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# Behavioral-analysis AI Detects Slight Differences in Human Movements

*Achieves fast analysis without prior machine learning*

**TOKYO, February 13, 2019** – Mitsubishi Electric Corporation (TOKYO: 6503) announced today that it has developed a unique behavioral-analysis artificial intelligence (AI) using the company's Maisart®* AI technology. Even without prior machine learning, the new technology can detect slight differences in human movements that people have difficulty noticing, which can be useful for analyzing human behavior in various fields, such as analyzing an assembly-line worker's motions to help eliminate unnecessary motions and thereby improve productivity.

* Mitsubishi Electric's AI creates the State-of-the-ART in technology Maisart

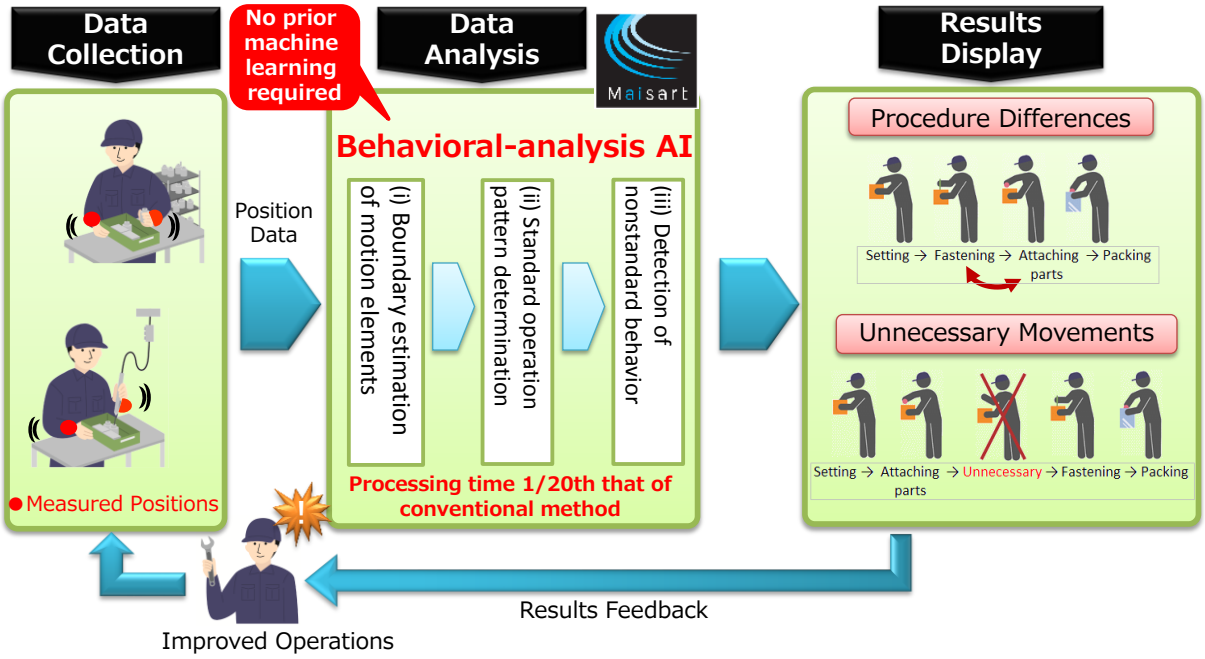


Fig. 1 Behavioral-analysis AI flowchart

## Main Features

### *1) Achieves fast processing without prior machine learning*

- Processes behavioral analysis at high speed, within a few seconds or few minutes, less than 1/20th of the time required by the company's conventional AI method.

The new technology analyzes human movements immediately after collecting required measurement data, focusing on similarities in repeated movements. The technology is easy to apply at work sites because, unlike conventional behavior-analysis AI, it doesn't require machine learning involving huge amounts of teaching data that must be introduced manually. Behavioral analysis can be performed at high speed, within just a few seconds or minutes, which is less than 1/20th of the time required for the company's conventional method. Analysis can be performed quickly at work sites to provide rapid feedback on improving workers' efficiency.

### *2) Detects slight differences in each person's motions to identify unnecessary motions*

- Using position data to measure human movements, it estimates the boundaries between motions (operating elements), determines standard motion patterns for each person, and then detects deviations from these standard patterns, such as slightly different or unnecessary motions.
- On assembly lines, it can be used as a tool to help workers master optimal motions and thereby raise efficiency for improved productivity.

When analyzing assembly work performed in factories, the technology uses sensors to measure the three-dimensional positioning of both hands of a worker. This data makes it possible to detect non-standard motions such as slight procedural differences or unnecessary motions. In the beginning, the AI pays attention to motions repeated in a given order, such as attaching a part and screwing it into place. It divides the measurement data equally as the initial value and temporarily sets boundaries for each motion (motions expressed in different colors in Fig. 2). Next, it extracts the waveform for each motion and compares it with the measurement data to update and determine the motion boundaries. Estimated motions are aligned to automatically determine standard motion patterns. Finally, by comparing the motion pattern extracted from measurement data with the standard motion pattern, it can detect non-standard motions.

## Future Developments

Mitsubishi Electric will continue developing its behavioral-analysis technology by conducting tests at the company's own factories. In addition, applications in various fields other than factories will be explored by leveraging the technology's capability to function without prior machine learning.

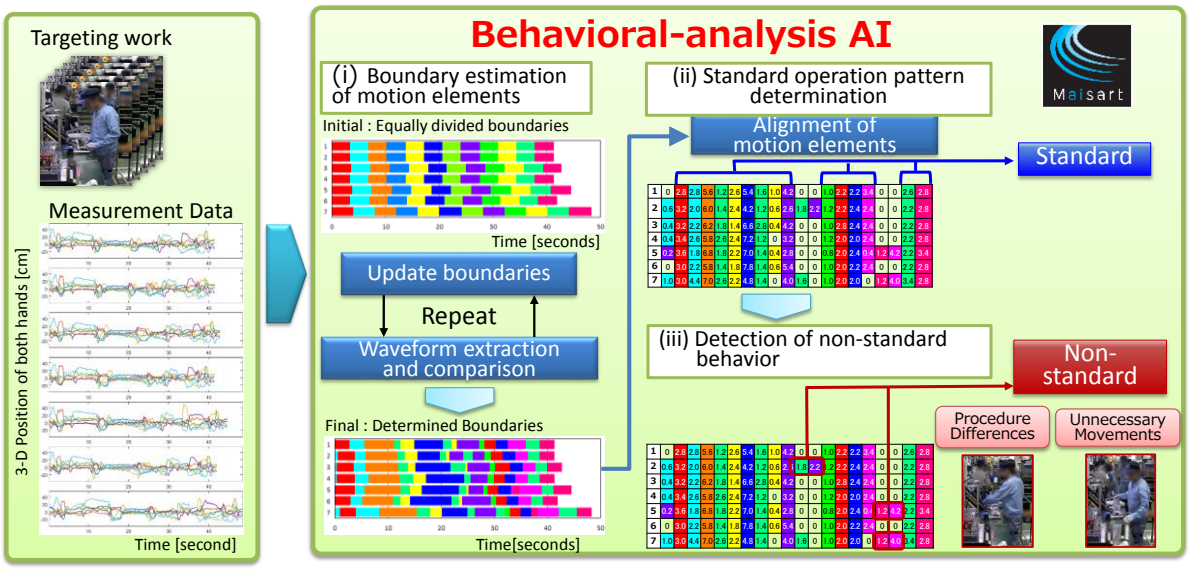


Fig. 2 Details of behavior-analysis AI

## 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.

## Patents

Pending patents for the technology announced in this news release number two in Japan and two outside of Japan.

*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