other high-value applications** beyond this specific use case.



Anomaly Detection in Aircraft Engines (Rolls-Royce PLC)

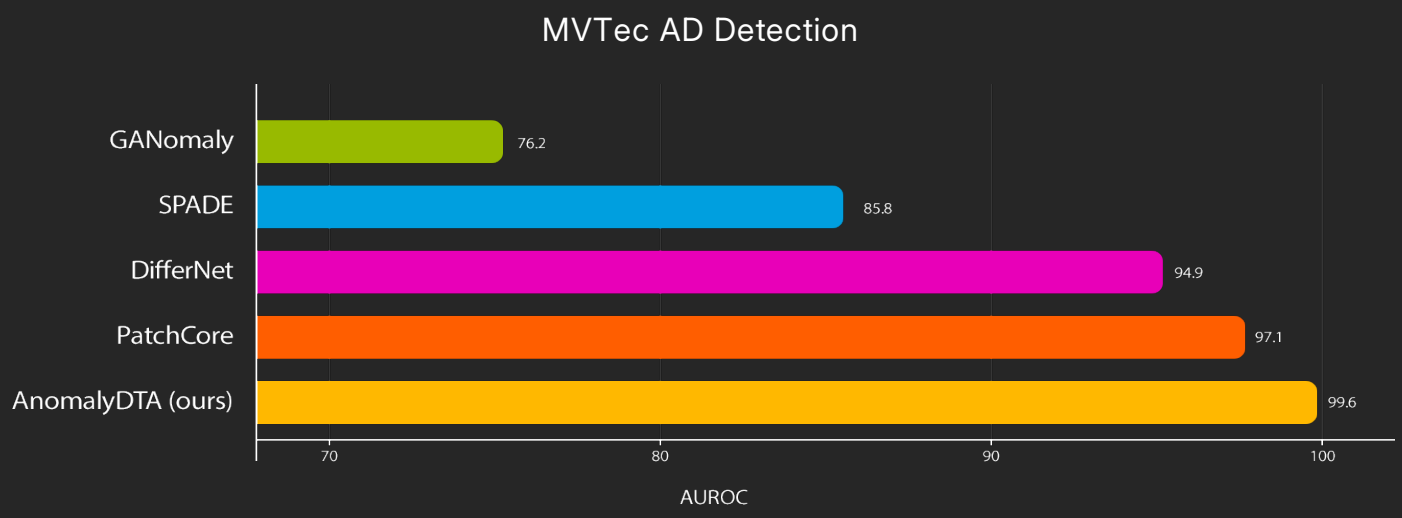
Partnering with Rolls-Royce PLC, AnomalyTDA employs advanced **unsupervised anomaly detection** on high-resolution aircraft engine images. This approach is superior for pinpointing subtle flaws—like micro-cracks or wear—that often evade traditional inspection methods. This capability has accelerated problem identification by at least **three times**, revealing **defects previously undetected**. By highlighting these issues early, we enable precise maintenance, significantly **reducing downtime** and **enhancing engine reliability**.



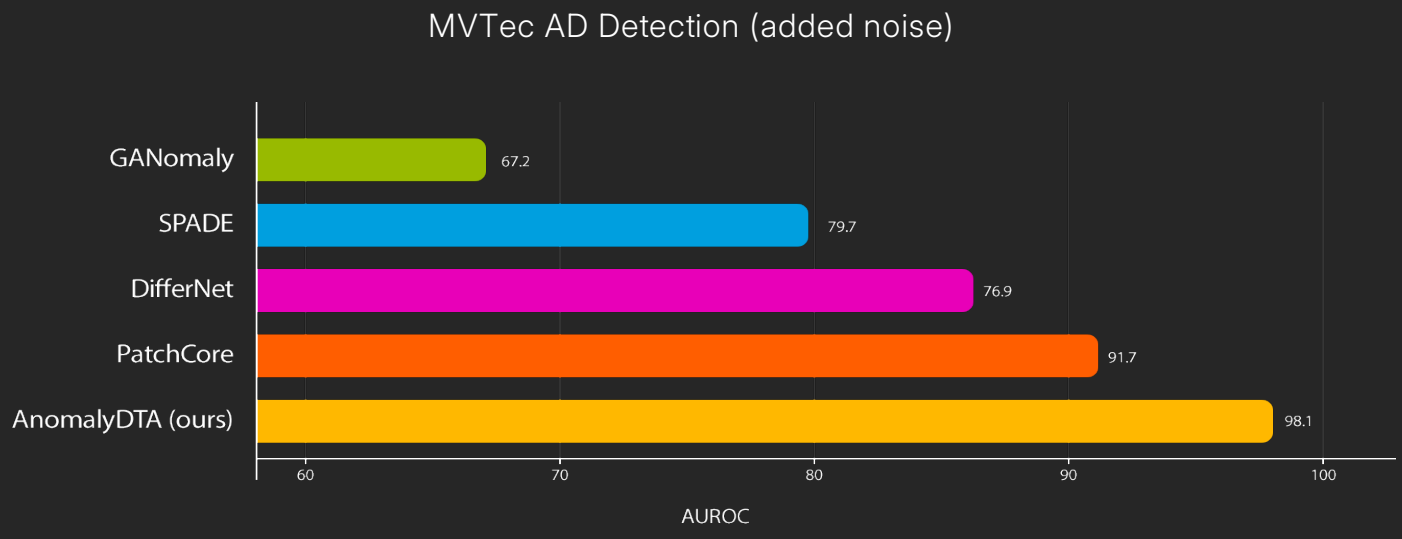
THE APPROACH

State-of-the-art technology

AnomalyTDA uses a hybrid model fusing Neural Networks (NN) with Topological Data Analysis (TDA). This powerful approach analyses the complex structure of data to identify novel, subtle anomalies that traditional statistical or standalone models often overlook, ensuring superior precision and resilience.



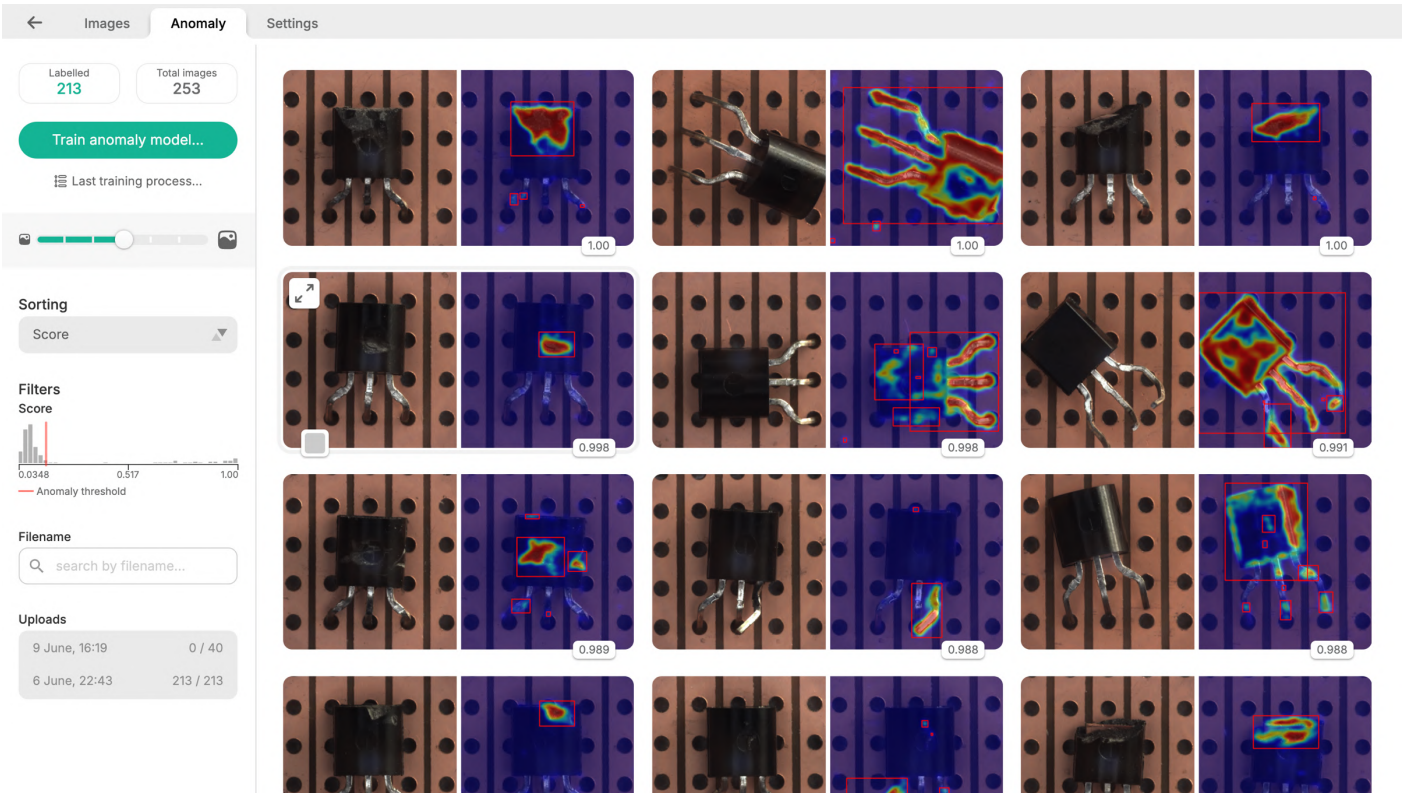
The MVTec Anomaly Detection (MVTec AD) dataset is a widely used benchmark dataset for unsupervised anomaly detection and localization in images. It is specifically designed to evaluate algorithms that detect defects in industrial and manufacturing settings.



The MVTec Anomaly Detection (MVTec AD) dataset with introduced image-level noise and synthetic anomalies at both the image and feature levels using gradient ascent to further test the model.

Anomaly Detection

Image Anomaly Detection is the **core feature of AnomalyTDA**, leveraging a powerful unsupervised approach that enables the system to self-train and identify defects autonomously without requiring prior examples of anomalies.

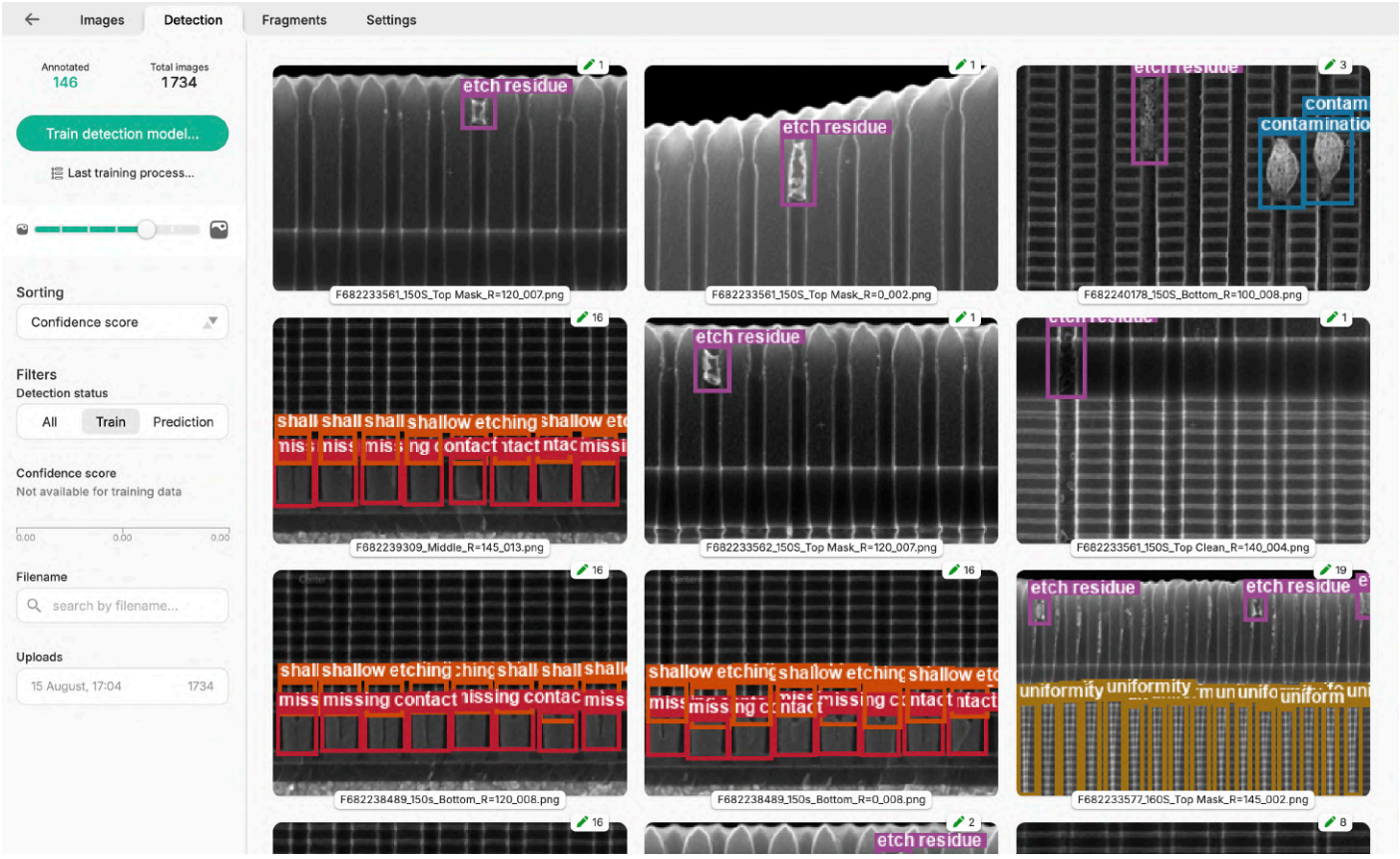


Key Features:

- **Autonomous Defect Identification:** The model self-trains using a set of images and learns what a "normal" or non-defective image looks like, enabling it to immediately flag any deviation as a potential anomaly.
- **Quality Enhancement via Good Samples:** Model quality is significantly enhanced by an optional refinement loop. After the initial training run, the user can select verified good images to retrain the model.
- **Automatic Anomaly Thresholding and Bounding Boxes:** Once training is complete, the model automatically determines the optimal anomaly threshold. It then clearly identifies anomalies by placing bounding boxes on top of images with an anomaly score exceeding that threshold.

Object Detection

Our Object Detection capabilities dramatically speed up the development cycle by redefining the data annotation process, ensuring maximum performance with minimal human effort.

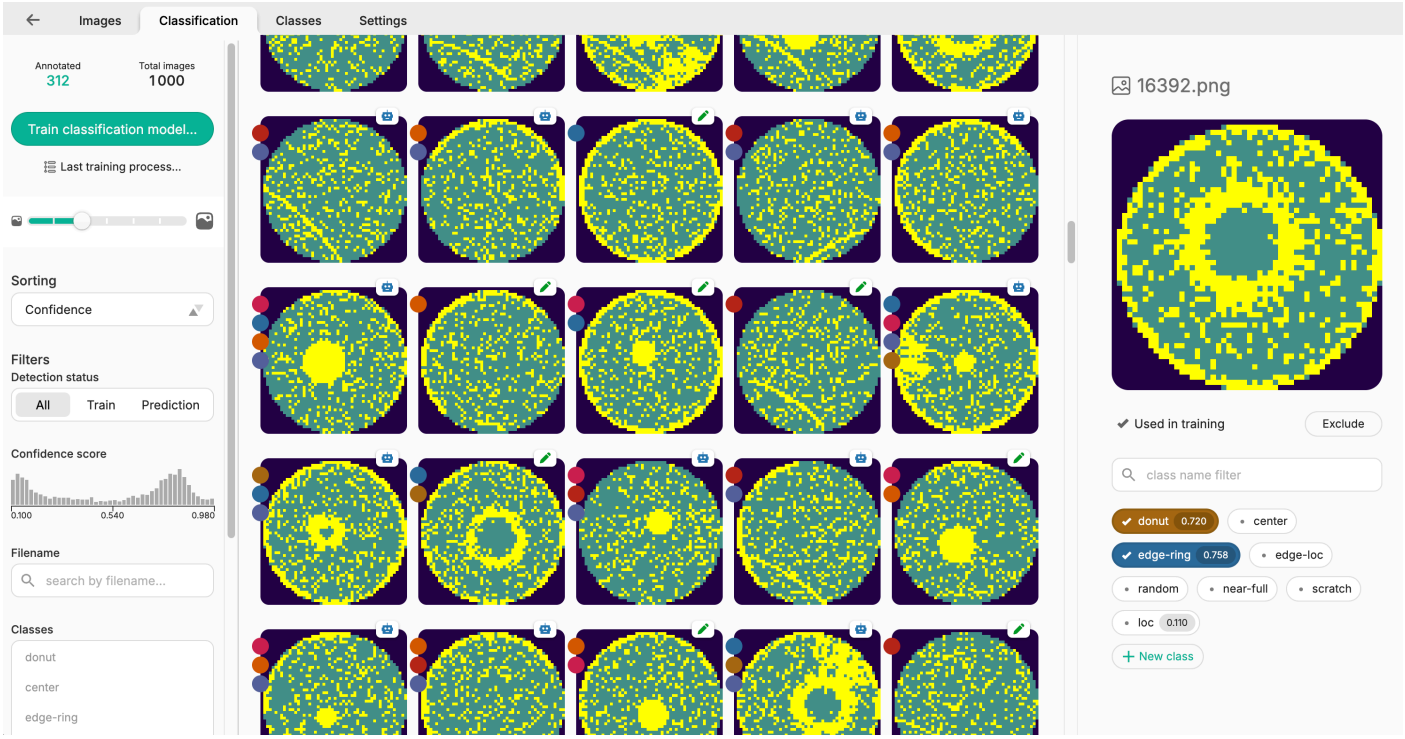


Key Features:

- **Active-Learning:** The model intelligently selects the most informative images, drastically reducing the human annotation burden.
- **AI-Assisted Labelling:** Our quick and user-friendly platform uses AI to assist by generating initial bounding boxes for rapid, accurate annotation.
- **Minimal Data Viability:** The model is highly data-efficient; labelling as few as 10 samples is sufficient to generate the first viable model for fast initial deployment.
- **High Performance with Small Sample Sets:** Achieve industry-leading performance metrics with only a fraction of the data typically required by conventional supervised systems.

Image Classification

Image Classification features are built for complex industrial demands, enabling highly accurate classification even on highly constrained datasets.



Key Features:

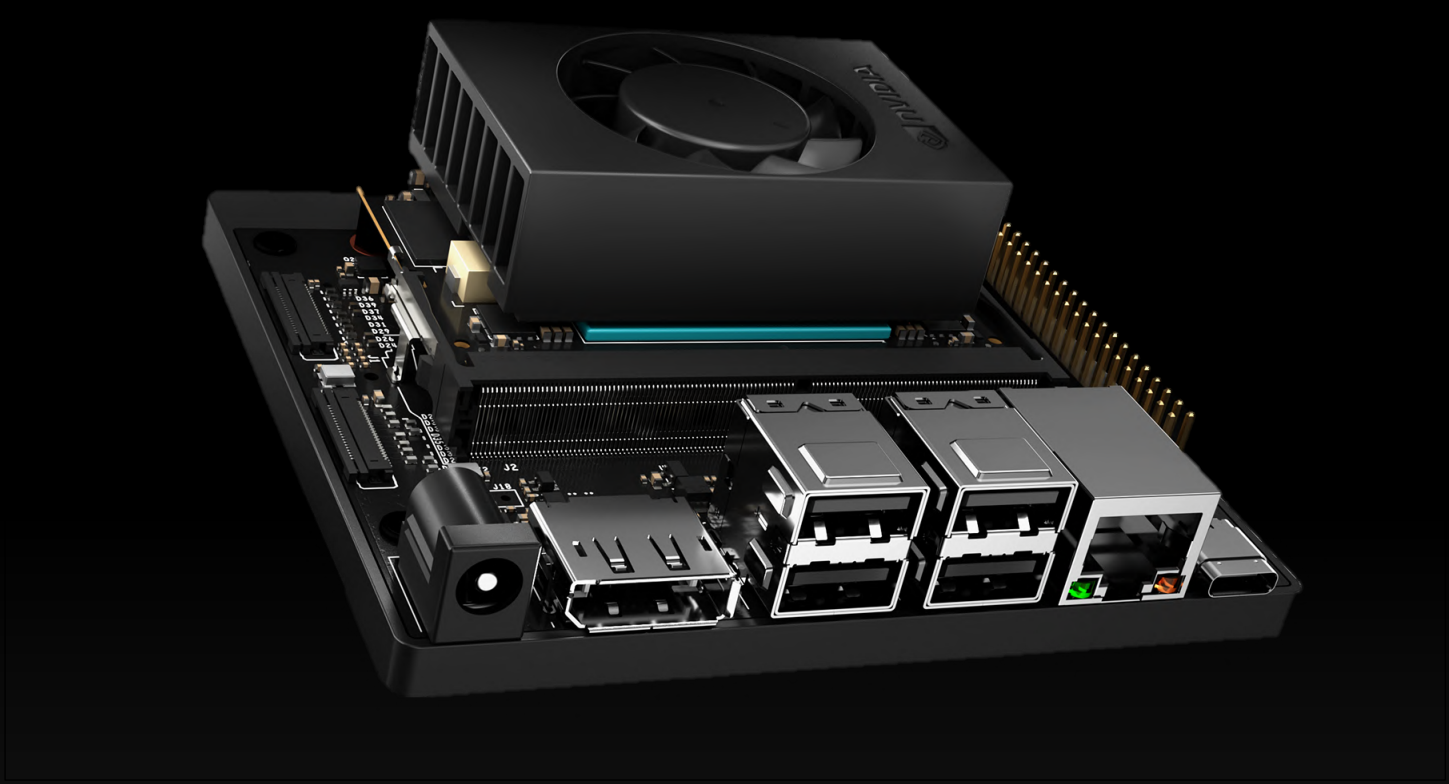
- **Multi-Label Classification:** Supports scenarios where a single image may contain and require labelling for a large number of distinct classes simultaneously.
- **TDA-Enhanced Performance:** Utilizes a state-of-the-art Transformer Classification Model merged with TDA to achieve optimal performance on very small datasets.
- **Scalability:** Designed to handle massive projects, supporting hundreds of classes and millions of images within a single classification workflow.
- **Edge Deployment Ready (ONNX):** Provides the ability to export the trained model in the standardized ONNX format for seamless and efficient inference deployment on edge devices.

THE OPTIMIZATION

Artificial Intelligence at the Edge

All three of our core model types: Image Anomaly Detection, Object Detection, and Image Classification are optimized for deployment on Edge devices, specifically leveraging the NVIDIA Jetson Nano Orin platforms.

By exporting trained models in the standardized ONNX format, AnomalyTDA ensures seamless and efficient inference directly on edge hardware.



Performance on Edge:

Our models are engineered for speed and efficiency, making them highly effective for industrial edge applications:

Near Real-Time Capabilities: Models such as Object Detection (known for its rapid annotation thanks to AI-assisted labelling) and Image Classification (powered by a TDA-enhanced Transformer model) can perform inference close to real-time. This ensures immediate decision-making for high-speed production lines.

Highly Efficient Design: Even our most advanced models, like the Image Anomaly Detection model (which self-trains and automatically determines anomaly thresholds), are optimized to run with high performance on resource-constrained Edge devices, providing continuous, localized monitoring.

The Hidden Costs and Risks of Internal R&D

Beyond upfront costs, internal R&D carries the **risk of failure** and becoming a sunk cost, as high-performance results are not guaranteed. The effort spent custom-coding basic infrastructure is a significant **opportunity cost**, distracting core ML talent. AnomalyTDA eliminates this risk by providing a commercially proven platform that benefits from **continuous, rapid innovation** driven by best practices across multiple industries.

Internally built solutions	AnomalyTDA
$400k+ in development cost	**State-of-the-art** Anomaly, Object, Classification Models
$120k / year in maintenance	**On-Prem/VPC Hosting** Full control of your data
Talent Needs Costly ML Experts, hard to hire	**Engagement managers** To support you on every step
Time Delay 12–18 months to launch, delay of ROI	**ONNX Model Export** Zero-License Edge Deployment
Technical Debt Growing complexity, future rework	**Built for Industry** Top Results, No Coding Needed
Focus Drain Shifts effort from core priorities	**Proven Results** Trusted by Intel Corp & Rolls-Royce PLC
Not future proof Critical reliance on employees who developed the tool's code	**Cost Predictability** Transparent pricing, no hidden maintenance fees

DataRefiner LTD 2025

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