Cognizant

Case Study: Oil and Gas

Aize aims to cut asset surface inspection costs by 50%

A novel asset management SaaS solution powered by machine learning and computer vision helps operators auto-detect rust anomalies in the heavy-asset energy industry.

Based in Norway and the UK, Aize revolutionizes project execution and operation in heavy-asset industries using software to increase efficiency, improve collaboration and reduce costs. The company is expanding beyond the era of petroleum, into renewables and other industries.

The company's product portfolio includes digital solutions that can automatically detect and measure surface corrosion. These products facilitate the seamless exchange of heavy asset maintenance and monitoring information between stakeholders across the value chain, and over the lifecycle of an asset. Aize products help energy operators design, engineer, construct and collaborate in a more intuitive and efficient way, improving profitability and quality.

At a glance

Aize collaborated with Cognizant to develop an innovative solution for the automatic detection of rust anomalies for sub-surface and topside assets installed in the oil and gas and other heavy-asset industries. Our solution has the potential to optimize the extremely time- and cost-intensive manual asset monitoring, to provide a range of benefits such as:

- Automated inspections of oil and gas assets for surface corrosion
- Reduced operational cost of human inspections
- Reduced number of resources needed for inspections
- Dramatically reduced cycle time and cost of rust detection, with improvement in the quality and integrity of operational work processes

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The challenge

The process of detecting rust on the surfaces of various assets used in energy industries such as oil and gas is a widespread challenge that drives up costs and extends operational efforts required in manual asset monitoring. Inspecting assets is a very expensive, laborious process that requires flying an engineer, typically on a helicopter, to an oil rig or other heavy asset along, with a drone pilot. The effort required is substantial, and is typically done manually, often with divers.

Some of the issues that energy operators face include how to identify, in a timely and efficient manner, anomalies such as the following:

- A surface coating breaking down or paint peeling off the top of a tank
- Corrosion and cracks requiring repair
- Mechanical damage, sometimes due to an iceberg knocking into an oil rig
- Foreign objects and underwater flora growing onto an asset and changing the physical property and strength of the structure
- The amount of pitting occurring on a metal surface
- Detecting if a pipeline is blocked by anchors
- Monitoring pipes to spot bubbles, which could indicate a leak

Proactive maintenance saves time and costs

Getting ahead of maintenance issues, before something breaks down, can potentially save people's lives and prevent natural disasters. As history shows, maintenance mishaps and equipment failures can result in oil spills and explosions that can wreak havoc across a company as well as ocean habitats.

Performing rust detection without the benefit of any technology support can take up to three months. In our collaboration with Aize, we set about to create a software platform using advanced machine learning that will help energy operators:

- Reduce the cost of rust detection
- Reduce the cycle time of performing a quality inspection
- Improve the quality of the inspection and accuracy of measurements
- Proactively save engineering time and maintenance time

The approach

Working closely with Aize, Cognizant helped develop a novel machine learning solution that combines computer vision techniques with a methodology that combines a rules-based approach with fuzzy labeling known as "weak-supervision." This process automates the rust detection process without requiring labor intensive labelling (tagging).

Weak supervision is a branch of machine learning where noisy, limited or imprecise sources provide supervision signals for labeling large amounts of training data in a supervised learning setting. This approach alleviates the burden of obtaining hand-labeled data sets, which can be costly or impractical. Instead, inexpensive and weak (fuzzy) labels are used with the understanding that they are imperfect but can nonetheless be combined to support a strong predictive model.

Using a digital representation to automate inspections

The goal of the new platform is to hold a digital twin, or digital representation, of an oil rig, vessel, gas container—or other heavy asset typical of those in use by Aize clients.

Using the new platform, engineers can work with the digital representation of the asset to plan inspections in detail, in advance of going to a location, to save potentially 50% of the effort it typically takes to conduct an inspection. Once on location, staff can follow the plan using the system to record everything, to capture a history of the development of issues on a particular asset.

In practical terms, energy operators can incorporate the computer vision capability into the systems and applications. For instance, in the context of drone inspection of structures, the identification of issues and measurement of degradation should be part of the inspection and planning workflow within an asset management solution.

Making rust anomaly detection easier

Because asset monitoring requires having a detailed understanding of operating ranges, the use of airborne and underwater-unmanned vehicles as well as connected devices provides important data. Surface inspections, however, are still mostly done through visual inspection by human operators on a determined schedule.

The ability to auto-annotate suspected rust areas using still images extracted from video streams collected during drone flights over land-based storage tanks is at the heart of the approach we developed. These capabilities can automatically detect areas of corrosion and measure the size of rust patches, excluding run off areas.

The solution developed by Cognizant uses computer vision tools that apply a weak supervision methodology to obtain fuzzy labels at pixel level, which are used to train a machine learning classification.

Key capabilities of the new asset management platform include:

Feature engineering: This capability uses classical image processing to standardize images and create basic and complex pixel-level attributes that also considers neighboring pixels.

Weak supervision/fuzzy labelling (Rust Yes/No): This capability employs methodologies proposed in academic papers and Cognizant-developed hypotheses to determine if a particular pixel is part of a rust patch, e.g., is the set of pixel level labels rust, not rust or unknown. Some of the labeling functions are straightforward, using common image processing and some are sophisticated multistep machine learning sub-processes. Some of the fuzzy labels focus on what is not rust to clear misclassification of run offs.

Consolidation of fuzzy labels: This capability considers the interrelationships between the weak labels, combining them into a weakly labeled training set that is almost as good as those labeled manually by an expert.

Classification (Rust Yes/No): This capability uses fuzzy labels to train a machine learning classification, filling in for the gaps in the weak labeling through pattern recognition.

Business outcomes

Aize sees their automated detection solution as the first step towards autonomous unmanned inspections using sophisticated sensors backed by weak supervision and powered by machine learning.

The solution aims to help businesses save and achieve the following benefits:

- Cuts down the effort required for integrity inspection by more than 50%, which translates to a potential 50% cost savings for this operation
- Automates inspections of assets for surface corrosion to prevent future issues
- Lowers the number of resources needed for inspections
- Dramatically reduces cycle time and cost of rust detection, with improvement in the quality and integrity of operational work processes
- Automatically suggests to engineers where to focus their attention by cutting out irrelevant scenes in the video stream

As an oil and gas industry provider of integrity and performance SaaS solutions, Aize plans to use the innovative new technology to provide highly sophisticated capabilities that always give clients a full picture into their heavy-asset operation. With better intelligent data management and analytics, Aize endeavors to help customers keep energy assets running smoothly, and faster, with smarter decision-making.

About Aize

Based in Norway and the UK, Aize develops industrial software for project execution and operation in heavy-asset industries. Aize products help organizations to increase efficiency, improve collaboration and reduce costs. The company is backed by Aker ASA, with its 180 years of industry experience, extensive global network of potential customers and considerable financial strength. To learn more, visit www.aize.io.

About Cognizant

Cognizant (Nasdaq-100: CTSH) is one of the world's leading professional services companies, transforming clients' business, operating and technology models for the digital era. Our unique industry-based, consultative approach helps clients envision, build and run more innovative and efficient businesses. Headquartered in the U.S., Cognizant is ranked 185 on the Fortune 500 and is consistently listed among the most admired companies in the world. Learn how Cognizant helps clients lead with digital at www.cognizant.com or follow us @Cognizant.

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