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[Human-machine Symbiosis Technology / Cognitive Development Systems]

Mass-production model Kurumi

Deciphering the next stage of the world from a symbiotic relationship between humans and robots

The decision to commercialize Kurumi, a caregiving and medical support robot

“Humans have evolved intellectually by creating tools. Now, we have arrived in an era where the tools humans create are endowed with intelligence. Incorporating tools with their own will in our everyday lives should help take humans to the next stage.”

So says Ryo Saegusa, associate professor at the Department of Robotics and Mechatronics in the Faculty of Creative Engineering at the Kanagawa Institute of Technology. His research theme is the symbiosis of humans and machines. In this day and age, robots and artificial intelligence are rapidly being incorporated into our daily lives, making research efforts into the symbiotic relationships between artificial tools and humans essential.

Two specific research themes are (1) caregiving and medical support robotics and (2) physical augmentation interfaces. Efforts in the first theme include the development of Lucia, a caregiving and medical concierge robot. The prototype model in the laboratory is equipped with multiple features for lightening the load of people working on the forefront of caregiving and medicine, including human interaction, patrol, remote operation, and monitoring of vitals.

“Lucia is equipped with various equipment for monitoring vitals. Disabled or elderly persons simply need to grip Lucia's arm with its sensor to measure vitals such as pulse and blood pressure. It also features image recognition via cameras for automated patrols around care facilities, and thermal cameras with face recognition that use machine learning to take the temperature of patients, then send the data to staff if there is a problem.”

One of Lucia's most important features is rehabilitation support. It provides visual and auditory stimulation in walking assistance, and is expected to help out the elderly and persons suffering from Parkinson's disease. Such versatile features have garnered high praise from the medical community, and the mass-production model Kurumi with only patrol and monitoring features is expected to go to market.

Research into physical augmentation interfaces as mentioned in the second theme are being applied in rehabilitation efforts. One example the professor talked about was finger interface Mano, a rehabilitation device for persons who cannot bend and extend their fingers.

"To rehabilitate someone who cannot move the fingers on their left hand, for example, artificial intelligence would learn right hand movement, then send the data to Mano, which is worn on the left hand. This enables rehabilitation via mirror image motion reproduction. When the patient views left hand movement, the motor section of the brain is activated, and physical stimulation by Mano allows them to perceive finger movement."

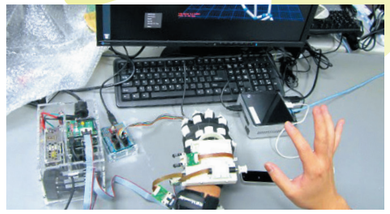
From physics to machine learning and finally to robot development

Associate professor Saegusa originally specialized in physics. In that field he learned modeling, a way to express the phenomena and principles of the world in mathematical formulas. He then wondered if this discipline could be applied to the field of information engineering, and began working in a machine learning laboratory in college. He wanted to use machine learning to create an artificial intelligence but ran into a problem - without a body, one cannot create human-specific intelligence. How could he endow an artificial intelligence with physicality? In the end, the professor found himself in his current field of robotics research.

“Using machine learning, I developed a robot that can mimic human behavior, proving that the intelligence of the robot is also developing thanks to physical mimicry. Now as the next step in my research, I am engaged in creating a framework from which people can learn through robotic assistance. This takes shape in the theme of rehabilitation.”

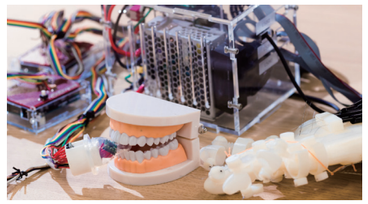
Recently we hear stories of more than half the jobs performed by humans being replaced by artificial intelligences or robots. However, associate professor Saegusa is only focused on a symbiosis between humans and machines.

“My interest lies in how the presence of robots will change humans. If human-derived intelligence can work in harmony with people, it is possible to move to the next stage in intelligence, just as when apes evolved into humans. I want to decipher the hints to this transformation via experiments in symbiotic relationships.”



This mirror-image finger rehabilitation system transfers data simulating movement of fingers on the right hand to an interface for the left hand. Using a technique known as “motion copying,” a variety of finger movement patterns are recreated despite the limited power source.

1 Associate professor Saegusa having discussion with a group of students around caregiving and medical concierge robot Lucia. Many researchers in the laboratory are women.



2 Mouth cavity interface Orale (on left) and finger interface Mano (on right). The mouth cavity interface is expected to be used by ALS (amyotrophic lateral sclerosis) patients.

3 The laboratory is home to an assistive bed and wheelchair for demonstrations akin to situations in the caregiving and medical fields.

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