By **Steffen Wagner**

8 June 2021

Evaluation is the key: AI takes process optimization to the next level

"A lot helps a lot." In my experience, this phrase is often applied to process optimization. To keep all processes within the optimal range, companies sometimes invest considerable time and finances. But are all deviations from the optimum equally relevant to the profitability of a plant? How can anomalies be prevented with low effort? It all comes down to artificial intelligence (AI) methods — and let me explain to you why they can be a game-changer when it comes to process optimization.

AI already pervades many areas of our lives and often provides valuable assistance in a wide variety of applications. Therefore, it only makes sense that AI should also be useful for plant operators in the industrial environment to help them easily and effectively optimize their plant. The goal of an AI-supported methodology is to alert plant operators to any anomalies and ways to quickly identify process events that could have a major impact on productivity, availability, or quality. Performing this type of evaluation using process automation data hasn't been possible until recently. While anomalies can be detected with process data, the extent to which an anomaly poses business relevance depends on specific production and market conditions.

Evaluation makes the difference

Let me use an example to show how different these assessments can be. In crude oil production, so-called sand passages can occur again and again, impairing the service life of the pumps. To protect the pump, the operator of the production station has to decide whether to reduce the flow rate or distribute it to other pumps until the sand has settled. This makes economic sense if the flow rate or the value of the oil produced is low compared to the cost of repairing or replacing the pump. If the flow rate and the value of the oil are relatively high, it might make more economic sense to continue to operate the pump despite sand passage. Until now, the operator relied on their experience to evaluate the situation and estimate the impact of the anomalies on the economic viability of the process.

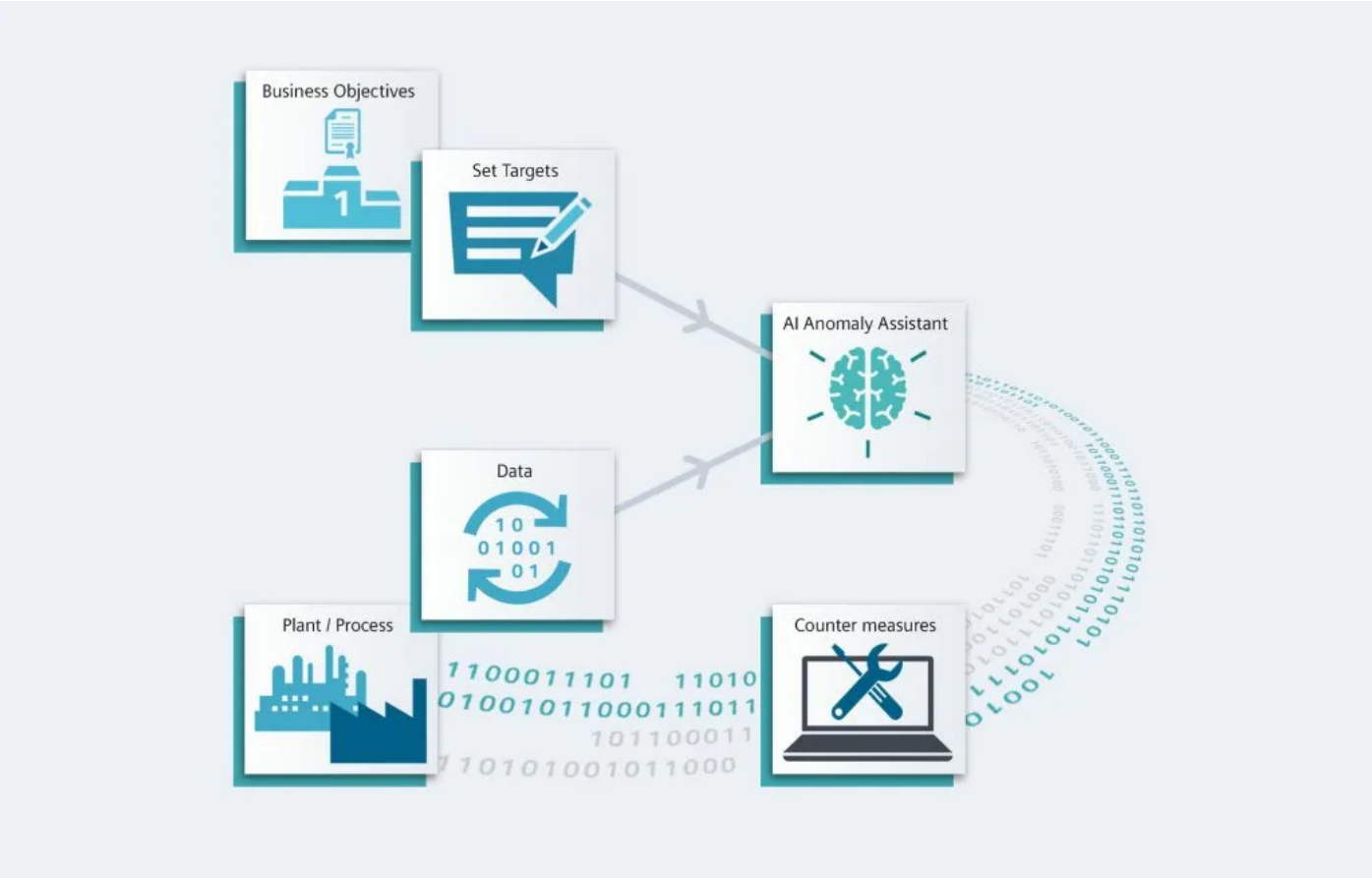
What happens, for example, if companies need to be capable of flexibly producing both low-cost and high-value products for different orders? Or if process parameters like energy consumption, productivity, and quality influence

each other? These makes evaluating disruptions and anomalies much more complex, and the economically optimal operating point of a plant needs to be determined using process modeling.

The physical models used in this process have a weak point, though: They're based on a specific plant condition. This challenge can be addressed with models that use AI to detect and evaluate anomalies. The underlying algorithms are continuously trained during plant operation, and they learn to recognize new anomalies. This cumulative learning is one of the key differences between AI-based and traditional process models, and one advantage is that different plant states can be flexibly incorporated. In addition, an AI-based model can make predictions about the outcomes of complex processes by correlating different connections and, for example, recognizing at an early stage when anomalies foretell a plant failure.

Anomaly detection with AI: From principle to practice

For AI to be able to precisely detect and evaluate relevant anomalies, the algorithms not only need to be trained, they also have to learn which anomalies have an impact on the plant's profitability. For its AI Anomaly Assistant app, Siemens developed a methodology that demonstrates how the training and focusing process can be applied to industrial processes. Let me explain it to you briefly.



Initially, the process data that will be used to train the app has to be collected and recorded. The data are transferred from the process control system to the customer-specific instance of AI Anomaly Assistant for this purpose. Then the first step in the AI training process begins: Data analysts at Siemens generate anomalies from the process data and

operator to filter potential anomalies according to their relevance. This step is especially important because not all detected anomalies are actually relevant to the process and the business.

Based on the feedback from this phase, the AI is trained again so that it only detects the anomalies identified as relevant. The experts at Siemens also use the user feedback to identify those anomalies that have a high probability of being business-relevant based on their impact on availability, yield, or quality.

This preselection of high-relevance anomalies lays the foundation for the plant operator to refine the AI. During this stage, the application supports the operator with a dashboard where anomalies can be commented on, evaluated, and selected. This evaluation phase is accompanied by several feedback loops, so that ultimately the plant operator receives a well-trained AI that can evaluate anomalies for their business relevance.

The AI Anomaly Assistant App uses artificial intelligence (AI) to detect anomalies in the process industry and assess their business relevance. A dashboard helps users classify and evaluate events.

AI is a valuable support in the business environment

Especially with sensitive processes, it's important that proprietary and/or confidential product and process data be protected. Here too, AI-supported modeling scores points: It allows process data to be generalized and anonymized to a greater degree. To assess anomalies and focus the AI, data analysts only need basic information about the nature of the process, and even the names of parameters can be largely anonymized. This allows AI Anomaly Assistant to ensure extensive protection of the plant operator's intellectual property rights.

I hope you've heard the key message from everything I've explained so far: Applications like AI Anomaly Assistant help

can leverage a tool that learns along with their processes and products and can also use anomalies to prevent risks. The combination of cloud technologies, AI, and application and process expertise ensures that AI-supported methods can be quickly and precisely adapted to the relevant requirements while also offering excellent protection of the plant operator's intellectual property. AI Anomaly Assistant can also be provided as on-premises installation if the plant operator prefers a local productive system.

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