MITSUBISHI ELECTRIC CORPORATION
PUBLIC RELATIONS DIVISION
7-3, Marunouchi 2-chome, Chiyoda-ku, Tokyo, 100-8310 Japan

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Customer Inquiries

Information Technology R&D Center
Mitsubishi Electric Corporation

www.MitsubishiElectric.com/ssl/contact/company/rd/form.html
www.MitsubishiElectric.com/company/rd/

Media Inquiries

Public Relations Division
Mitsubishi Electric Corporation

prd.gnews@nk.MitsubishiElectric.co.jp
www.MitsubishiElectric.com/news/

Mitsubishi Electric Develops Compact AI Knowledge Representation and Reasoning Solution for Human-Machine Interfaces

TOKYO, January 28, 2020 – Mitsubishi Electric Corporation (TOKYO: 6503) announced today it has developed a compact knowledge representation and reasoning solution designed for deployment in embedded human-machine interfaces. Based on the company's Maisart®* artificial intelligence (AI) technology, the new development enables edge devices to understand vague user commands through the extrapolation of missing information. It achieves this by means of a "knowledge graph" which integrates user information, device specification and functionality and external information, and will allow responsive and easy-to-use human-machine interfaces to be embedded in consumer products such as televisions and car navigation systems.

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

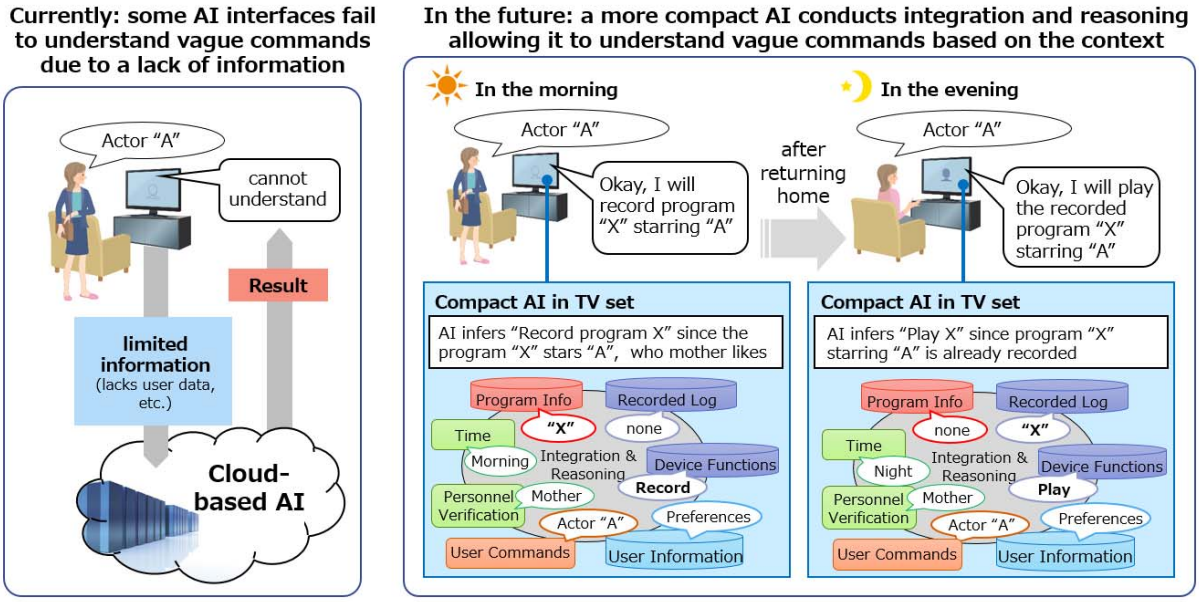

Fig 1: Example of application used in a television

Key Features

1) Understands vague commands by deducing missing information using a knowledge graph

This new technology allows missing information in voice commands to be deduced by means of a knowledge graph. This is a database that expresses the relevance of information using three sets of components—subjects, predicates and objects—where user information, device specifications and functionality and external information are integrated.

For example, as in fig. 1, when a user issues just the instruction “Actor A” to their television before going out in the morning, the newly developed solution contained in the device will respond, "I will record the program ‘X’ starring actor ‘A’". In this example, the artificial intelligence embedded in the solution deduces the lacking information as follows. First, using its cameras it identifies the user as the “mother”. It then retrieves from the knowledge graph the information that the mother’s favorite program is X, the program X stars Actor A, it starts from 10 AM, the mother will not be able to watch the program because of her daily schedule, and it is not currently due to be recorded. Finally, by using this information, the system infers that the mother wants to record program X and takes appropriate action.

2) Compact reasoning technology enables quick HMI response in edge devices

As part of this new solution, Mitsubishi Electric has developed a reasoning methodology that reduces the amount of computation and memory usage required to interpret vague commands. It achieves this through a reduction in the size of the required knowledge graph by adjusting its relevance with reference to user commands and sensing information. This allows a fast and responsive human-machine interface on edge devices.

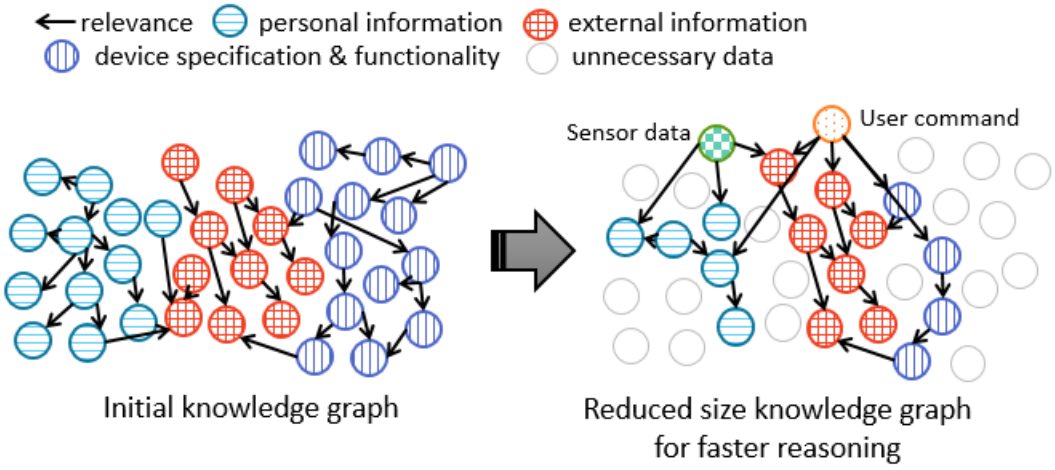

Fig. 2: Overview of knowledge graph reduction

Future Developments

Mitsubishi Electric intends to initially deploy this new technology in home appliances and car navigation systems, aiming to commercialize it from 2022 onwards. In the future, the company will consider applying the technology to inquiries and quality control processes within Mitsubishi Electric's own internal operations.

Background

Complex equipment has traditionally required humans to understand and adapt to the equipment's own operating processes. In recent years, AI applications supporting device operation using cloud-based big data are becoming more widespread. However, as verbs or objects are frequently omitted in users' speech commands, previous AI solutions often failed to correctly interpret these. In addition, the demand for faster response by edge devices is growing, and there is increasing reluctance on the part of users for their personal data to be uploaded to the cloud.

Mitsubishi Electric's "Maisart" AI technology automatically supplements missing information in order to allow devices to understand ambiguous commands by its use of a knowledge graph integrating user commands, and personal information as well as sensing results and device specifications and functionality. In addition, it incorporates a compact reasoning method using a knowledge graph which enables a fast response from edge devices such as home appliances and car navigation systems.

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.

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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 a revenue of 4,519.9 billion yen (US$ 40.7 billion*) in the fiscal year ended March 31, 2019. For more information visit:
www.MitsubishiElectric.com
*At an exchange rate of 111 yen to the US dollar, the rate given by the Tokyo Foreign Exchange Market on March 31, 2019