Machine Learning – a holy grail in the next generation industrial automation revolution.

Today's imperative means extracting additional value. Going forward, only data-driven solutions incorporating comprehensive information from operations, maintenance, financial, and human resources system will detect conditions that limit asset effectiveness and expose profit opportunities. The key element is the proper application of Machine Learning technology. Indeed, the time for companies to implement Machine Learning is now.

In 2017, McKinsey & Company conducted a study on productivity gains driven by technology transformations. McKinsey points out three transformational phases – the steam engine, early robotic technology and advances in information technology. McKinsey also suggests that manufacturing is at the brink of the next generational industrial automation revolution. Advances in robotics, artificial intelligence and Machine Learning will match or outperform humans in a range of work activities involving fast, precise, repetitive action, including those requiring cognitive capabilities. Consequently, McKinsey sees unprecedented annual productivity growth between 0.8 – 1.4% in the decades ahead. The man versus machine debate provokes both positive and negative opinions but the reality is that to remain competitive, complex industries need to deploy industrial automation more than ever.

Improving reliability and maintenance outcomes

ARC Advisory Group calculates that the global process industry loses $20 billion annually from unplanned downtime. Companies spend millions of dollars on traditional maintenance approaches searching for specific wear and age-based failures using techniques to optimize inspection routines. However, the ability to detect the "apparently" random failures causing more than 80% unplanned downtime eludes them. Lead time is the critical issue. A significant need exists to detect all types of degradation early and enable decisions to change the outcomes. Failure prevention must evolve from opinion-driven estimates to data-driven truths.

Machine Learning is powering that change. Not only, can it detect patterns of impending degradation far earlier than contemporary approaches but applied within context, it can cast a "wider net" around machines to capture process induced degradation that causes most failures. While it is generally impossible to separate the behavior of both the machine and process, only a unique technology approach can do so. Thus, the answer is not a maintenance only approach but one that arrives at the confluence of maintenance and operations department activities that is critical for asset intensive industries, such as manufacturing and transportation. With a data-driven technology in place, organizations can decipher patterns of looming degradation and secure sufficient warning to prevent failures and change outcomes.

Predicting downtime with Machine Learning software

Advanced Machine Learning software has demonstrated incredible successes in the early identification of equipment failure. State-of-the-art software is almost autonomous and learns behavioral patterns from streams of digital data produced by sensors – which reside on and around machines and processes. Autonomous in nature and requiring minimal human resources, this advanced technology constantly learns and adapts to new signal patterns when operating conditions change. Failure signatures learned on one machine inoculates that specific machine, so the same condition does not recur. Learned signatures readily transfer to similar machines, preventing the same degradation conditions from affecting them.

For example, a North American energy company was losing up to a million dollars in repairs and lost revenue from repeated breakdowns of electric submersible pumps. The advanced Machine Learning software application learned the operational behavior of 18 pumps from archived historical values and maintenance events. In doing so, it detected the pattern leading to casing leak that caused an environmental incident on one pump. In applying this failure signature to all 18 pumps, it provided an early warning on another pump, which was about to suffer the same failure. Early action to pull and repair the pump avoided a repeat incident and major losses.

In another instance, a leading railway freight firm operating across 23 states in the US used Machine Learning software to address perennial locomotive engine failures, costing millions in repairs, fines and lost revenue. The Machine Learning software application was deployed on a very large fleet of locomotives to examine

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lube oil data looking for extremely early indicators of engine failure. Such early detection has made it possible to avoid dozens of catastrophic engine failures. In one case, the application detected the degradation signature for engine leaks, even while the engine passed a low-pressure leak test. Such early warnings, well before failure, provide leeway to make decisions. In doing so, locomotives can complete a journey before proceeding for service in a convenient manner, avoiding a breakdown and saving the company millions of dollars in costly downtime and fines.

The next generation industrial automation revolution

In addition to Machine Learning, current market conditions are ideal for process manufacturers in capital intensive industries to accelerate performance with emerging technologies. Tablets, smartphones, and wearables enable engineers, technicians, and plant operators to make decisions on the go. Like minded professionals collaborate and solve problems using social networking. Cloud containers streamline the deployment experience, reduce cost of ownership, and increase application scope. The Industrial Internet of Things (IIoT) connects plants with model based sensors on all equipment, to enable machine-to-machine communication, across control systems and reliability management systems. Advanced algorithms used in search and pattern recognition automatically detect data-based patterns to predict future outcomes and guide optimal responses. As such, emerging technologies increasingly help users to navigate complexity and address the biggest areas of opportunity. Analytics, models, and big data open the exploration of data potential inside the plant fence, and across a corporation. High performance computing also provides the necessary computational horsepower to address larger issues around asset optimization; and stimulate further advances in metadata sharing across all industries for even more efficiencies.

Today's imperative means extracting additional value. Companies can no longer rely solely on traditional maintenance practices. A large asset, such as a manufacturing process, comprises building blocks based on many processes and equipment types. Risk occurs at many levels from specific equipment failure, the way a process is operated, and perhaps due to the design and overall plant configuration. They need a robust, multi-faceted solution to avoid and mitigate issues that affect profitability, safety, and the environment. Going forward, only data-driven solutions incorporating comprehensive information from operations, maintenance, financial, and human resources system will detect conditions that limit asset effectiveness and expose profit opportunities. The key element is the proper application of Machine Learning technology. Indeed, the time for companies to implement Machine Learning is now. ■

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