

SOLUTION BRIEF

Advanced Analytics
Manufacturing & Industrial



Creating an insights-driven factory floor

Fero Labs and Intel empower manufacturing decision makers with advanced analytics

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Executive Summary

Manufacturers today need to fight against shrinking profit margins while transforming established processes to become more data-driven. The good news is that these changes do not need big investment, and the benefits they bring can not only cut costs, but also increase productivity, streamline operations and enhance quality.

Fero Labs, using Intel® hardware, has developed a cloud-based machine learning (ML) solution designed to be quick and easy to implement while enabling manufacturers to get maximum value from their data. Its algorithms use current and historic data to provide factory decision makers with dashboards that display the latest activity and provide probabilistic predictions about what might happen next. This added insight, combined with the expertise of managers and engineers, helps uncover opportunities and possible issues sooner and ensures action can be taken proactively.

By 2025, McKinsey forecasts that “smart factories” will generate as much as \$3.7 trillion in value¹

Solution Benefits

- **Confident decision making:** Predictions are assigned probabilistic confidence intervals using machine learning with added context, and provide interpretable explanations about how they are made, so decision makers have the context they need to apply their own insight and judgment
- **Time and cost savings:** Applying advanced analytics to more complex data than previously possible allows manufacturers to uncover opportunities to increase efficiencies and optimize processes to save time and money
- **Real-time insights:** Web-based dashboards provide up-to-the-minute insight into trends across the production line, delivered using advanced analytics and powerful Intel® processors

Growing factory floor data needs new analysis models

Since the idea of 'Industry 4.0' was introduced, manufacturers have been working hard to equip their factories and supply chains with the latest in Internet of Things (IoT), automation and other technologies that will help them thrive in the digital age. The potential cost savings, efficiency improvements and quality gains that these innovations can bring are huge, but it can be hard to fit them into existing processes and ecosystems.

Traditional operating models like Six Sigma and Lean Manufacturing rely on classical statistical methods that struggle to scale to handle the huge volumes of 'messy' data that manufacturers are now generating, for example through sensors on factory equipment, incident database and robot logs. The data is there to provide managers and engineers with insights that will help them optimize processes and preempt issues, but in such large and growing volumes that the current manual methods cannot keep up. In an environment with hundreds of variables to measure, knowing which ones to have your time-stretched personnel focus on can be tricky.

However, being able to pinpoint the insights that will help improve efficiencies and reduce costs is more critical than ever, with profit margins being squeezed ever tighter. For example, a break down on the production line can create costs that quickly spiral up, with an automotive factory losing around USD 22,000 every minute² that it is not operating. Being able to identify the fault and address it before it stops the production line could make a big difference to the bottom line. Accuracy is critical though, especially when it comes to introducing any element of artificial intelligence (AI) like machine learning. Making the wrong prediction could result in lost money, wasted time, or even a safety risk. As manufacturers seek to add advanced analytics to their growing and increasingly complex data assets, they need to maintain a strong element of human control and oversight.

Advanced analytics helps save time and money

A specialist in machine learning for the manufacturing industry, Fero Labs has developed a product that enables its customers to use their factory data to reduce costs and optimize processes, while keeping human decision makers in the driving seat. The use cases that it supports vary depending on each organization and its specific requirements. In a steel production environment, for example, they may include:

- **Improving quality control:** The manufacturer must ensure that a wide range of quality thresholds are met. Failure to do so means having to go through parts of or the whole production process again, increasing scrap rate, and wasting time and money. Being able to use IoT devices to monitor each of the relevant criteria and then apply analytics to all that data at once means the manufacturer can spot areas where requirements are not being met and take steps to address them during the first round of production. This helps ensure a higher quality output first time and minimize any scrap.

Advanced Analytics in Manufacturing: Potential Use Cases

- Predict production quality issues
- Minimize machine downtime
- Identify production bottlenecks
- Intelligently schedule maintenance



• **Speeding quality checks and time to market:** Quality control is a part of daily life for most manufacturers, but it can be time consuming. For example, a steel coil, once produced, may need to be checked against a number of criteria, but, to do so manually, the engineers may need to wait for up to three days for it to cool enough to be safe to handle. Then, it can be tested in the lab and either approved or sent back to be re-processed if it does not satisfy requirements. By applying analytics to data coming from the still-hot coil as it comes off the production line, the manager can get an accurate picture of what the lab result is likely to be. If a concern or potential failure is identified, the coil can go straight back into production and avoid the delay and expense of sending it to the lab when it is unlikely to pass.

With capabilities like these, manufacturers can not only improve efficiency across their own internal processes, but also ensure that every product leaving the factory is of the highest quality and meets service level agreements (SLAs). This means that any customers purchasing the steel to use in their own manufacturing process (such as an automotive manufacturer) will find their testing and production cycles are accelerated as well, and the need to return any faulty products is minimized.

Maintenance is another area where the ability to discover and predict patterns can make a big difference. For example, IoT sensor data combined with advanced analytics can tell you when a piece of equipment is likely to fail or need servicing. With more advanced warning, maintenance personnel can plan these updates into the factory's schedule to minimize disruption. If they know they will need to take a part of the production line offline soon in order to carry out essential repairs, production line managers can make decisions, for example, to reduce pressure on a certain part of the system to keep things moving until a big order is complete, and then come offline between that and the next big job. This helps ensure that any maintenance or updates are done when needed, but also in line with business priorities, and that there are no surprises.

Creating confident decision makers

Fero Labs helps its customers transition from traditional operating models and reporting based on spreadsheets to more dynamic analysis and decision making based on real-time data. "There's sometimes a feeling when we speak to manufacturers that 'we already do reporting, so we don't need advanced analytics or data scientists' but when they start to look at the use cases, the value of using machine learning becomes clear," says Berk Birand, CEO of Fero Labs. "Not all companies need to hire a team of data scientists, but they can definitely all benefit from data science, and that's what our solution delivers."

The Fero Labs solution, powered by Intel® technology, integrates with existing technology and processes, helping minimize the cost of implementing advanced analytics and achieving a faster return on investment (ROI). It offers engineers and production line managers a real-time view of what is happening across hundreds of variables, enabling them to identify and respond to issues and opportunities faster, or even uncover important insights that would not

be visible at all using traditional analytics. It also provides predictions, based on current and historical data, about what might happen next. Using an approach based on machine learning with added context, each prediction has a confidence interval assigned to it, which empowers the decision makers in the process to make more informed, more timely decisions that help improve outcomes from end to end. It also provides users with interpretable data that helps them identify the source of any issues, so they can take steps to resolve it permanently.

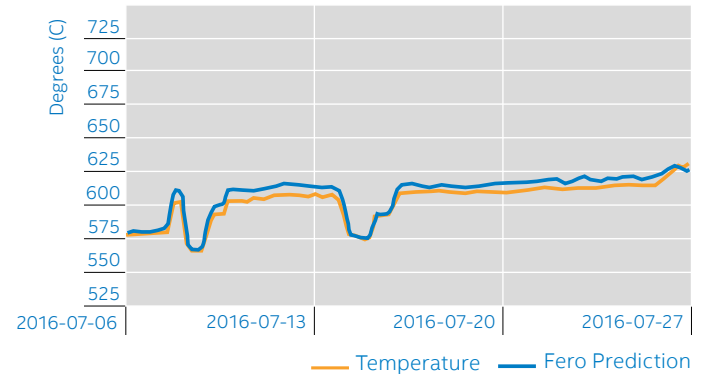


Figure 1: Temperature measure and prediction³

"We're helping manufacturers collect and curate all their data from across the business in a way that wasn't possible before," continues Birand. This includes human inputs, even in the form of free-entry text, as well as sensor and database data. "By creating this holistic view of their existing environment and applying machine learning to it, our customers can discover insights from their data and better decide what to do now, and what to do next. It is very hard to estimate the value of a machine learning investment ahead of time, because its ROI depends on the nature of the data. To address this, we set up our sales approach to first train our algorithms on a snapshot of a customer's data, without making any demands on their IT infrastructure. Our customers then get a detailed report showing the prediction accuracy of our models, and can decide to go forward with full deployment."

Solution Architecture: Fero Cloud

The cloud-based Fero Labs software provides the machine learning capabilities manufacturers need to pull insights from their factory floor and supply chain data. It is designed to help them get up and running fast, with no prior machine learning experience.

As a first step in any implementation, the manufacturer creates a snapshot of its data and stores it as a spreadsheet before uploading it into the Fero cloud. The data is used to train many proprietary machine learning algorithms to automatically identify the ones with the highest predictive accuracy. Then, once all necessary optimizations to the data and the algorithms have been made, full deployment goes ahead.

Solution Ingredients

- Intel® Xeon® processors: Scalable, flexible computing power for complex calculations
- Fero Labs software: Advanced analytics and machine learning for manufacturing environments
- Microsoft Azure* cloud environment for integrated cloud support

Feeds from sensors, historian databases, robots and any other connected sources are collated within the company's network by a piece of Fero collector software before being sent to the Fero cloud, where its machine learning algorithms perform advanced analytics to identify the trends and patterns specified by the customer. These insights and predictions are then delivered to managers and engineers on the factory floor and in the back office through a series of tailored web-interface dashboards. Blueprints for common use cases (called modules – see fig 3) are available within the software, enabling users to get set up quickly. Once these individuals have their dashboards in place, they can then decide on the most appropriate action to take – for example, alerting a machine operator of a change or servicing that needs to be carried out. Meanwhile, the machine learning tool continues to refine and improve itself as more data flows in and more decisions are made.

The solution is designed to be fully compliant with all industrial security regulations. All data is collected from inside the factory and then pushed out to the cloud, without ever connecting into the factory via a virtual private network or firewall. "We believe the cloud is the most secure option for our solution," says Birand. "Some factories still try to stay disconnected, believing it's more secure but this isn't necessarily so. A strategy to proactively address security requirements and plan for security in your infrastructure will likely be more secure in the long run than attempting to isolate your infrastructure from the outside world."

The Fero solution runs on a Microsoft Azure* cloud environment powered by Intel® Xeon® processors E5 family. It has recently run a test of the latest generation Intel® Xeon® Scalable processors and plans to migrate to this platform in the near future. The company chose to run its solution on CPUs based on Intel technology as the algorithms involved require many small operations to be carried out iteratively in order to complete the complex calculations needed. "An important part of our solution is the ability to do contextualized machine learning, which enables us to have a greater level of trust in our algorithms," says Birand. "Other methods can tell you that there may be a fault, but it's hard to know how accurate the prediction is. Using machine learning with added context, we not only get the fault prediction but also an indication of its probability of being correct. Predicting with such confidence intervals is a complex operation that goes beyond many off-the-shelf machine learning solutions today, as you need distinct levels of control and interpretation. It's also an iterative process

Fero Labs Machine Learning Analytics for Manufacturing

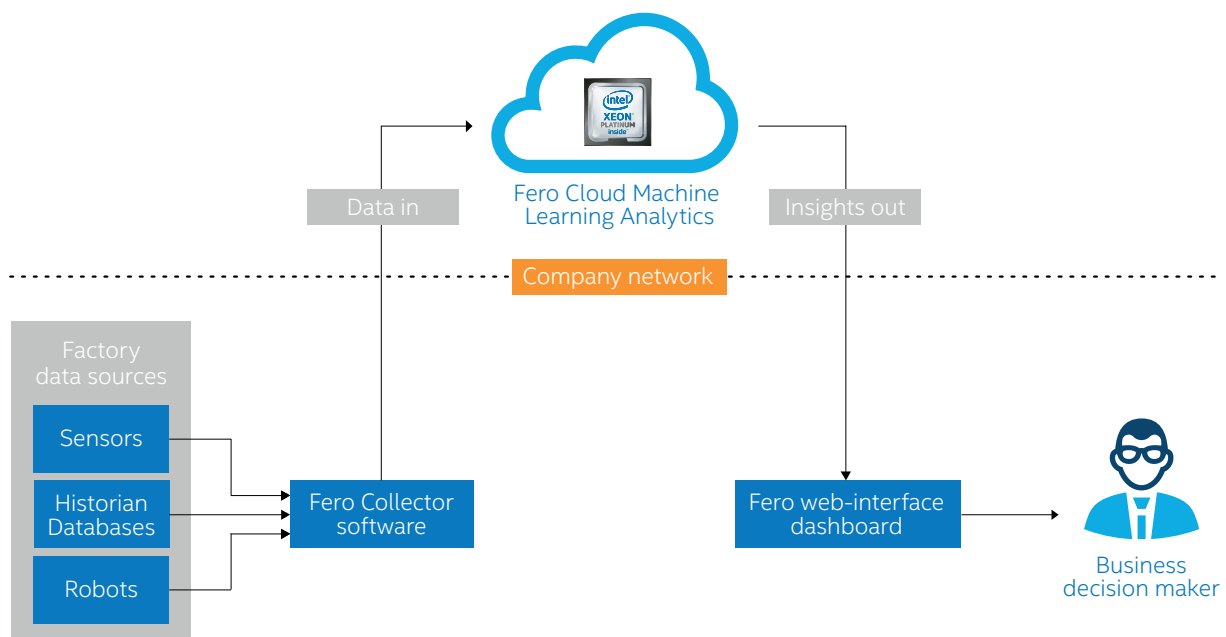


Figure 2: The Fero Cloud environment

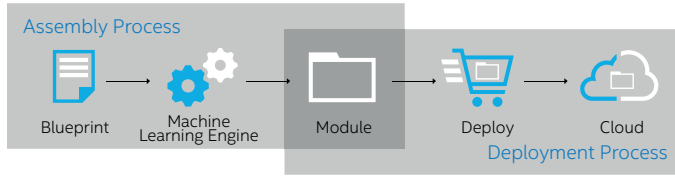


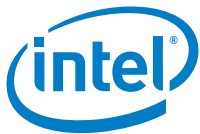
Figure 3: Fero Labs begins each project with a blueprint to create a Fero Module

that needs to be completed quickly. We feel that these types of transparent machine learning algorithms need powerful and reliable CPUs, which is why we've chosen to work with Intel to develop our product.”

In addition to compute power, Fero relies on Intel technology to deliver AI performance and code optimization. It uses the Intel® AI Portfolio to deliver enterprise-ready AI capabilities for both its cloud-based and on-premise activities. Meanwhile, the Intel® Math Kernel Library helps increase the performance of its analytics application while reducing development time.

Conclusion

Moving on from well-established ways of working can be daunting, but the data you hold is growing every day, and with it the potential value you can extract from it. By implementing advanced analytics to help your employees make more informed, timely and proactive decisions you can quickly create positive impacts – on your people, your processes and your bottom line.



¹ <http://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/the-internet-of-things-the-value-of-digitizing-the-physical-world>

² <https://arimo.com/machine-learning/2016/manufacturing-downtime-cost-reduction-predictive-maintenance/>

³ Source: Fero Labs data

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- [Planning Guide: Getting Started with Advanced Analytics](#)

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