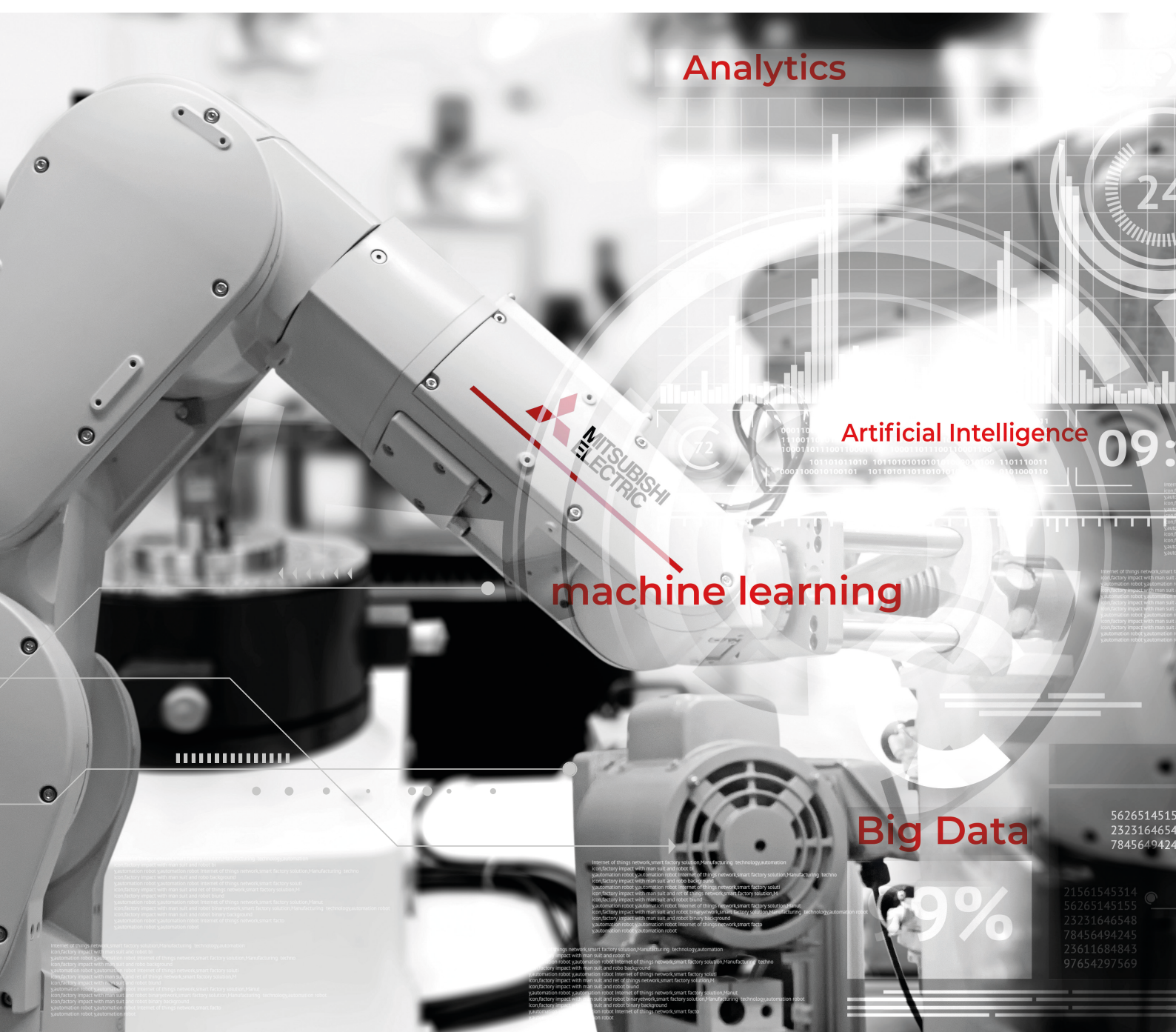


Visual guide to data science in manufacturing

An easy, visual guide on how to approach data science in modern manufacturing lines.



Analytics

Artificial Intelligence

machine learning

Big Data

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How data science is transforming today's manufacturing

With the growing complexity of manufacturing, more complex solutions have to be implemented. Proper data science strategy can help manufacturing companies achieve a competitive advantage in ways that were not possible even couple of years ago.

We at Mitsubishi Electric understand that data science can be quite overwhelming to start with, but we believe this simple guide will help you in making first choices and considering initial technologies.

Core message

To simplify the process of data science implementation, create data science strategies as close to your influence area as possible.

- Prioritize equipment level,
- Chose edge over cloud,
- Utilize data from existing sensors and factory floor devices.



Modern manufacturing at your fingertips



Quick tips



Look at a challenge

Look at a specific challenge in your production. The more specific, the better.



Clear goal

Define a clear goal together with your Management on what should be achieved (and when).



Team of experts

Work with a team of experts from different disciplines (management, operators, engineers) and involve process experts.



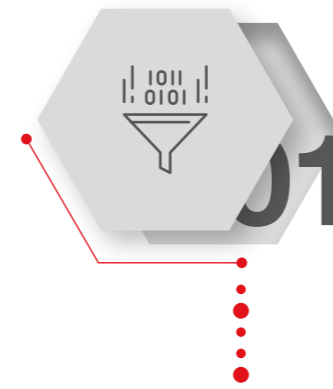
Data gathering

Remember that even by just collecting the right process data and visualizing them as a trend you are already making the first step in your data science journey.

Hassle-free framework for data analytics

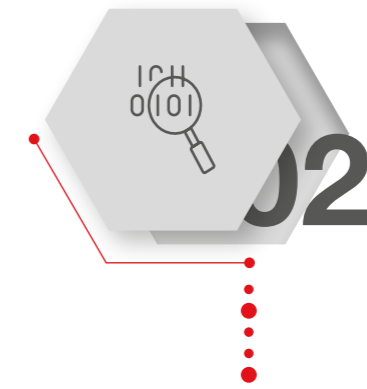
A Manufacturing Site or a machine does not have to be highly modified to implement data science strategies. **Start with setting up a simple framework, where you clearly define what is expected.** It makes a lot of sense to start with small goals and to learn from the experience.

Three steps in data analysis



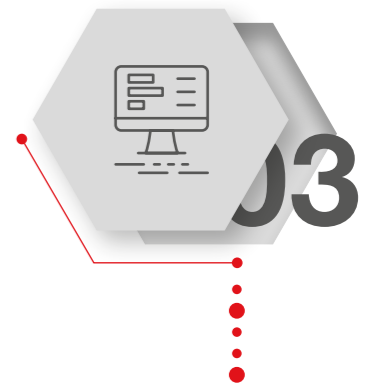
Collect data

Collect data from manufacturing site



Analyze data

Analyze data to create diagnostic rules



Diagnosis based on analysis

Establish and operate diagnostic systems



Typical areas where data science can easily be implemented:



Production improvement

Identify factors that are most affecting your production speed or volume and try to understand the causes



Quality improvement

Identify where quality problems arise and try to confirm improvement areas



Asset maintenance

Try to understand your equipment better

Where to take the data from?

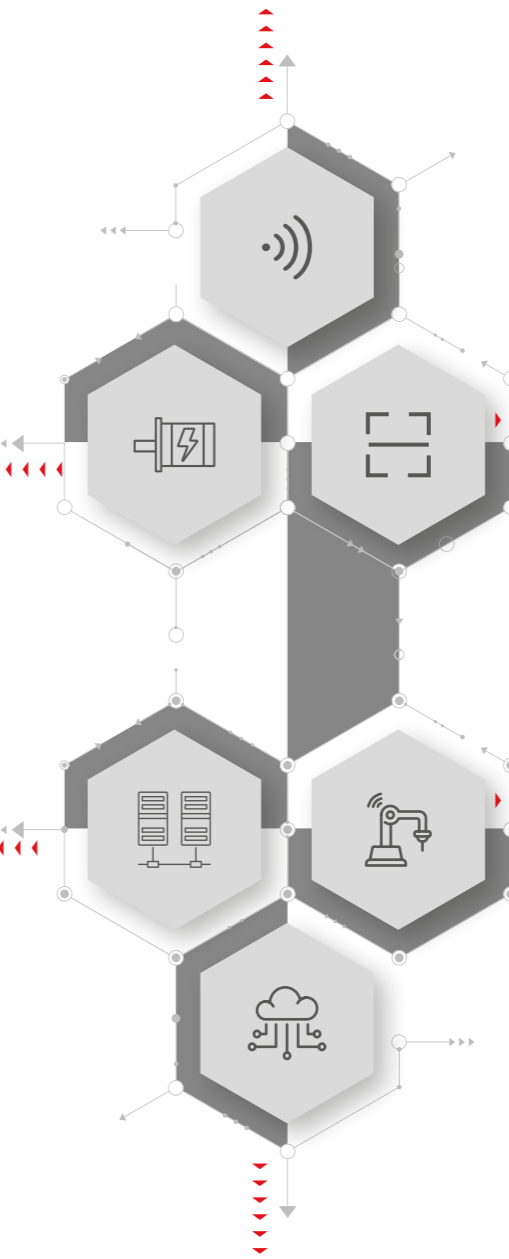
Sensors
If you maintain a good network structure, data from sensors can provide additional insights for data science needs. Sensors can also recognize the surrounding conditions (for example by detecting the sensing quality level)

Servo motors with high-resolution rotation monitoring
This provides extremely useful insights on the performance of rotating equipment

Servo amplifiers
These are controlling motors with high precision, but they also recognize lots of potential problems related to the mechanical surroundings

Vision systems and line scanners
These provide perfect, high-resolution insight for quality inspection

Robot arms
Robotics is a huge portion of automated production, so robot arms provide invaluable data regarding production speed, volume, and mechanical surroundings

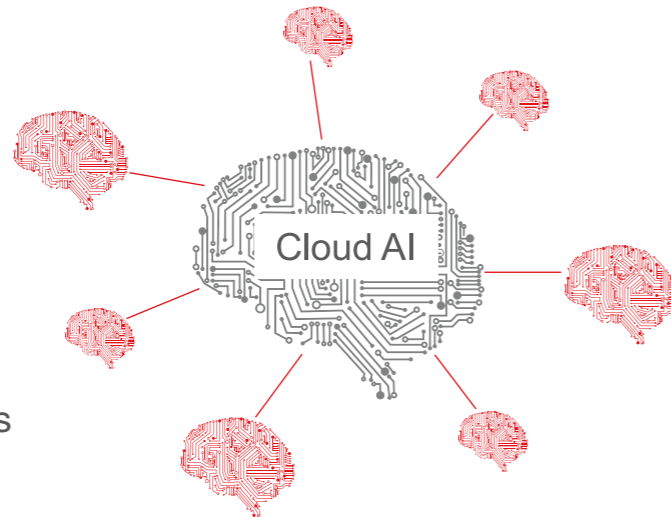


Industrial networks
Modern and advanced industrial networks such as CC-link IE TSN (Time Sensitive Networking) provide a large bandwidth to transfer the control and motion data, but they also provide a space for additional insights from various equipment

Edge vs cloud for data science

Edge

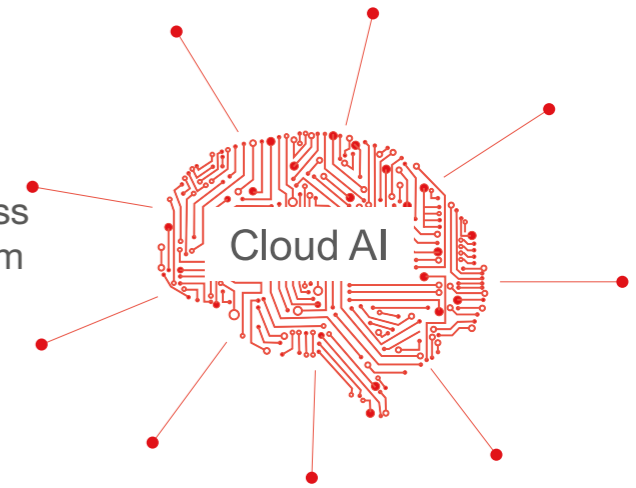
- Low latency
- Data security
- Low bandwidth
- Huge scalability options (including the cloud connection)



Edge Computing

Cloud

- Ability to store and process large amounts of data from different sources
- Huge computing power



Cloud Computing

Customer doesn't have to trade cloud for edge or edge for cloud. While we believe edge computing is the more suitable technology at the starting point, there is no obstacle to integrating a cloud system with an existing edge install base.

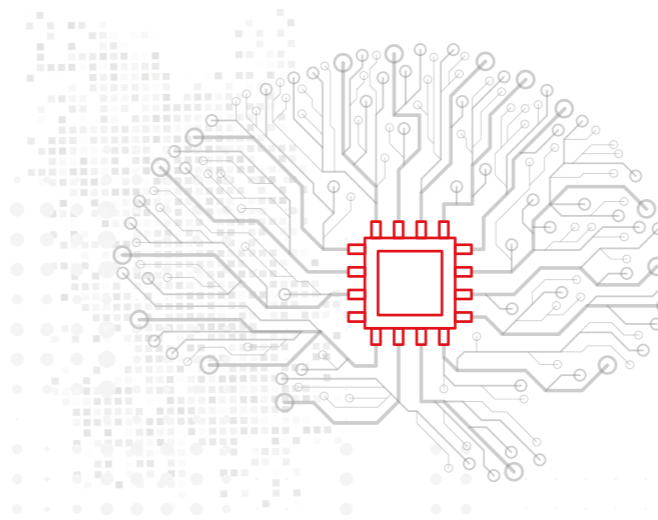
Cybersecurity



When using edge technologies, you are better protected from cyberthreats

- Data and your know-how stays in the company
- Data science system can be separated from the normal operations in the factory

Integration with advanced analytics



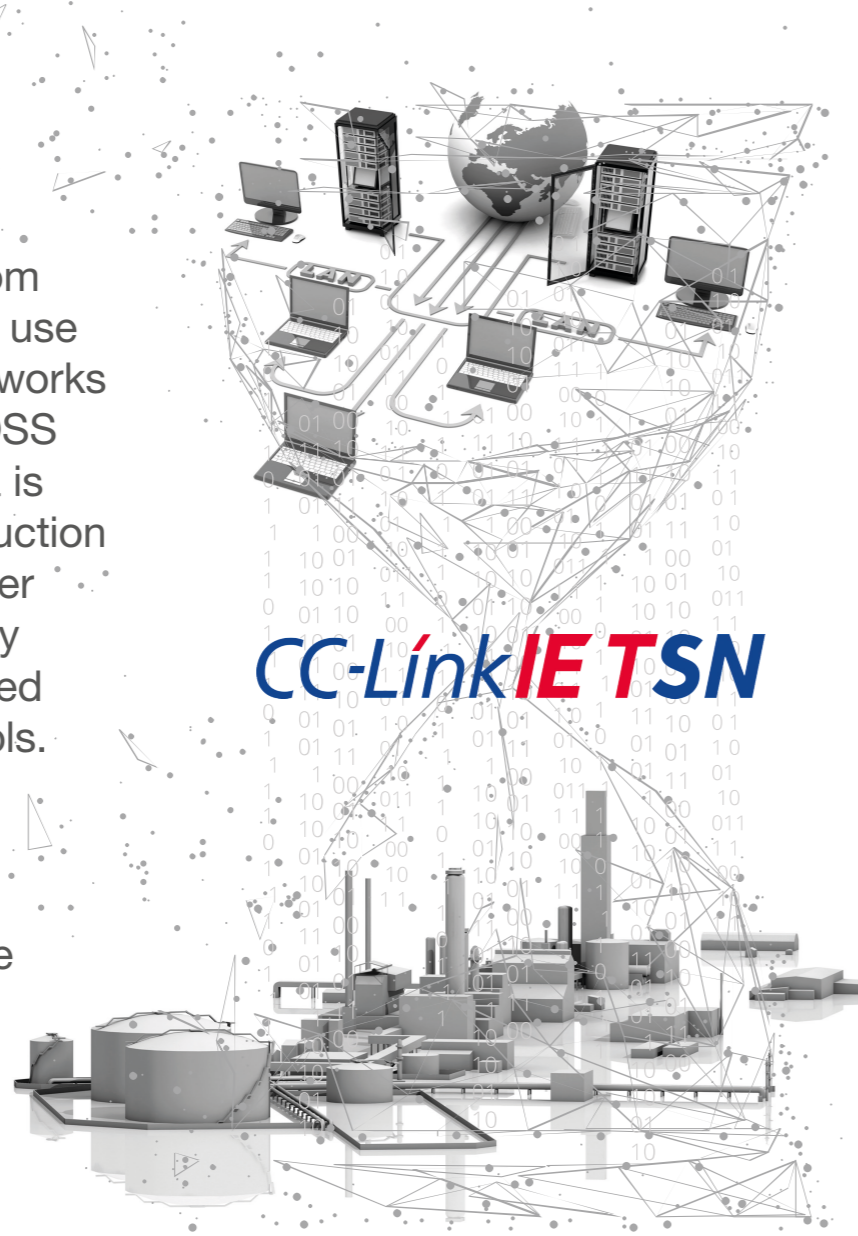
When using the cloud, a wide world of advanced analytics awaits:

- Open source and proprietary technologies are available
- Scaling of an application is easy
- Data science tasks can be outsourced to external data scientists

How to integrate a data science system into a production site?

You can collect data from existing equipment that use a variety of devices/networks by using the EDGE CROSS software platform. Data is retrieved from the production using CC-Link IE or other industrial networks or by using other TCP/IP-based communication protocols.

OPC UA, MQTT
These two protocols are gaining in importance, also in data science applications.



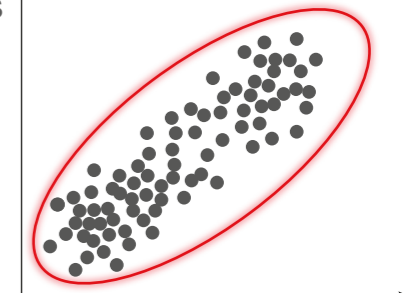
Since MELIPC is a stand-alone complete platform for edge computing, any brownfield application can be connected to it.

What data analytics strategies can be used?

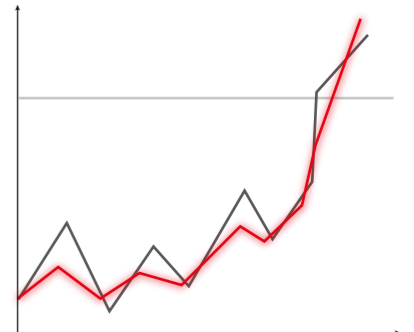
VARIOUS STATISTICAL ANALYSIS METHODS



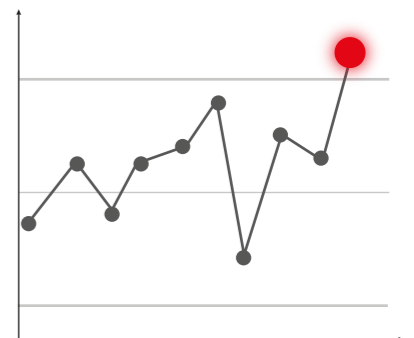
- Learns normal status and measures deviation of the current condition
- Can detect abnormalities even in devices that are less prone to abnormalities



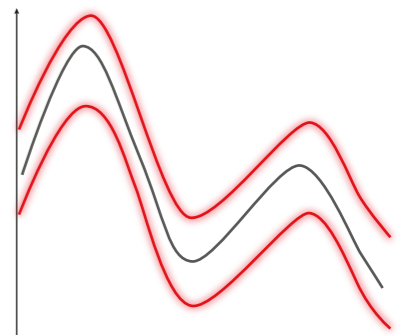
- Generates a formula to predict certain figures
- Predicts quality of products that can be quantified



- Monitors variance of quality within manufacturing processes

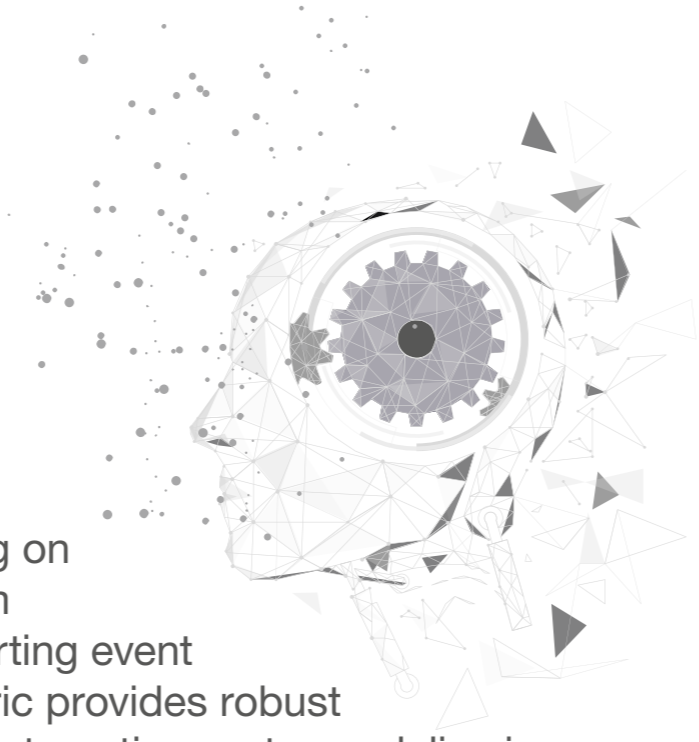


- Monitors threshold along the waveform




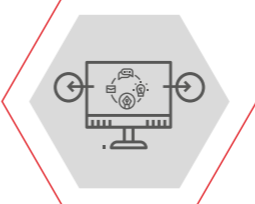


Incorporating AI Technology

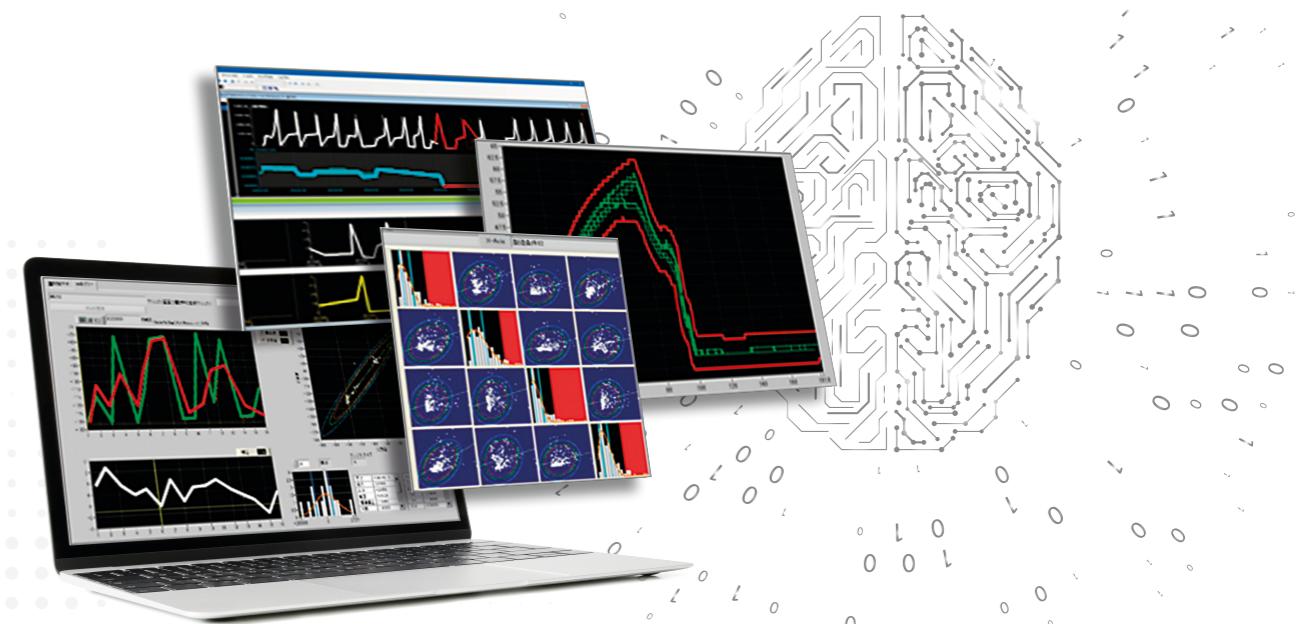
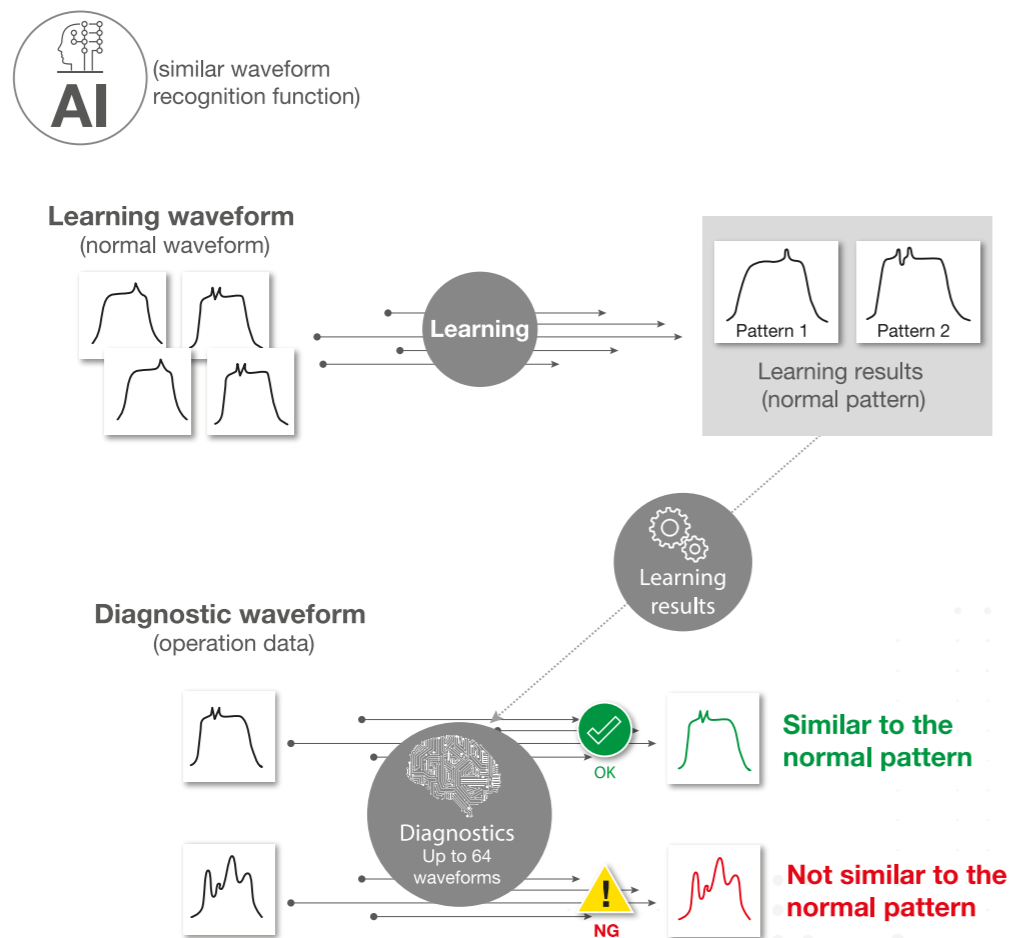
Mitsubishi Electric's AI technology detects abnormalities without relying on human expertise. It improves system diagnostics troubleshoots by supporting event sequence features. Mitsubishi Electric provides robust integration between IT and factory automation systems, delivering intelligent solutions that reduce costs while improving operations, production efficiency and effective supply chain management



How is it different from traditional approaches?

-  The use of high-level programming languages for data science is not necessary
-  Simplifies your analysis work with rich GUI functions
-  Visualize waveform data often found on the shop floor or input threshold with a single button
-  Single software for offline analysis and real-time diagnostics - Off-line analysis applied without affecting the running production, highly accurate rules for diagnosis and easy review or modification within the software

How AI works



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