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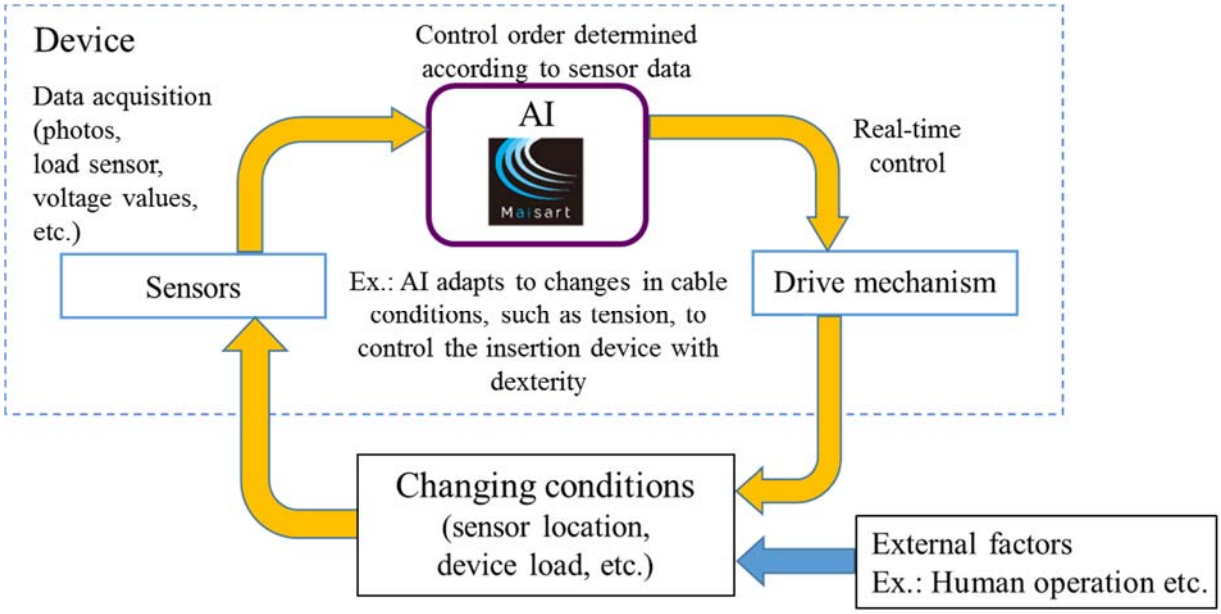
Mitsubishi Electric Develops Smart-control AI Technology that Adapts Rapidly and Nimbly to Changing Conditions

Enables industrial robots to optimize motions in real time, even as objects move

TOKYO, February 8, 2018 – Mitsubishi Electric Corporation (TOKYO: 6503) announced today that it has developed a smart-control artificial-intelligence (AI) technology under its Maisart* AI brand that enables devices such as industrial robots to rapidly grasp and nimbly adapt in real time to changing conditions of target objects. The application of this AI technology in devices will simplify automation tasks, even in the case of dramatically changing conditions, such as adapting to the changing shape of a non-rigid object.

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



Main Features

1) Uses AI technology and multiple sensors to grasp changes in objects in real time

The technology grasps the state of an object via multiple sensors and then recognizes any change by applying the company's Maisart-brand smart-learning AI. Through repeated estimation based on deep learning, tests have shown that the technology can decrease learning time and grasp changes in conditions in just 3.5ms

2) Technology redesigns control algorithms autonomously in real time

The automatic generation of optimal control algorithms through deep reinforcement-learning frees designers from having to redesign complex control algorithms. Application of this technology in industrial robots, etc. makes it possible for such devices to adapt to objects that are conventionally difficult to adapt to, such as flexible objects that change shape or objects for which conditions can change dramatically.

Development Objectives

	Learning/Control Method	Target
New	Grasp conditions immediately using multiple types of sensors and real-time control	Adapt to objects such as flexible items that change their shapes or for which conditions can change dramatically
Conventional	Learning and controlling based on predetermined conditions	Only objects for which conditions change in a predictable way

Details

1) AI technology and multiple sensors grasp changes in objects in real time

If runtime conditions are expected to change, designers need to account for the predicted changes in the designing step since conventionally operating runtime environments are fixed. This leads to problems with devices that cannot adapt to unpredictable changes in conditions, such as grasping a flexible object or controlling multiple robots that move in time. In Mitsubishi Electric's new technology, however, by repeating things that always receive feedback from environments via sensors and using values estimated based on deep learning in real time, it is possible to adjust control in real time (just 3.5ms).

2) Technology redesigns control algorithms autonomously in real time

Conventional designing must include complex controls to correspond to the shapes and locations of objects. Deep learning, however, can perform high-level estimations without preliminary data, although huge and costly amounts of learning data are required to generate optimal controls. Automatically repeating trials combined with reinforcement learning, which autonomously searches optimal actions, can help to reduce the costs of control designing and data collection, enabling the technology to be applied in generic control steps.

Learning time also can be a problem when trials are conducted solely with machines because such trials use conventional reinforcement learning based on random searches. By starting trials based on motions taught by humans, the learning time can be reduced significantly.

Background

AI technology capable of high-level information processing through deep learning is expected to be applied in various industries. Special attention is focused applications for industrial robots, which could help to overcome Japan's increasing lack of working-age personnel.

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 "**M**itsubishi Electric's **AI** creates the **S**tate-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

Patents for the technology announced in this news release number six in Japan and six outside Japan.

Maisart is a trademark of Mitsubishi Electric Corporation.

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About Mitsubishi Electric Corporation

With over 90 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 4,238.6 billion yen (US$ 37.8 billion*) in the fiscal year ended March 31, 2017. For more information visit:
www.MitsubishiElectric.com

*At an exchange rate of 112 yen to the US dollar, the rate given by the Tokyo Foreign Exchange Market on March 31, 2017