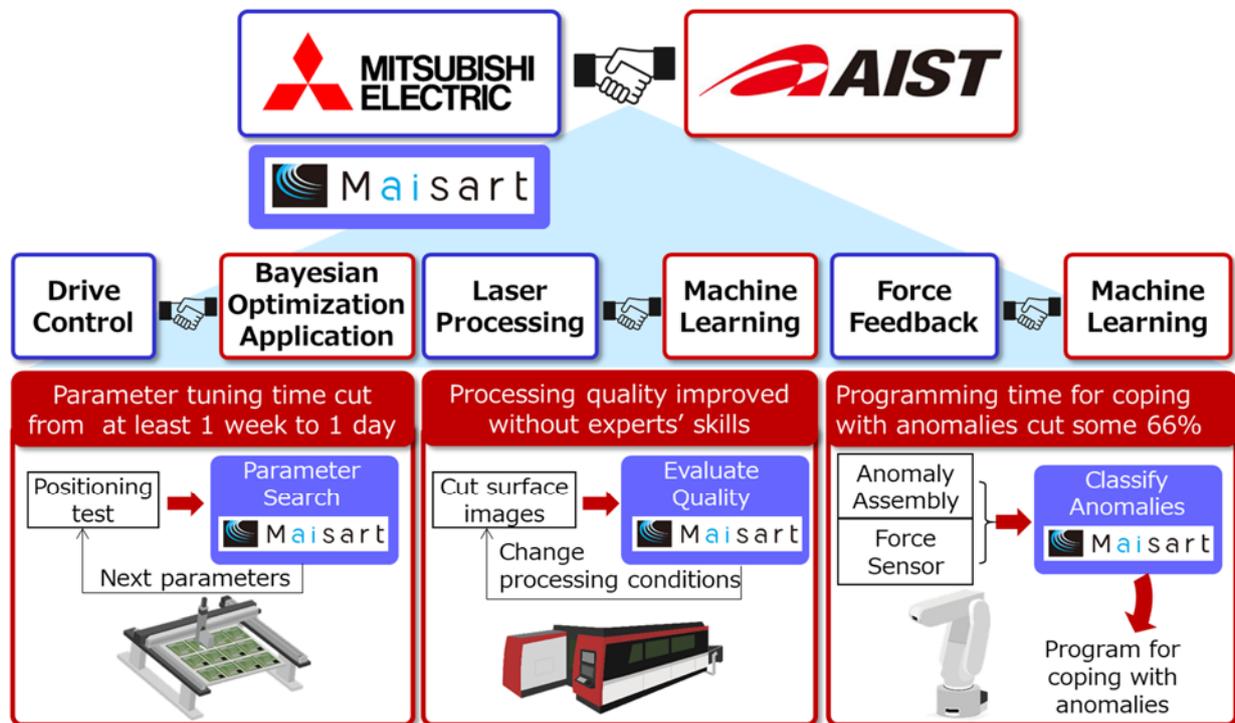


AI Technology Developed for Rapid FA Equipment Setup in Factories

Mitsubishi Electric and National Institute of Advanced Industrial Science and Technology collaboration

TOKYO, February 5, 2019 – [Mitsubishi Electric Corporation](#) (TOKYO: 6503) and [the National Institute of Advanced Industrial Science and Technology \(AIST\)](#) announced today that they have developed an artificial-intelligence (AI) technology that can reduce time for setting up factory-automation (FA) equipment. The new technology, which combines AIST’s AI technologies and Mitsubishi Electric’s FA technologies for highly effective application in the FA field, will be implemented in Mitsubishi Electric's Maisart^{®1} products for greatly increased factory productivity.

¹ [Mitsubishi Electric's AI creates the State-of-the-ART in technology](#) 



AI technology for rapid FA equipment setup in factories

The time for setting up FA equipment and systems prior to production, such as tuning or programming, is increasing in line with the growing demand for small-lot production. In addition, the supply of experts capable of performing such procedures is becoming insufficient. In response, Mitsubishi Electric collaborated to develop an AI technology that reduces the time for setting-up FA equipment and systems.

Key Features

1) *Servo system² positioning parameters tuned automatically in one day*

- Mitsubishi Electric's drive-control expertise is combined with AIST's Bayesian optimization³ application technology to enable positioning parameters to be tuned automatically in one day compared to one week for manual tuning by experts.
- High-speed positioning control cuts positioning time up by to 20 percent using as many as 720 parameters in eight categories, which even experts would have difficulty adjusting.

² Drives and controls various industrial machines at high speed and with high accuracy

³ Method for searchingly estimating maximum or minimum values of unknown functions or non-differentiable functions

High-speed positioning within allowable positioning error ranges is required when using servo systems for positioning control. Vibration and other characteristics usually differ depending on the target position and travel distance, so it is necessary to establish optimal parameters to determine the desired speed and acceleration for each position and distance. However, it can be difficult to adjust large numbers of parameters. Mitsubishi Electric previously developed products with 18 parameters in two categories. Mitsubishi Electric has now developed a new system with 720 parameters in eight categories for highly precise control, where even experts would have difficulty adjusting such an extensive number of parameters. Since the time required to automatically determine optimal settings for so many parameters would be a problem, the process has now been reduced by limiting the search range with Mitsubishi Electric's drive-control expertise and by increasing search efficiency with AIST's Bayesian optimization application technology. As a result, it has become possible to complete servo-system parameter adjustments in just one day, rather than at least one week as conventionally required by experts. In addition, positioning time is reduced by up to 20 percent.

2) *Laser processing quality determined automatically without the participation of experts*

- The combination of Mitsubishi Electric's laser processing knowhow and AIST's machine-learning technology for image recognition enables automatic evaluations of processing quality comparable to manual evaluations performed by experts.

A standardized procedure using the above evaluations allows operators to change settings for enhanced processing quality.

In sheet metal-cutting using laser processing machines, various factors can lower processing quality, such as debris on the lens used to focus the laser beam, changes in the temperature of the machine, and the condition of the workpiece surface, any of which can lead to scratches or discoloration on the cut surface, which lower quality. Conventionally, experts must check the cut surface to evaluate the resulting quality and then make adjustments as required to improve the quality.

By combining Mitsubishi Electric's laser-processing knowhow and AIST's machine-learning technology for image recognition, the automatic quality-evaluation technology using cut-surface images achieves the level of manual evaluations performed by experts. In addition, a newly standardized procedure allows laser-processing machine operators to change settings based on the automatic evaluations and thereby improve processing quality without the experts' skills.

3) **Programming time reduced to one-third of precedent to cope with anomaly of industrial robots**

- Mitsubishi Electric's force-feedback control⁴ technology and AIST's machine learning technology for data analysis are combined in a machine-learning system that classifies anomalies in the assembly operations of industrial robots.
- The time to create programs to cope with anomalies, a serious burden in setting up industrial robot systems, is reduced by some 66 percent.

⁴Technology for modifying position commands according to force-sensor outputs

In setting up industrial robot systems, a high volume of programs is required to cope with anomalies, which differ from system to system. Conventionally, experts predict possible anomalies in advance, such as errors in grasping or alignment, and then develop the many programs required to address the anomalies and recover normal operations. Developing such programs, however, takes far more time than the actual programming of normal robotic motions.

Accordingly, the new technology learns to classify anomalies using force-sensor outputs obtained during robotic operations. This is achieved by combining Mitsubishi Electric's force-feedback control technology for industrial robots and AIST's machine-learning technology. As a result, the new technology eliminates the need to develop anomaly classification algorithms, which conventionally must be created separately for each system, and thereby reduces the time required to create such programs by some 66 percent.

Collaboration in using AI for FA

Name	Contributions
Mitsubishi Electric	Expertise in servo systems, laser processing and industrial robot systems. Implementation, improvement and evaluation of AI algorithms.
National Institute of Advanced Industrial Science and Technology	Optimization, image-recognition and data-analysis technology using AI

About Maisart

Maisart encompasses Mitsubishi Electric's proprietary artificial intelligence (AI) technology, including compact AI, automated-design deep-learning algorithm and extra-efficient smart-learning AI. Maisart is an abbreviation for "Mitsubishi Electric's AI creates the State-of-the-ART in technology." Under the corporate axiom "Original AI technology makes everything smart," the company is leveraging original AI technology and edge computing to make devices smarter and life more secure, intuitive and convenient.

Maisart is a registered trademark of Mitsubishi Electric Corporation.

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About Mitsubishi Electric Corporation

With nearly 100 years of experience in providing reliable, high-quality products, Mitsubishi Electric Corporation (TOKYO: 6503) is a recognized world leader in the manufacture, marketing and sales of electrical and electronic equipment used in information processing and communications, space development and satellite communications, consumer electronics, industrial technology, energy, transportation and building equipment. Embracing the spirit of its corporate statement, Changes for the Better, and its environmental statement, Eco Changes, Mitsubishi Electric endeavors to be a global, leading green company, enriching society with technology. The company recorded consolidated group sales of 4,444.4 billion yen (in accordance with IFRS; US\$ 41.9 billion*) in the fiscal year ended March 31, 2018. For more information visit:

www.MitsubishiElectric.com

*At an exchange rate of 106 yen to the US dollar, the rate given by the Tokyo Foreign Exchange Market on March 31, 2018

About AIST

The National Institute of Advanced Industrial Science and Technology (AIST), one of the largest public research organizations in Japan, focuses on the creation and practical realization of technologies useful to Japanese industry and society, and on “bridging” the gap between innovative technological seeds and commercialization. For this, AIST is organized into 5 departments and 2 centers that bring together core technologies to exert its comprehensive strength. AIST, as a core and pioneering existence of the national innovation system, has about 2000 researchers doing research and development at 10 research bases across the country, based on the national strategies formulated with the changing environment involving innovation in mind. AIST is also actively building a global network by, for example, signing memorandums of understanding for comprehensive research cooperation (MOUs) with 30 major research institutes around the world.

AIST endeavors to achieve a rich and eco-friendly society through “Green Technology,” healthy and safe living through “Life Technology,” and a super smart society through “Information Technology,” with the hope of building a sustainable society.