

FOR IMMEDIATE RELEASE

Development of Active-learning Dialogue Data-based AI Technology

Reducing Labor Time for Conversation Contents to One Tenth

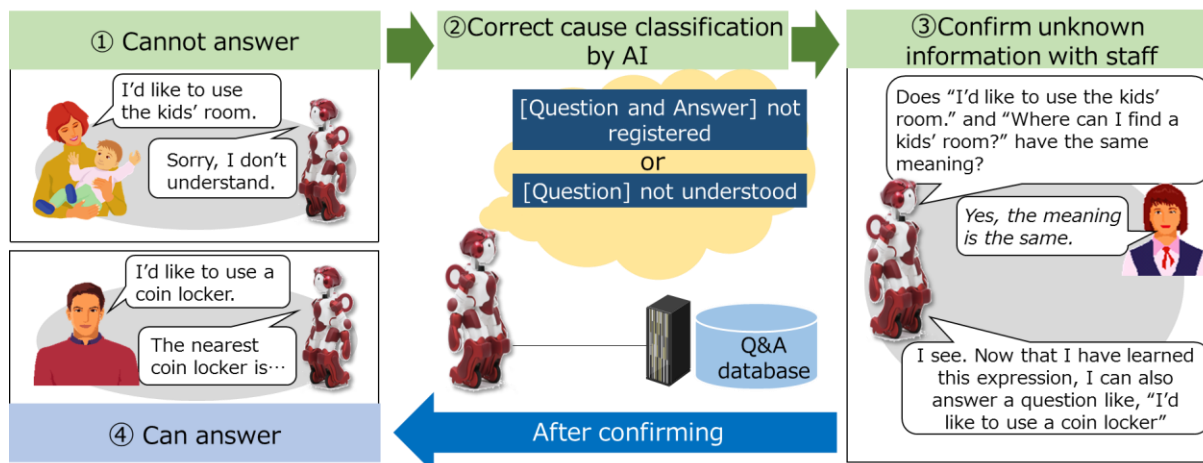


Fig. 1. Learning process

Tokyo, September 28, 2017 --- Hitachi, Ltd. (TSE: 6501, Hitachi) today announced the development of active-learning dialogue data-based AI technology to enable EMIEW3, Hitachi's human symbiotic service robot,^{*1} to spontaneously "learn" how to respond to questions that it could not previously answer. EMIEW3 clarifies the meaning of enquiries with related staff through dialogue interaction, and in the process, automatically increases its dialogue contents to increase "comprehension" for appropriate responses. Hitachi is currently developing EMIEW3 with view to use in customer service and guidance settings. Using this technology, EMIEW3's dialogue contents can be enhanced by staff without specialist training, simply by responding to queries posed by EMIEW3, and was found to reduce labor-hours for this process to about one-tenth the time previously needed.^{*2} Further, this technology allows EMIEW3 to learn more quickly about products or facilities which may change daily, as well as increase comprehension and correctly respond to customer enquiries. Hitachi is aiming to provide even higher quality dialogue data-based solutions by using this technology.

In recent years, in light of companies facing labor-shortage for customer service desks, there is an increasing anticipation for advanced robot-based voice-dialogue solutions. Hitachi has conducted several field-tests for customer service and guidance solutions with EMIEW3^{*3} through which it has found that due to wide variation in how a customer

query might be posed, that in some cases EMIEW3 is unable to comprehend the nature of the question, and thus unable to answer the question. To address this issue, conventionally, a system administrator would need to continuously analyze interaction logs even after commencement of the service, and regularly expand the dialogue contents. Recognizing the importance of being able to efficiently expand the dialogue contents after the service has been initiated, Hitachi developed active-learning AI technology that investigates questions which EMIEW3 was unable to answer, identifies the causes and clarifies questions that it did not previously understand, to enable EMIEW3 to “learn and grow” through voice-based dialogue with staff. The technology developed consists of the following two points:

(1) Active-learning technology

Machine learning was applied to identify and spontaneously learn about components of the dialogue that could not be understood. The technology analyzes the causes of unanswerable questions, and classifies them into two patterns: one where the answer is not registered, and the other, where the intention of the query was not understood due to the question being expressed in an unfamiliar form. In the first case of where the question was understood but the answer is not registered, EMIEW3 will ask a staff member for the appropriate information. In the second case where the question could not be understood due to the way it was expressed, a similar question registered in the question-answer database will be sought, and EMIEW3 will confirm with a staff member if the similar question has the same intent as the query which could not be understood. The new “response” and “query expression” learned from the staff response is then automatically registered in the question-answer database.

(2) Technology to efficiently use newly learned query expressions

Natural language processing techniques such as morphological analysis and syntax analysis were used to develop technology to efficiently learn new forms of expressing the query. The technology uses morphological analysis and difference detection to find interchangeable components from two different ways of asking the same question, and learns rules about diverse forms of how the same question might be posed (hereafter referred to as rephrasing). Further, syntax analysis and machine learning are used to check if incorrect rephrasing is remembered. Through this, more correct rephrasing rules are formed, and by applying this to other questions, increases the pattern of expressions which have the same meaning.

As a result, log analysis by system administrators become unnecessary, and enables daily enhancement of the dialogue contents by simple on-site dialogue between staff with appropriate business knowledge and EMIEW3.

Using this technology, Hitachi aims to provide higher quality correct response voice-dialogue solutions to businesses with customer service desks. This technology will be demonstrated with EMIEW3 in the showcase at the Hitachi Social Innovation Forum 2017 TOKYO, to be held from 1-2 November at the Tokyo International Forum in Yurakucho, Tokyo. Demonstration field-tests will also be conducted in collaboration with the Haneda Robotics Lab^{*4} at as part of the Haneda Airport Robot Experiment Project.

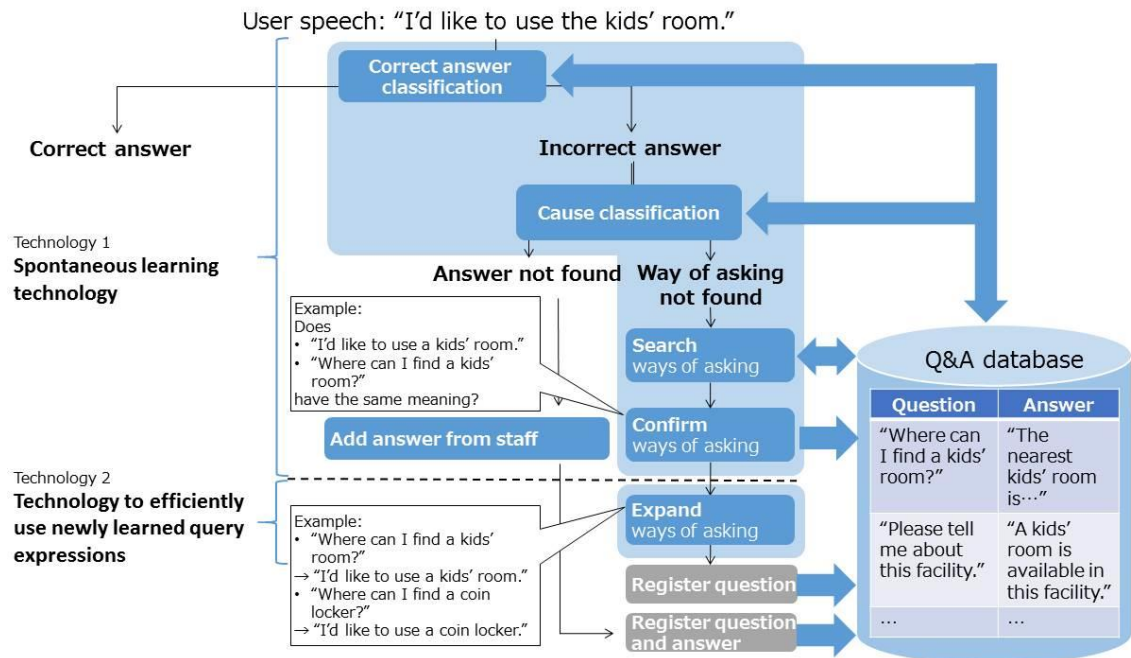


Fig. 2. Overview of this technology

*1 Hitachi News Release issued on 8th April 2016, announcing EMIEW3 and its Robotics IT Platform <http://www.hitachi.com/New/cnews/month/2016/04/160408.html>

*2 The actual reduction ratio will depend on the target business operation and the amount of data involved. The ratio given in this release is based on simulation results from help desk operation and related data within Hitachi.

*3 Hitachi News Releases on EMIEW3 field tests

9 February 2017: <http://www.hitachi.co.jp/New/cnews/month/2017/02/0209.html> (in Japanese)

2 December 2016: <http://www.hitachi.co.jp/New/cnews/month/2016/12/1202.html> (in Japanese)

2 September 2016: <http://www.hitachi.com/New/cnews/month/2016/09/160902.html> (in English)

*4 For more information on the Haneda Robotics Lab, please visit the webpage on the Japan Airport Terminal Co., Ltd. website <https://www.tokyo-airport-bldg.co.jp/hanedaroboticslab/en.html>

About Hitachi, Ltd.

Hitachi, Ltd. (TSE: 6501), headquartered in Tokyo, Japan, delivers innovations that answer society's challenges. The company's consolidated revenues for fiscal 2016 (ended March 31, 2017) totaled 9,162.2 billion yen (\$81.8 billion). The Hitachi Group is a global leader in the Social Innovation Business, and it has approximately 304,000 employees worldwide. Through collaborative creation, Hitachi is providing solutions to customers in a broad range of sectors, including Power / Energy, Industry / Distribution / Water, Urban Development, and Finance / Government & Public / Healthcare. For more information on Hitachi, please visit the company's website at <http://www.hitachi.com>.

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