

Co-evolution of Human and AI-Robots to Expand Science Frontiers

Project Manager

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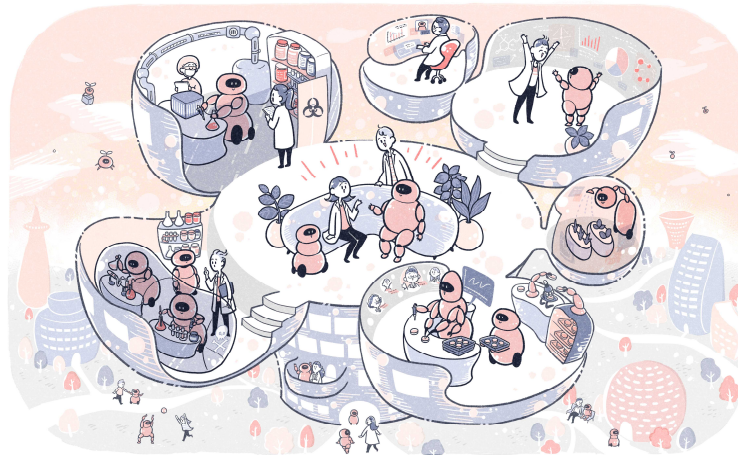
Participating Institutions

Nagoya University, The Australian National University, Osaka University, Ritsumeikan University, The University of Tokyo, Tokyo, Tohoku University, Kyusyu University, Medical and Dental University



Project Summary

This project aims to develop AI-robots conducting scientific experiments in a challenging environment (e.g. in a hazardous atmosphere, or in a micro-scale setup), while interacting with scientists as a peer scientist. AI robots and scientists will change their mutual interactions and do tries-and-errors together to handle objects or work in environments that they have never experienced with. The proposed concept will realize the discovery of scientific principles and solutions by AI-Robots in the science fields by 2050.



Vision of AI-robot scientists in 2050

Milestone for 2030

The project will develop AI-robots that estimate and reflect the intentions and thoughts of scientists based on their past activities to autonomously perform scientific experiments that could not be done by human scientists alone.

Milestone for 2025

The project will develop AI-robots that automatically interpret a large set of experimental results and propose hypotheses to scientists that humans would not be able to come up with, enabling scientists to formulate new strategies to perform scientific experiments that could not be done by human scientists alone.

Research topics

AI-robot scientists that autonomously explore science and work as a peer scientist require **the body** whose physical capabilities are beyond those of human scientists in terms of accuracy, precision, and dexterity, and **the brain** whose processing capabilities are beyond those of human scientists in terms of the data size and data modalities to handle, and the body and brain need to be integrated so that the AI-robots scientists can autonomously explore science without being pre-programmed by human scientists. Laboratory automation is to automatically conduct pre-programmed experiments, and thus the time required for scientific discovery can be shortened, but the quality of discovery would be the same. The AI-robot scientists with degrees of autonomy are to alter the quality of scientific discovery by compensating human scientists. The project involves researchers in many disciplines, including both engineers and scientists. The collaborating scientists use AI-robot prototypes for **scientific applications** while giving feedback to engineers.

<Topics>

(1) Body of the AI-robot Scientists

Robotic platforms and micro-robotic tools will be developed to enable accurate, precise, and dexterous manipulation beyond the physical capabilities of human scientists.

(2) Brain of the AI-robot Scientists

AI for knowledge to interpret experimental results and propose hypotheses, **AI for skills** to interpret experimental manipulation and propose manipulation strategies, and **mathematical foundations** to abstract knowledge and skills will be developed.

(3) Scientific applications

Scientists will use prototypes of AI-robots to conduct experiments.

Math. foundation



NagoyaU
Shogo
TANIMURA



ANU (Australia)
Yoshihiro
MARUYAMA



OsakaU
Takashi
MATSUBARA

AI for knowledge



NagoyaU
Ichiro
TAKEUCHI



NagoyaU
Kensaku
MORI



RitsumeikanU
Tadaihiro
TANIGUCHI



UTokyo
Kei
OKADA

AI for skills

Tool



UTokyo
Fumihito
ARAI

Platform



UTokyo
Kanako
HARADA

Scientific Applications



TohokuU
Nobuyuki
UOZUMI



KyusyuU
Mieko
ARISAWA



NagoyaU
Yoshikatsu
SATO



TMDU
Takanori
TAKEBE