Improving Industrial Manufacturing Outcomes with Machine Learning

Empowering inanimate objects and intangible things with the ability to learn and make informed decisions have been one of the many goals of civilization. In the past, Da Vinci's attempt to build functional robots to the creation of the '2001 – A Space Odyssey' movie, had tried to capture what automated processes and robots would look like and be capable of with limited successes. However, the introduction of AI and its subset machine learning changed everything.

Today, we understand the importance of data and utilizing software to create telemetries and discover patterns that help with decision making. Leveraging on the foundation of data analysis, imbibing inanimate objects with machine vision and software with the capacity to automate processes are here to stay. And the manufacturing industry is expected to be a great beneficiary of these advancements.

The manufacturing industry is expected to utilize AI and machine learning to their full potential due to the unique features of its production processes. Generally, the average production cycle is made up of multiple interrelated processes and systems. You have the supply chain, logistics, and inventory that must be properly managed, the material handling system that must function optimally, and manufacturing equipment that handle the production process.

Successful manufacturing enterprises seek to optimize these interrelated processes and systems to reduce waste, increase profitability and to ensure safety on the shop floor. Achieving these admirable qualities is the driving force behind Industry 4.0 and the smart factory. The smart factory is expected to be run through automation with equipment taking important decisions and robots roaming freely through the shop floor.

The Two Major Categories of Machine Learning and their Application in Manufacturing

To gain insight into the application of machine learning in manufacturing, an understanding of the different ways machine learning is executed is required. These two categories include:

- Supervised Machine Learning – The application of supervised machine learning is to map the connection between a defined input and output data. The goal for supervised machine learning involves the use of algorithms and aggregated datasets to map the functions that connect both the input and output data. The algorithm takes an iterative approach until it provides an accurate answer that maps input to output.

  Supervised machine learning is the commonly used approach within the manufacturing industry. For example, it maps the causation factors between a manufacturing process, which is the input data, and wastage, which is the output data. Thus, supervised machine learning forms the foundation for applying predictive maintenance strategies and implementing data-driving production optimization plans.
- Unsupervised Machine Learning – Unlike the supervised version, unsupervised machine learning analyzes data to find patterns without the help of output data. The endpoint or output data is unknown and the algorithm must do the underlining analysis to discover patterns. For example, the use of simulation technology to optimize processes within the shop floor using historical datasets without a defined endpoint highlights the application of unsupervised machine learning. Artificial neural networks try to mimic how the human brain functions when solving problems and they fall under the unsupervised category. Neural networks learn by processing examples with known inputs and outputs before undertaking more complex unsupervised processing activities. In manufacturing, an example of the application of neural networks is the navigational abilities of autonomous mobile robots.

Application of Machine Learning in the Manufacturing Industry

The role of Industry 4.0 is to automate processes within a smart, interconnected facility. Adopting AI and machine learning within the manufacturing industry supports the change Industry 4.0 defines. Today, excellent examples of applying machine learning within the industry exist and they include:

1. Predictive Maintenance – As stated earlier, predictive maintenance is one of the popular applications of machine learning within the manufacturing industry. One example is Siemens creation of the Mindsphere smart Cloud platform that monitors a fleet of machines or equipment. The monitoring process seeks to analyze patterns to discover minute changes and pinpoint the causation factors before any equipment goes bad. Leveraging machine learning-

enabled predictive analytical software has assisted manufacturers to reduce machine downtime by approximately 75%.

2. Connecting Interrelated Processes – Monitoring and managing the interrelated processes that support a production cycle helps with improving productivity. These interrelated processes can be intangible sometimes and machine learning can help with connecting the dots and providing insight into improving productivity. One example is the use of GE's Brilliant Manufacturing Suite to track assets and processes within the shop floor. The platform monitors all aspects of the shop floor and provides insight on improving them. Applying these insights have assisted the first Brilliant Factory located in India improve its productivity by 18%.
3. Automating Material Handling Processes – Implementing a smart material handling system speeds up delivery and supports the application of just-in-time strategies within the average shop floor. Autonomous mobile robots utilize machine learning to safely navigate the factory floor and deliver materials at specified durations. The timely delivery of raw materials or tools eliminates backlog, reduces traffic, and improves productivity.

Conclusion

The application of machine learning within the shop floor is still in its infancy. Advancement with equipping machines with machine vision and applications with sentient qualities is expected to deliver the smart factory of the future where human interactions and movement within facilities will be reduced to the bare minimum.