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Mitsubishi Electric Develops Behavioral-analysis AI that Analyzes Manual Tasks Without Requiring Training Data

Reduces time for analyzing manual work on production sites by up to 99%

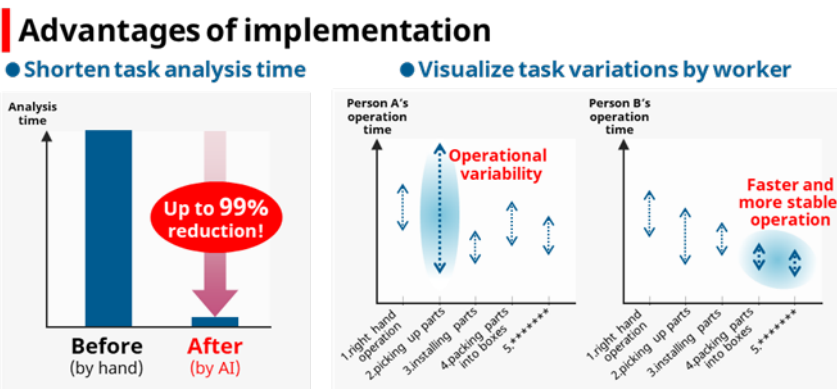
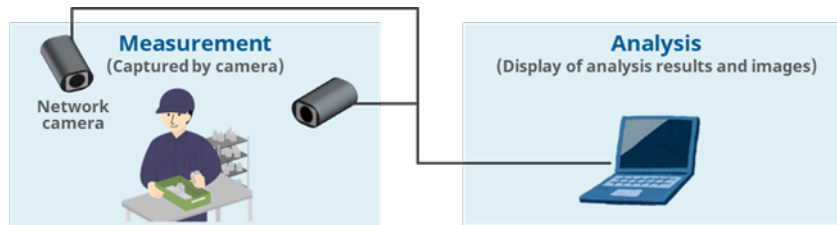


Fig. 1 Advanced system for work analysis and resulting improvements in work efficiency

TOKYO, January 25, 2024 – [Mitsubishi Electric Corporation](https://www.mitsubishielectric.com) (TOKYO: 6503) announced today that it has developed a behavioral-analysis AI that analyzes the efficiency of manual tasks performed on production sites in just a few minutes without requiring operators to prepare AI-training data¹ in advance, by adopting a probabilistic generative model.² This new addition to the company's Maisart³ AI lineup quickly analyzes videos of people performing repetitive tasks and then visualizes how tasks can be performed more efficiently for greater productivity.

This is believed to be the world's first⁴ application of a probabilistic generative model that modeled cyclical (repetitive) physical actions performed during factory work. The technology, first announced by Mitsubishi

¹ Data set of examples and correct answers for AI machine learning

² A type of AI that treats data as random variables, and models the process of generating observed data

³ Brand name ("Mitsubishi Electric's AI creates the State-of-the-ART in Technology") of AI for making devices smarter



⁴ According to Mitsubishi Electric research as of January 25, 2024

Electric on February 13, 2019,⁵ has been shown in tests to reduce the time conventionally required for work analysis by up to 99%.⁶

Commercialization is targeted for the fiscal year ending in March 2026, or later.

The technology will be exhibited and demonstrated at IIFES 2024 (Innovative Industry Fair for E x E Solutions 2024), which will be held at Tokyo Big Sight from January 31.

Features

1) The world's first application of a probabilistic generative model for the analysis of repetitive work on production sites

For the first time in the world, Mitsubishi Electric has used a probabilistic generative model that modeled the process of generating waveform data of various body movements performed repeatedly in specific tasks. Using a video of work as it is performed, the skeletal structure of the worker is detected and their physical movements are recorded as waveform data. The behavioral-analysis AI analyzes the data using a probabilistic generative model of repetitive body movements. The AI identifies and analyzes the performance of repetitive tasks, such as moving an object or tightening a screw, based simply on the approximate time required to perform the given task one time. The AI can also identify non-repetitive tasks that differ from repetitive tasks in terms of time or waveform.

The analytical results can be incorporated into a video of the work being performed, allowing users to confirm each step of the task and even assign labels, such as "screw tightening." Unlike existing work-analysis AI, the new technology eliminates the need to create data for training the AI, thereby reducing the overall time required to analyze work by up to 99%. In addition, the technology's significantly reduced computational complexity eliminates the need for high-performance computers, such as graphics processing units (GPUs). Compared to manual analysis, inspection accuracy is 80% or more for work performed by unskilled workers and 90% or more for work performed by experienced personnel.

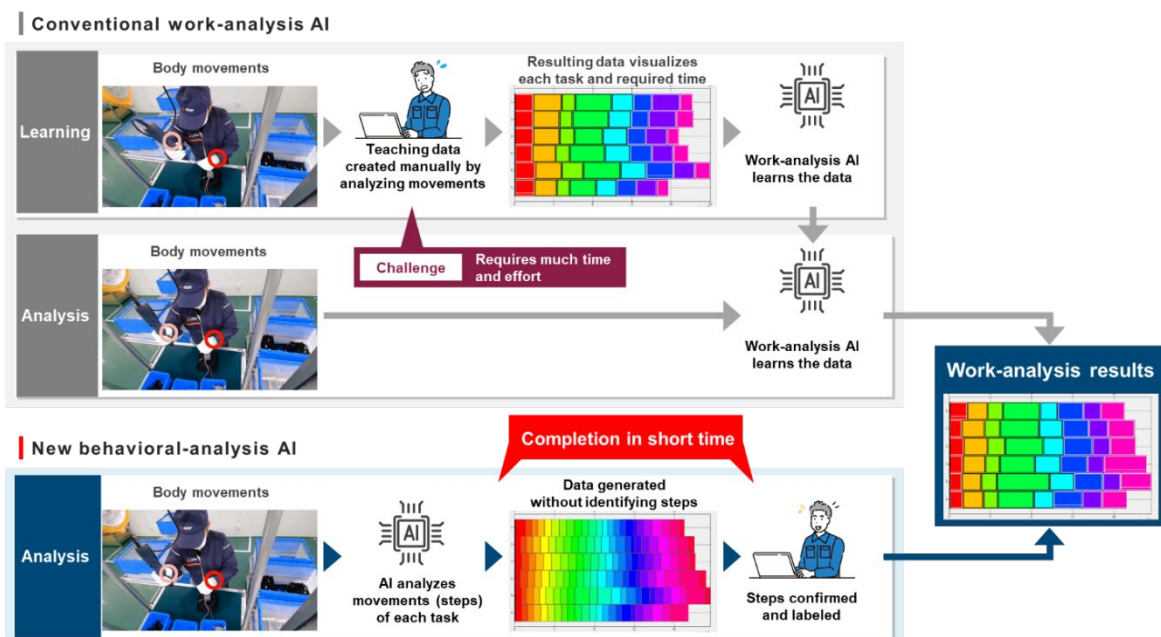


Fig. 2 Work-analysis results achieved with behavioral-analysis AI

⁵ <https://www.MitsubishiElectric.com/news/2019/pdf/0213-c.pdf>

⁶ Comparisons with the time required to create data for manual analysis and existing AI for general work analysis

2) Support for enhancing different levels of work proficiency and transferring skills

One of the purposes of work analysis is to help new workers learn skills. However, to analyze the differences between work performed by new and experienced personnel, existing AI requires training data on each individual to be prepared in advance, which can take much time and effort.

The new technology eliminates the need for training data, so analysis is fast even when observing multiple workers. By making comparisons with experienced workers, the AI can easily identify differences to help new workers learn advanced skills, leading to greater proficiency in a short period of time. In addition, the new technology can select the most representative examples of skilled and unskilled repetitive work in a video, enabling new personnel to easily grasp the differences at a glance and accelerate their learning of advanced skills.

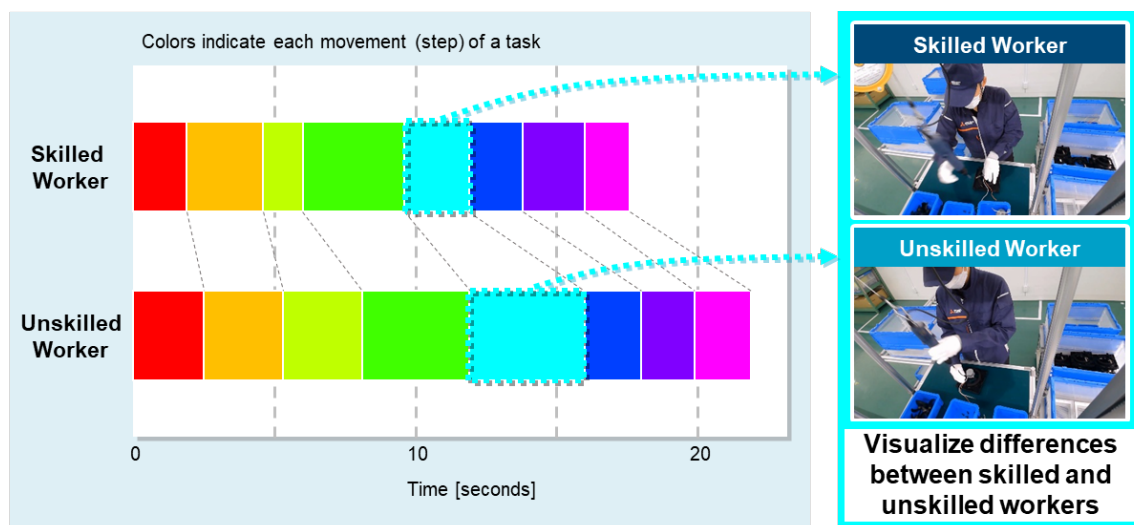


Fig. 3 Comparison of tasks performed by new and experienced workers

3) Fast creation of data to correct faulty work methods and maintain production quality

Existing AI for identifying abnormal work methods requires the preparation of data to teach the AI how to compare work in progress with correct, standard methods. However, work methods may differ depending on the version of the product being manufactured or, in some cases, the particular worksite. As a result, it is often necessary to modify the training data according to specific circumstances, which can greatly increase the time and effort required for data preparation.

Mitsubishi Electric's new AI simply creates its training data by using the results of work analysis. Even if different product versions or production processes are changed, real-time detection of abnormal processes can be realized in a short time and with minimal effort, ultimately helping to prevent quality defects in production.

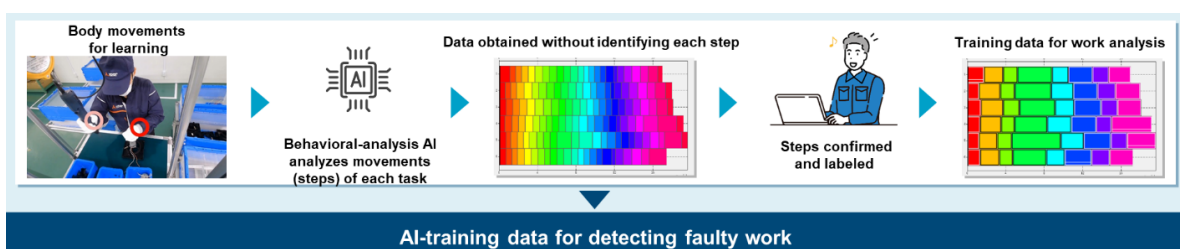


Fig. 4 Creation of training data for AI to detect abnormalities

Future Developments

Going forward, Mitsubishi Electric will conduct further verification of its new AI at both internal and external production sites, including plants operated by Sysmex Corporation and Sumitomo Rubber Industries Co., Ltd., with the aim of launching a commercial product in the fiscal year ending in March 2026, or later.

Background

In recent years, production automation technology and know-how have advanced, but capital investment has not kept pace due to high costs, so many processes are still performed manually. Human performance tends to vary in terms of work time and quality, which can create bottlenecks in manufacturing processes. To minimize variations in human performance in order to maintain high quality, analysis is required to quantify and standardize the time and methods required to perform basic tasks, such as moving objects or tightening screws. However, manual analysis of work processes is time-consuming and labor-intensive. In response, efforts are being made to automate such analysis, including through the use of AI. But until now, the adoption of AI has been hampered by the need to create training data required by the AI to learn about differences between each worker and process.

About Maisart

Maisart encompasses Mitsubishi Electric's proprietary artificial intelligence (AI) technology, including its 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 more than 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. Mitsubishi Electric enriches society with technology in the spirit of its "Changes for the Better." The company recorded a revenue of 5,003.6 billion yen (U.S.\$ 37.3 billion*) in the fiscal year ended March 31, 2023. For more information, please visit www.MitsubishiElectric.com

*U.S. dollar amounts are translated from yen at the rate of ¥134=U.S.\$1, the approximate rate on the Tokyo Foreign Exchange Market on March 31, 2023