Goal 3 Realization of AI robots that autonomously learn, adapt to their environment, evolve in intelligence and act alongside human beings, by 2050.

Here begins our new MIRAI
MOONSHOT RESEARCH & DEVELOPMENT PROGRAM

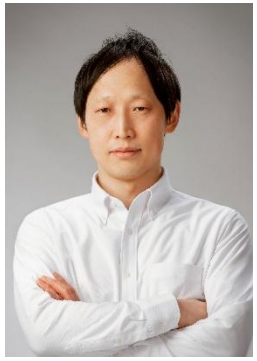
Creation of Embodied Intelligence through Self-Reinforcing Capability Expansion

Project manager

(selected in 2026)

MORIMOTO Jun

Professor, Graduate School of Informatics, Kyoto University



Leader's institution

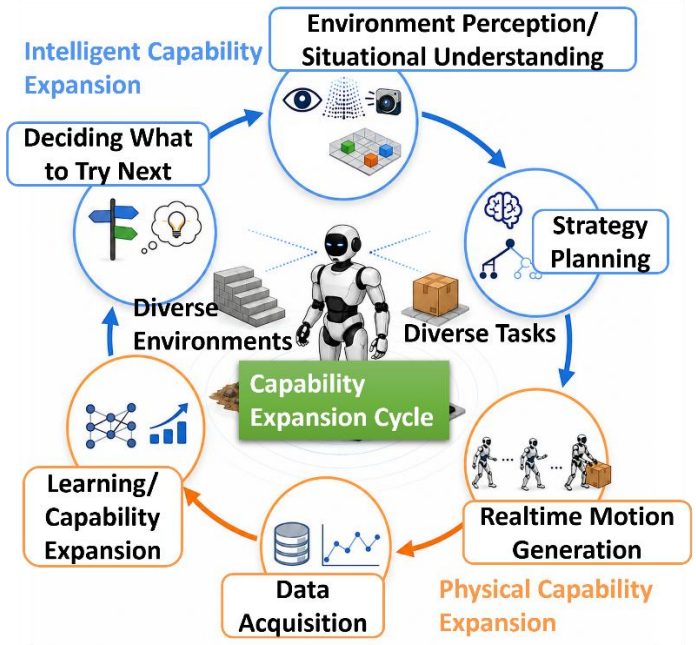
Kyoto University

R&D institutions

Kyoto University, Advanced Telecommunications Research Institute International (ATR), Institute of Science Tokyo, Kawasaki Heavy Industries, Ltd.

Summary of the project

We aim to establish a framework that enables humanoid robots to autonomously perceive their surroundings, explore appropriate actions, and learn through accumulated experience. Instead of relying on humans to explicitly teach individual movements, the robot will determine what to try next and progressively expand its behavioral capabilities through its own interaction with the environment. To achieve this, we will integrate a high-level mechanism for understanding the environment and selecting appropriate actions with a low-level mechanism for generating and executing whole-body movements according to the current situation. By tightly coupling these processes, we seek to build a foundation for humanoid robots that can adapt flexibly to diverse environments, continuously acquire new capabilities, and autonomously improve through experience.



Milestone by 2030

We aim to realize embodied recursive improvement in humanoid robots, whereby robots autonomously accumulate experience and progressively expand their capabilities by leveraging skills they have already acquired. By reusing and combining movements and capabilities learned from past experience, the robot will efficiently acquire more complex and novel behaviors.

Specifically, we will develop a framework in which previously acquired capabilities serve as building blocks for learning multiple types of composite behaviors, enabling the robot to acquire increasingly advanced capabilities in a stepwise manner. Compared with learning each behavior independently from scratch, this approach is expected to reduce the amount of training data required while achieving a more stable learning process for humanoid motion generation.

Project structure

Project Manager (PM) Jun Morimoto (Kyoto University)		
①Embodied Foundation for Capability Expansion	②Intelligence Foundation for Capability Expansion	③Body Design for Capability Expansion
Embodied Intelligence Coordination Framework **Jun Morimoto (Kyoto U.)**	Data Collection and Reward Design Based on Capability Space Construction **Hidetoshi Shimodaira (Kyoto U.)**	Capability-Space-Based Human–AI Collaborative Design **Gen Endo (Inst . of Science Tokyo)**
Composite-Task Evaluation of Embodied Intelligence **Norikazu Sugimoto (ATR)**	Metacognitive Assessment for Capability Expansion Diagnosis and Prediction **Risa Katayama (Kyoto U.)**	Capability Evaluation through Human–AI Collaborative Design **Masayuki Kamon (Kawasaki Heavy Industries)**

*Certain illustrations in this document were created with the assistance of generative AI.

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