

Liberation from Biological Limitations via Physical, Cognitive and Perceptual Augmentation

Project manager

(selected in 2020)

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Leader's institution

Advanced Telecommunications
Research Institute
International ATR

R&D institutions

ARAYA Inc., Osaka University,
Keio University, AIST, Sony
Computer Science Laboratories,
Inc., University of Tokyo,
Tokyo Institute of Technology,
Tokyo Metropolitan Institute of
Medical Science, Waseda
University, University of
Melbourne, University of
California, San Francisco,
National Institute for
Physiological Sciences

Summary of the project

If a person's intentions can be estimated, the ultimate CA (cybernetic avatar)*1, which can be operated as desired, becomes possible. For estimation, not only internal brain activity but also brain surface information and interaction information with others are important clues. By 2050, we will realize the ultimate BMI-CA that can be operated as a person wishes.

Milestone by year 2030

[Realization of a remote mutual assistance society where people can overcome their disabilities and participate in social activities]

People with physical and brain limitations can independently expand their own physical, cognitive, and perceptual abilities using AI-assisted BMI-CA*2 that can decode words and actions in their minds with high accuracy, and can further expand these abilities by collaborating and cooperating with experience-sharing CAs of others with whom they agree, and participate in new cultural, artistic, sporting, and educational activities.

Milestone by year 2025

[Technological Transformation of Communicating Words and Actions Conceived in the Mind to Others]

The expansion of physical, cognitive, and perceptual abilities beyond one person's work capacity and the speed of voice communication can be realized by coordinating and collaborating AI-assisted BMI-CAs that decipher with high precision the words and actions that anyone can conceive in his or her head. In particular, if a person with a disability wishes to have a surgical operation, some functions of the AI-assisted BMI-CA can be extended beyond those of a single person, enabling a new way of life.

*1 Avatars, like teleoperated robots or characters in cyberspace, share sensory perceptions with humans and engage in social activities. In this project, avatars function as semi-autonomous agents, and when combined with AI technology, they are applications that extend human physical, cognitive, and perceptual capabilities.

*2 AI-assisted BMI-CA: Cybernetic Avatar (CA) that can decipher words and actions in the user's head with high precision according to the combination of different types of BMI by machine learning of AI. This project uses non-contact BMI to estimate behavior from environmental sensors, non-invasive BMI to decode words and behavior from EEG on the scalp surface, and invasive BMI to decode from brain information near the dura mater during surgical procedures.

Project structure

Theme1 IoB Interface



Ushiba
Keio Univ.



Watanabe
Waseda Univ.



Furuya
Sony CSL



Koizumi
Sony CSL

Theme2 IoB Middleware



Sasai
Araya



Hayashi
AIST



Oizumi
Univ Tokyo



Arulkumaran
Araya



Rekimoto
Univ Tokyo



Koike
Tokyo Tech

Theme3 IoB Core Technology



Yanagisawa
Osaka Univ.



Nishimura
TMIMS



Komatsu
Tokyo Tech



Chang
California Univ.



Wake
NIPS

Theme4 Development of Common Technologies



Kanai
Araya



Takemi
Keio Univ.



Usiba
Keio Univ.



Komamura
Keio Univ.



Akutsu
Araya

Theme5 IoB Minimally Invasive Technology



Sekitani
Osaka Univ.



Nakamura
Osaka Univ.



Grayden
Melbourne Univ.



Uemura
Osaka Univ.