THE BENEFITS OF ARTIFICIAL INTELLIGENCE (AI) AND MACHINE LEARNING (ML) IN MANUFACTURING

Data is a new business asset for many companies, especially manufacturing companies. These organizations' manufacturing processes produce massive amounts of data each day. That data presents a powerful opportunity for competitive advantage—as long as it's used to its full potential.

To better leverage data, manufacturing companies have embraced digital transformation (DX) initiatives. These initiatives are widespread throughout the manufacturing industry. More than 80% of respondents to Lifecycle Insights' recent ROI of DX study stated they have started or plan to start DX initiatives.

In beginning these initiatives, executives often look to sensors throughout the manufacturing process that produce a variety of useful data. This data can be used to train artificial intelligence (AI) and machine learning (ML) models, ultimately improving manufacturing processes. Thanks to sensors, organizations gain better insights into production operations, uncover potential problems before they arise, and drastically improve the productivity of their manufacturing assets.

This brief will cover the role of AI and ML in the industrial internet of things (IIoT). It will examine specific benefits of AI and ML, as well as the ways companies can use AI and ML models along with sensor data to transform production.

ROLE OF AI AND ML IN MANUFACTURING

To better understand how AI and ML play a critical role in manufacturing, it's important to have some background knowledge on these technologies.

AI is the science and engineering of leveraging computers and machines to mimic the problem-solving and decision-making capabilities of the human mind. Overall, the goal of artificial intelligence is to create a device that can think and act like humans. In the context of manufacturing, a computer or device will think and act like an experienced manufacturing executive when presented with the correct information about a manufacturing problem or situation.

ML is a branch of AI and computer science that uses data and algorithms to imitate the way that humans learn, gradually improving in accuracy. In the context of manufacturing, ML algorithms learn from manufacturing data. The algorithm's accuracy improves as it is exposed to data.

Both technologies rely on data collection. Many manufacturers harness physical sensors for this purpose. In recent years, the cost of sensors has fallen dramatically, offering an inexpensive solution to capture more data from manufacturing processes. These sensors can be installed to measure anything and everything that might be of value in an AI and ML context. Manufacturers can measure and collect data on everything from temperature and humidity to motor speed, flow rate, and more.

Once sensor data is collected, it's streamed to an IIoT platform, where the AI/ML magic happens. The data is put to work training and improving ML models that represent the digital equivalent of the manufacturing system. Once perfected, these ML models become powerful predictors and decision-makers.

INFLUENCE OF AI AND ML ON OEE

AI and ML are crucial to manufacturers' success in today's competitive and volatile business environment. Manufacturers must reduce their risks in all areas, especially in overall equipment effectiveness (OEE). AI and ML play a crucial role in keeping the OEE score high.

OEE defines the percentage of time a manufacturing facility is productive to determine whether it is being used to its full potential. Manufacturing executives compare the actual utilization to the potential utilization when the manufacturing facility is up and running. The higher the OEE, the better.

To raise the OEE, manufacturers need to increase throughput, reduce downtime for the manufacturing facility by predicting and addressing potential failures, and improve quality to reduce or eliminate the amount of rework involved. AI and ML can help in all of these areas.

INCREASING THROUGHPUT AND REDUCING DOWNTIME

Throughput is the quantity a machine or manufacturing line produces per unit time. Using AI and ML, manufacturing engineers can forecast the throughput. Then they can use this information to increase the throughput by making better provisions for labor, modifying the schedule of jobs to be undertaken, and adding more machines.

ML models, combined with the power of AI, can foresee potential problems by spotting anomalies early in the game. In this way, they can predict manufacturing systems' downtime and allow executives to take preventative action. These models act as early warning systems that point out issues before they occur, but that's not all they do.

AI can indicate when and what type of predictive maintenance must be scheduled. It can also indicate the impact of out-of-turn maintenance on OEE. With this information in hand, manufacturing executives can keep the facility well-maintained and ensure high throughput at a minimum maintenance cost.

Scheduled predictive maintenance has tangible cost benefits for any manufacturing company. Predictive maintenance prevents catastrophic failures that cost much more than maintenance. By knowing when to schedule predictive maintenance and what maintenance to perform, engineering executives reduce the total manufacturing cost for a facility.

IMPROVING QUALITY

Finally, AI and ML improve the quality of manufactured components. Manufacturing companies cannot afford to put low-quality products into the market. Inferior products result in higher product recall and warranty costs. And eventually, a company's brand image will be negatively affected.

Even if defective components *are* spotted before they are shipped to the customer, it costs more to rework and fix these issues in a reactive manner.

It's better to be proactive than reactive. AI and ML can predict poor quality before issues emerge—and pinpoint the root cause of the problem. With this information, engineers can take corrective action to prevent future quality issues.

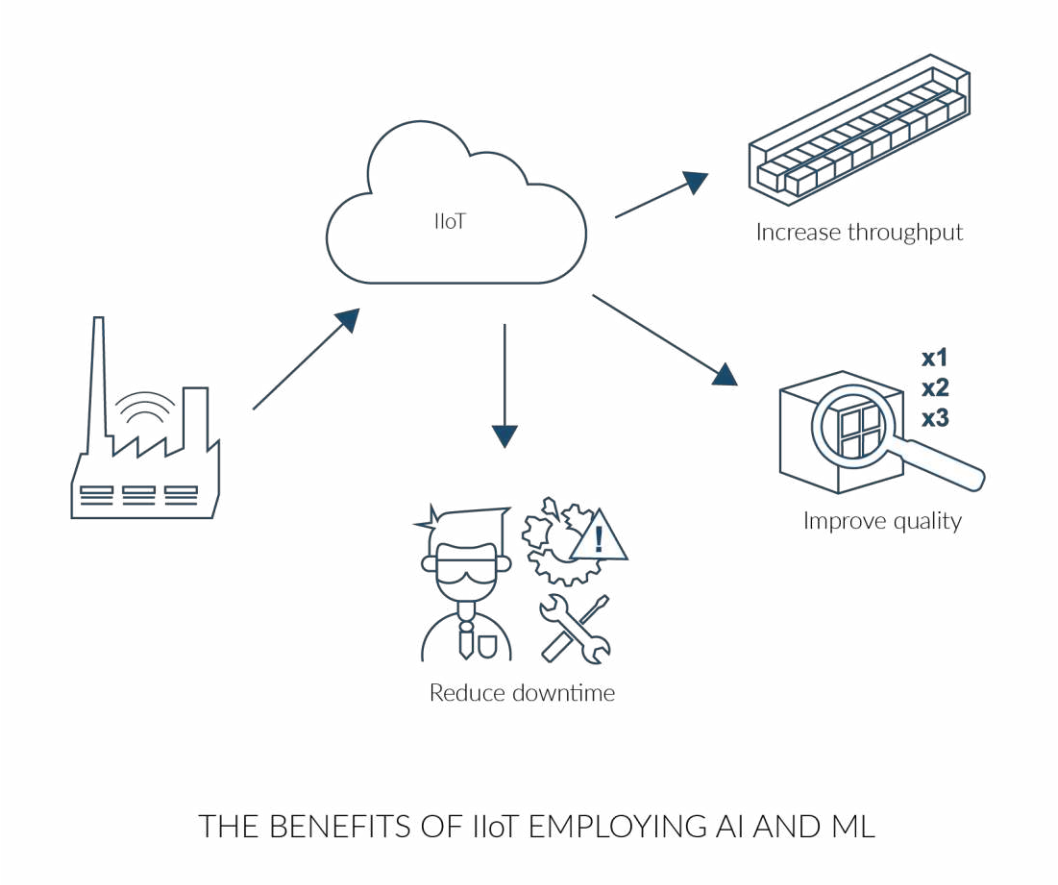

Figure 1: By connecting their manufacturing to the IIoT platform and using AI and ML to study manufacturing operations in realtime, companies improve their OEE.

BUILDING, DEPLOYING, AND USING THE AI AND ML MODELS

With the right data, ML can build and train numerical models for analytics. That data can come from two sources.

First, the data can come from the physical sensors on the equipment in the manufacturing process. Sensor data can be used to build and improve the model. Alternatively, engineers can gather the data from virtual sensors in

the simulation model of the machine. Instead of generating data from a live manufacturing setup, engineers simulate the process on a computer and create data from virtual sensors. Virtual and physical sensors can continuously improve existing models by augmenting generated data. This allows comparisons between what is happening and what should be happening in a manufacturing environment.

After manufacturers develop the AI and ML models, engineers deploy them on an edge device, an IIoT platform, or both. A model uses real-time data to identify anomalies in the manufacturing process. Based on the findings, executives can take timely actions.

Anomalies must be presented to stakeholders in a clear and presentable form. But sharing the information and insights that the models find is a difficult task. It's one thing for AI and ML models to find a beneficial, interesting insight. It's another to condense and convey the findings. The ability to clearly communicate information is just as important as finding the information in the first place.

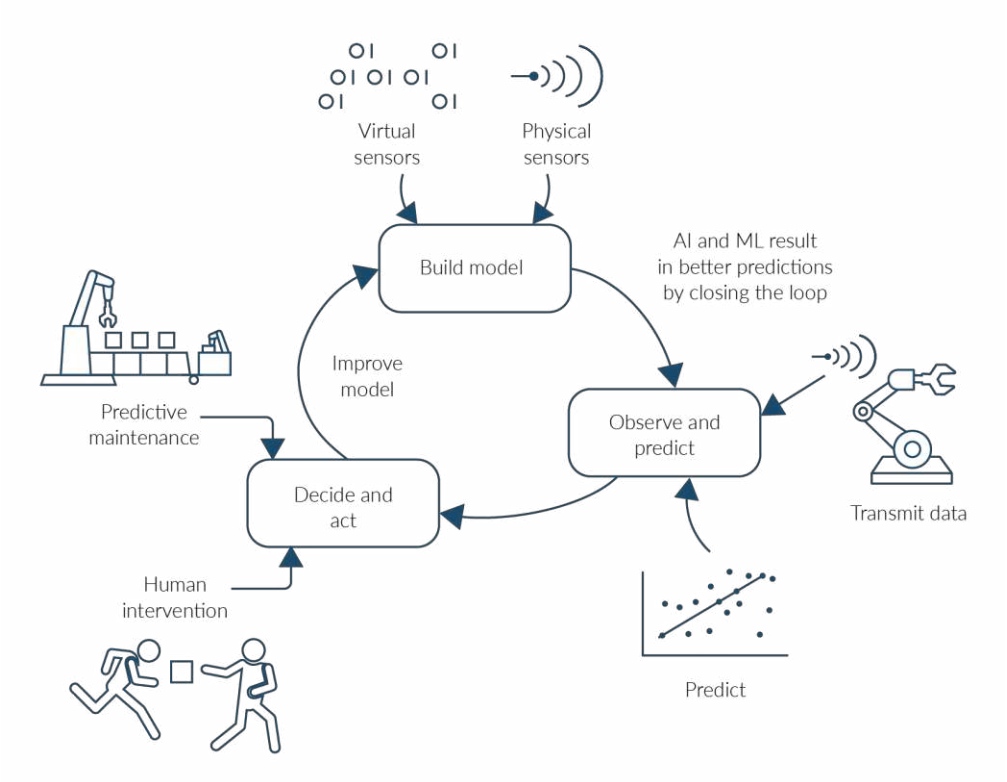

Figure 2: The process of building and using the AI and ML models in an IIoT platform yields tangible business advantages.

User-friendly apps can help with this. However, it's difficult for most manufacturers to build out custom applications. The traditional way for manufacturers to accomplish this task is to assemble a team of dedicated

programmers who are well-versed in programming and data science. These apps take time to develop and are usually only built for one purpose. The progressive way for manufacturers is to take advantage of low-code platforms. These platforms allow engineers to easily build, test, and deploy IIoT applications to the IoT stack. Low-code development allows almost anyone to build out a solution or modify existing IIoT solutions.

CONCLUSION

Companies are producing more data than ever before. To realize that data's full potential, companies need to convert it into a business asset. AI and ML enable manufacturers to use data to find hidden insights that result in tangible benefits for OEE. Manufacturers are able to increase throughput, reduce downtime, schedule predictive maintenance, and improve product quality thanks to these insights.

Building and training the models that facilitate these insights requires a steady flow of accurate data. Manufacturers can use both physical and virtual sensors to develop exceptional models. Once models are developed and deployed, they need to be able to convey anomalies and insights.

These insights are only effective if they can be shared in a timely manner with the people who need to see them. To enable this, business leaders need an application that allows them to easily see and share these insights. Low-code environments empower engineers to create, test, and deploy these apps on the IIoT platform.

The future of manufacturing goes hand-in-hand with AI and ML. As more manufacturing data is processed and analyzed, the importance of AI and ML expands. Companies looking to gain competitive advantage have to look toward AI and ML. These are the technologies of the future.

Lifecycle Insights is a research and advisory publishing firm. Our mission is to help executives reap more value from tech-led initiatives without disruption.

Lifecycle Insights' team of analysts conducts research and thought leadership programs, attends and speaks at industry events, and reviews emerging technology solutions.

EMAIL - contact@lifecycleinsights.com

SITE - www.lifecycleinsights.com