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

Mitsubishi Electric Separates Simultaneous Speech of Multiple Unknown Speakers Recorded with One Microphone

Speech-separation technology achieved with proprietary "Deep Clustering" AI method

TOKYO, May 24, 2017 – Mitsubishi Electric Corporation (TOKYO: 6503) announced today that it has created the world's first technology that separates, and then reconstructs with high quality, the simultaneous speech of multiple unknown speakers recorded with a single microphone in real time. In tests, the simultaneous speeches of two and three people were separated with up to 90 and 80 percent accuracy, respectively, which the company believes are world's firsts as of this announcement. The novel technology, which was realized with Mitsubishi Electric's proprietary "Deep Clustering" method based on artificial intelligence (AI), is expected to contribute to more intelligible voice communications and more accurate automatic speech recognition.
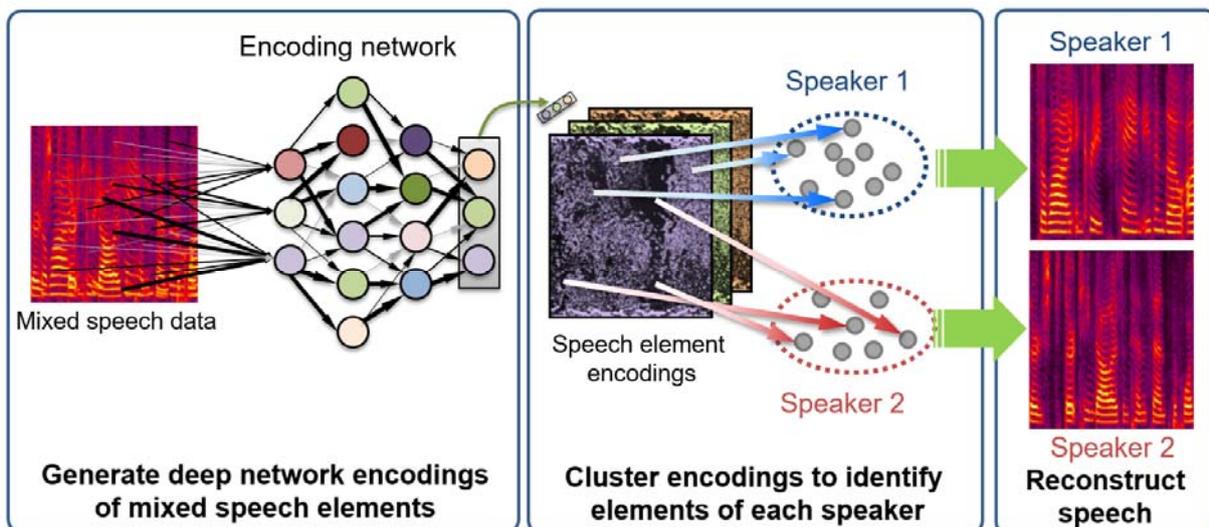
In the case of two simultaneous speakers, accuracy exceeded 90 percent, sufficient for commercial applications, compared with 51 percent accuracy using conventional technology. The new technology is able to discern between combinations of several spoken languages and gender. The above results are based on ideal recording conditions, including low ambient noise and speakers talking at roughly similar volume.

The Deep Clustering technology uses Mitsubishi Electric's proprietary deep-learning method to learn how to encode signal components of the original speech data of multiple people so that signal components

belonging to each individual speaker can be easily distinguished by their encodings. To accomplish this, the encodings are optimized such that different signal components belonging to the same speaker have similar encodings, and those belonging to different speakers have dissimilar encodings. The learned encoding transformation is applied to the input speech, and the encodings of the signal components of each speaker are identified using a clustering algorithm, which processes data points into groups depending on their similarities. Each person's speech is then reconstructed by resynthesizing their separated speech components.

Accuracy in Separating Simultaneous Speech of Multiple Speakers*

	Two speakers (single microphone)	Three speakers (single microphone)
New technology	>90% (world's first)	>80% (world's first)
Conventional technology	51%	—

*Based on ideal recording conditions

Noise-reduction technology for eliminating noise from a mixture of speech and noise is implemented in commercial applications, such as the hands-free telephony functions of car navigation systems. To separate the speech of a targeted person from the simultaneous speech of other people, existing methods require multiple microphones to acquire information on the location of each speaker. Until now, however, there has been no effective method to accurately reconstruct the speech of multiple unknown speakers recorded with just one microphone.

Going forward, Mitsubishi Electric will explore opportunities to apply its new technology to improve the quality of voice communications and the accuracy of automatic speech recognition in real environments, such as cars, homes and elevators.

Patents

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

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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