Reaping the Rewards of Digital Asset Management in the Oil and Gas Industry

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The industrial world is awash with data and new information from sensors, applications, equipment, and people. However, the data is worthless if untouched or not used to its full potential to gain insights and make improved decisions.

To make the most of big data, oil and gas leaders should implement machine learning alongside accurate engineering models linked to the Industrial Internet of Things (IIoT). This practice will leverage the digital DNA of the asset to take advantage of the increased performance and reliability insights that engineering information can bring to the operation. Using reality modeling technologies to capture existing asset conditions, applied together with IIoT and machine learning, companies can reap the rewards of cost savings and improved uptime.

Demystifying machine learning

We have all experienced some form of machine learning, from streaming movie recommendations, to detecting fraudulent activity by monitoring spending patterns. Now, the industrial arena is moving quickly toward using this type of artificial intelligence to leverage IIoT.

As a greater variety of data becomes available to monitor just about anything, machine learning is managing increasingly large and fast-moving datasets. Previously, organizations with predictive analytics could use big data (current and historic) to predict the future — with reasonable results. Machine learning brings a more accurate prediction, using algorithmic models to deliver more insight.

Machine learning can handle large and complex information from sensors, mobile devices, and computer networks to discover hidden patterns or trends in the data. It can then learn these patterns and apply it to new, real-time data to detect similar patterns in the future. For example, through modeling the performance of a piece of equipment, in relation to the temperature of its surroundings, machine learning can be taught to see what normal and abnormal behavior looks like. Then, by applying the model to current data, it can identify events, such as when the pressure within a pipe increases while the temperature remains the same. The system can predict, from existing knowledge, that something is not right and prescribe actions. The more data that is analyzed, the more accurate the predictive model.

Machine learning techniques — two paths to choose

Part of the implementation process is understanding how machine learning works and the number of techniques involved. The most common techniques are:

- Supervised machine learning: The program is trained on a predefined set of test data, historical or similar to the real thing, to reach an accurate conclusion when given new data.
- Unsupervised machine learning: The program is given a mix of data and must find patterns and relationships with no training whatsoever, without any specific target or outcome.

When implementing machine learning, there are many other considerations regarding the data, the insights, and how they can be applied within the business.

We need machine learning to stay competitive

In the oil and gas industry, recognizing equipment failure—and avoiding unplanned downtime, repair costs, and potential environmental damage—is critical to success across all areas of the business, from well reservoir identification and drilling strategy, to production and processing. It is even more relevant in today's turbulent times. With machine learning, there are numerous opportunities to improve the situation. Some forms of predictive analysis that machine learning can deliver to the oil and gas industry include predictive maintenance, reservoir modeling, video interpretation, and case-based reasoning.

Predictive maintenance

This failure inspection strategy uses data and models to predict when an asset or piece of equipment will fail, allowing teams to plan maintenance ahead of time to minimize disruption. It can cover failure prediction, failure diagnosis, and recommending mitigation or maintenance actions after failure. With the combination of machine learning and maintenance applications leveraging IIoT data, the range of positive outcomes and reductions in costs, downtime, and risk are worth the investment.

Reservoir modelling

Machine learning makes the process more reliable with decisions made more quickly by providing the reservoir with data that recognizes patterns for history matching, answering the question of how reliable estimations are when calculating how a reservoir reacts to fracture treatments. The models will be robust enough to help improve the accuracy of the reservoir properties' predictions.

Video interpretation

Video technology used in the down-hole drilling environment can benefit from machine learning, as well as the many sensors that monitor a platform or plant. Machine learning can be applied to interpret video and image data through anomaly detection to provide accurate assessment wherever video technology is applied for sensing tasks, therefore improving safety, costs and efficiency.

Case-based reasoning

With case-based reasoning, a current problem or case is compared to historical cases to find similarities that could provide clues to help identify the actions or behaviors to take that could help overcome the current situation. Frequent operational and reliability problems are still common within the oil and gas process because of the number of complex parameters, with well blow-outs, leakages, and production issues being some of the serial offenders. This practice could include analyzing data, such as weather conditions, depth, equipment used, costs, and more. Case-based reasoning is not a new approach in the oil and gas sector, but machine learning can significantly speed up the process.

Visualization bridging the gap between real assets and virtual assets

Machine learning capabilities will help organizations realize insights from the large amounts of data provided by sensors and IIoT. Bringing it all together is visualization through engineering models for structures, such as offshore platforms and onshore processing plants.

IT/OT convergence has become an accepted practice, with operators gaining new insight from known information. But misalignment in corporate strategy still results in silo building across many areas, especially within engineering technologies (ET), where engineering models often remain stranded, inhibiting the ability to leverage this information to optimize operations. They should be included within the existing IT/OT conversation, driven by IIoT and machine learning.

Designing and testing new products, systems, and even plants in a virtual environment makes a compelling case, particularly from a cost perspective. Virtual models can tie these domains together over the whole lifecycle of an asset, using its embedded digital DNA. From an asset management perspective, it is about predicting a problem before it occurs and enabling maintenance to be performed at optimum rates and costs. This will be accelerated with the application of machine learning to make the decision-making process smarter, faster and, more importantly, in context.

Continually modeling an oil field or installation means that personnel can survey the asset throughout its lifecycle, from initial design to current condition, applying the difference in data to maintain up-to-date information on the equipment's condition along the way. Reality modeling can link engineers in the field directly to the office, sharing information and data collaboratively. With the use of IIoT data provided by the images in the building of 3D models, machine learning algorithms provide a predictive capability and deliver more informed business insight, resulting in faster and more reliable decision-making.

Digitalization and machine learning

While machine learning gives the impression that human involvement is minimal, it is not the case. It gives the user more intelligence, context, and insight to make the decision-making process easier and improve productivity.

For those firms adding machine learning to their asset management journey, the next logical step is to go model-centric, by adding visualization dashboards, cloud-based IIoT data, analytics, and reality models to machine learning. A machine learning strategy will give companies unprecedented insight into their operations and lead to significant benefits in efficiency, safety, and optimization, as well as the speed in which decisions can be made.

Conclusion

With the arrival of IIoT, the amount of data is growing and becoming more accessible. With the ability to acquire more data, more advanced technologies are required to scrutinize and filter out the important information and the value held within. But, it can only be exploited by identifying what works well and what does not. Machine learning features complex algorithms to sort through large amounts of data, identifying patterns and trends within it, to make predictions.

The use of machine learning in oil and gas doesn't have to stop at just exploration and production, but can be applied across the whole operation, where algorithms are used to continually improve the overall performance across the whole facility and the equipment within it. By combining these machine learning practices with IIoT and visual operations, they will bring, as it matures, significant benefits. IIoT, engineering models and machine learning should no longer be considered just buzzwords. Instead, when combined, they can be an organization's number one priority for achieving operational excellence.