

# SUPPORTING THE TECHNOLOGY GAME-CHANGERS

AN ANKLE SENSOR FOR THE ELDERLY is just one example of a disruptive AI technology being fostered by a venture capital company in Japan

## A Japanese venture capital and incubator called DEEPCORE

is fostering a culture where entrepreneurs can flourish, especially in the area of artificial intelligence (AI). Looking to deep learning as the next revolutionary technology, DEEPCORE is cultivating entrepreneurs who want to use AI to benefit society. It provides hands-on support for potential entrepreneurs from the very earliest stages — even before they decide to start a business. The company connects industry with engineers and researchers working on disruptive technologies that are transforming society. One example is Condisense, a Japanese start-up established in 2020 and supported by DEEPCORE to develop deep-learning-based solutions for the ageing society. It is producing technologies such as ankle bands that monitor motion in the leg muscles of older adults.

## Finding solutions for a super-ageing population

Japan is the world's most aged society, and so nursing care for the elderly is one of the biggest issues facing the country. Of the approximately 5.6 million people in Japan caring for elderly family members,

about 250,000 are also simultaneously raising children. These carers who are looking after two generations are often shouldered with tough financial, mental and physical burdens, and their number is increasing.

“One solution for alleviating these burdens is to extend the healthy lifespan of the elderly and thereby postpone the timing of nursing care,” says Yusuke Seino, Condisense's CEO.

**FALLING, JOINT DISEASE AND BONE FRACTURES ARE THE MAJOR CAUSES OF PEOPLE BECOMING BEDRIDDEN IN JAPAN.**

## Providing a way to escape the negative spiral

Major reasons behind the need for nursing care are falling, joint disease and bone fractures. The COVID-19 pandemic is contributing to the negative spiral in which inactivity can lead to muscular atrophy and eventually to people becoming bedridden.

“If we had a system that can detect reduced muscle activity

in the legs of the elderly, we could suggest appropriate interventions before their condition worsens, preventing them from falling into such a negative spiral,” Seino says.

Using his expertise in time-series data analysis, Seino is developing a system that utilizes an ankle band with a nine-axis sensor and that can predict fatigue and monitor leg muscle activity. Data from the nine-axis sensor is used as input data and electromyographic data as the training label. A model is developed using this data and deep neural networks. The trained model can then predict changes in muscle activity from the sensor data alone.

Muscle activity varies significantly between people, while the electromyographic amplitudes for muscle activity for the same person fluctuate day to day. “Since electromyographs are highly variable, the challenge is how to extract the essential characteristics of fatigue patterns from the data,” Seino says.

Numerous factors determine muscle activity, so it is crucial to utilize deep-learning technologies to unravel the highly entangled features, Seino

says. The team spent seven months acquiring their own walking data to determine how muscle activity varied between steps, which enabled Seino to develop a better method for extracting the essential features of muscle fatigue and other changes.

## The road to commercialization

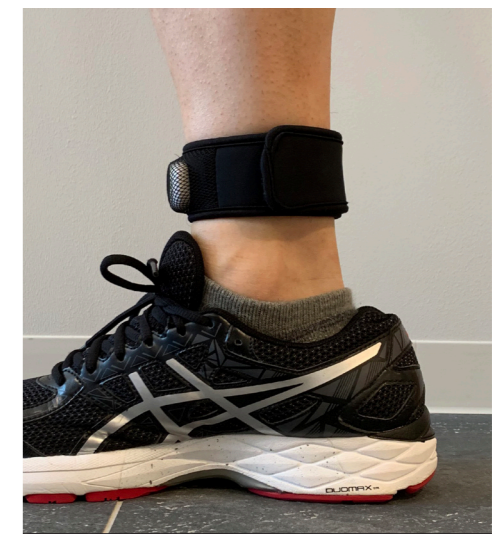
Muscle activity is generally measured using blood tests or electromyographic equipment, but these methods are expensive and require professional support, making them impractical for daily use. With Condisense's technology, the user just wraps the sensor around their ankles, and it monitors their muscle activity with every step using the trained model. The user will be able to view changes in their muscle activity as a numerical score on a smartphone app. When the score drops relative to the past several weeks, the user will be sent videos of exercises that will help them recover from fatigue. The suite of exercises depends on the user's condition, and the user can view their recovery as the score rises.

When the score drops, the app automatically sends an alert to the user and the

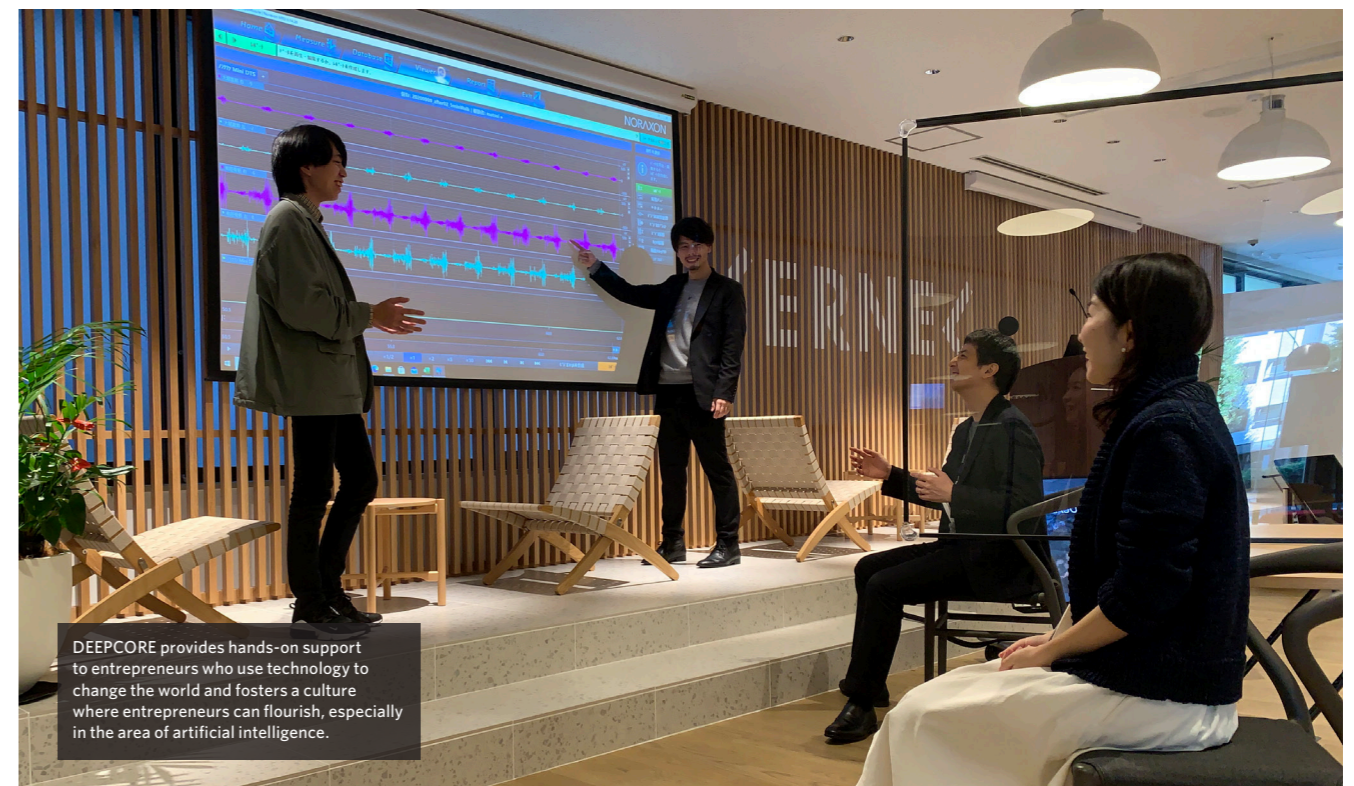


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Condisense is using artificial intelligence to help monitor muscle activity during everyday life.



This ankle band for sensing muscle activity is easy to wear.



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user's family or carers. The app enables family members to send messages of support to the user, and encouragement to do the exercises.

In collaboration with nursing-care facilities in Japan, Condisense is now improving the accuracy of the trained model. It plans to offer the device at a reasonable

cost, so that carers who are looking after their parents can try it without too much financial outlay.

International collaborations could help Condisense to expand the service globally. “We want to use deep-learning technologies to alleviate the nursing-care burden worldwide, as it's increasingly becoming

a serious issue for many countries,” says Seino.

DEEPCORE saw Seino's potential in his problem-solving capabilities and expertise in deep learning. “We need more such entrepreneurs who can really impact the world, but there are still very few in Japan,” says Takayuki Matsui, vice president

for business development at DEEPCORE. “That's why DEEPCORE is committed to supporting entrepreneurs who use technology to change the world.” ■

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