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Sight Machine Enables Operational Intelligence with the Digital Twin

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Keywords

Operational Intelligence, Digital Twin, IIoT, Manufacturing Big Data, Predictive Analytics, Prescriptive Analytics, Digital Enterprise, Factory Floor Analytics

Summary

Emerging technologies and digitization are rapidly changing the face of manufacturing production systems, processes, supply chains, and even the work force. This digital transformation taking place across industries also affects all stages of the product lifecycle, from early product design to service in the field.

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A key benefit of the digital enterprise is operational intelligence. A vast quantity of end-to-end manufacturing data is available in most plants and factories, but the question manufacturers often ask: How can we transform this huge repository of data into actionable intelligence to gain value from it?

Many vertical industries are starting to leverage predictive analytics to improve the operational state of equipment and maintain it better to reduce downtime and preserve these assets. However, the digital enterprise also offers manufacturers a much richer opportunity by providing opportunities to discover and understand the source of complex problems and identify decision-based options for improving processes and refining product development. These include concepts like the *digital twin,* which enables analysis of empirical data derived in real time from the physical machine. This includes predictive analytics for maintenance and prescriptive analytics for operational intelligence.

Digital Twin Mirrors Manufacturing Big Data

Manufacturing Big Data includes operational and executed work records, quality assurance records, work flow histories, operational deviations and variations, engineering changes, and many other records related to the production process. According to the US Bureau of Labor Statistics, the manufacturing sector (both discrete and process), has the most stored data of any industrial or business sector. These data, representing a virtual "digital brain trust," come in a wide variety of formats, both structured and unstructured, and need to be aggregated, analyzed, and converted into actionable information.

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Several decades ago, when manufacturers began to adopt the basic principles of Lean Manufacturing, quality assurance, statistical process control (SPC), continuous process improvement, Six Sigma, and so on, they laid the foundation for what we now refer to as "operational excellence." The primary difference today is the availability of next-generation analytics tools based on Big Data and machine learning.

We're also learning that the digital twin can be employed to help provide plant personnel with operational intelligence. The digital twin is where the physical and virtual worlds of the product, including its engineering design and operational functions, are merged to support design improvements, continuous process improvements, identification of conditional states of the machine/system, and operations and maintenance improvements.

The digital twin can also support closed-loop PLM, which can enable manufacturers to improve production processes and validate "as-built," to "as-designed."

By bringing together Big Data, statistical sciences, rules-based logic, machine learning, and the digital twin, manufacturers can empirically discover and reveal the origins of the complex problems and then determine decision-based options for resolving these. This represents a move from

predictive to prescriptive analytics and is where manufacturers will realize the real payback from Big Data and advanced analytics.

Sight Machine Provides Actionable Information from Manufacturing Big Data

Sight Machine recently briefed ARC Advisory Group on its solutions, designed to address each of the major issues discussed above. The platform is based on a three-pronged data strategy of Acquire, Analyze, and Visualize. This enables manufacturing companies to gain real-time visibility and actionable insights for every product, sensor, machine, production line, equipment, and factory throughout their enterprise.

In today's manufacturing enterprise environment, accessing and acquiring data remains one of the primary challenges. The sheer variety and multiple formats of data is daunting and can come from many sources.

In today's manufacturing environment, accessing, aggregating, and analyzing data remain primary challenges. Manufacturing data can come in many different formats (both structured and unstructured) and from many different sources: smart sensors, PLCs, DCSs, HMIs, MESs, motion control systems, vision systems, historians, completed work records, operator and maintenance logs, quality records, automation protocols, batch reports, energy meters, spreadsheets, databases, and a host of other sources. To meet these challenges, Sight Machine's acquisition engine is designed to ingest, aggregate, and condition the entire variety of data from the factory floor and then channel it to the company's AI Data Pipeline for analysis.

First, the data is contextualized automatically using artificial intelligence, including an expert system, machine learning (ML) classifiers, and highly sophisticated ML algorithms.

Next, a factory/plant digital twin is generated and configured to mirror the actual manufacturing production systems. The digital twin, a dynamic, empirical mirror of the factory production systems, machines, equipment, and processes produces a real-time semantic context for all product, production, and process data.

Analytics are performed on real-time data streaming from sensors, machines, and production systems to determine state condition and support best practices based on quality reporting, engineering diagnostics, and KPIs for asset performance. Using an analytics workbench, users can design new

reports and dashboards that address predictive maintenance, process optimization, root cause analysis, statistical process control, KPIs, process deviation, etc. The analyzed data can be visualized as real-time, actionable information for every machine, line, and plant across an enterprise using Sight Machine's Global Ops View and contextualized dashboards that are designed to present the right information to the right people.

Conclusion

As companies move into the next generation of manufacturing, future factories must be equipped to meet the challenges of performance analytics and a new era of operational excellence. Operational intelligence will become mandatory for manufacturers to be able to compete in global markets and extended supply chains. Actionable information derived from both operational production processes in real time and historical production work records will provide the life-blood for optimizing manufacturing processes and determining and establishing best practices going forward.

Today's operational analytics applications for manufacturing can glean through this production process Big Data and use both predictive and prescriptive analytics engines that employ machine learning, multi-variant statistics, and rules-based logic to empirically reveal the origins of even the most complex problems and suggest decision options to solve them.

Actionable information will provide the life-blood for optimizing manufacturing processes and determining and establishing best practices going forward.

Discovering and analyzing the information contained in the vast reservoir of manufacturing Big Data will be the key to the digital factory of the future.

Solution providers like Sight Machine are incorporating technologies that can address multiple elements of the operational intelligence process and providing manufacturers with tools that will enable them to revisit the fundamental concepts of operational excellence.

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