Hospital Tests Neuromorphic Chip-Powered Robotic Arm

The device, mounted on wheelchairs and powered by technology that imitates the way the human brain works, could provide patients new levels of independence

ALYN Hospital in Jerusalem plans to begin testing how neuromorphic computing could be used to operate a robotic arm mounted onto a wheelchair.

PHOTO: ALYN HOSPITAL

*By **Sara Castellanos***

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The first clinical trial involving an experimental artificial intelligence chip made by Intel Corp. will begin in the next few months, with patients using a robotic arm at a pediatric and adolescent rehabilitation hospital in Israel.

ALYN Hospital in Jerusalem will work with computer scientists at the Open University of Israel and other experts to test how neuromorphic computing, which imitates the way the human brain works, could be used to operate a robotic arm mounted onto a wheelchair.

The clinical trial represents a step toward the researchers' goal of commercializing an affordable, low-energy, AI-based robotic arm for wheelchair users. The predominant robotic

arm for wheelchair users today is made by Canada-based Kinova Inc. and doesn't use artificial intelligence, according to a company executive.

Neuromorphic chips aim to mimic the human brain's ability to learn about the environment and adapt to it in real time, while using minimal energy. The chips also have broader applications in business. For example, German auto maker Mercedes-Benz AG is exploring how neuromorphic chips could help increase energy efficiency, speed and accuracy for vehicle-related AI uses.

An affordable AI-based robotic arm could help wheelchair users with spinal injuries, muscular dystrophy and cerebral palsy with daily tasks ranging from eating and drinking to picking up objects off the ground, said Arie Melamed Yekel, general manager of ALYN Hospital's innovation center, ALYNnovation.

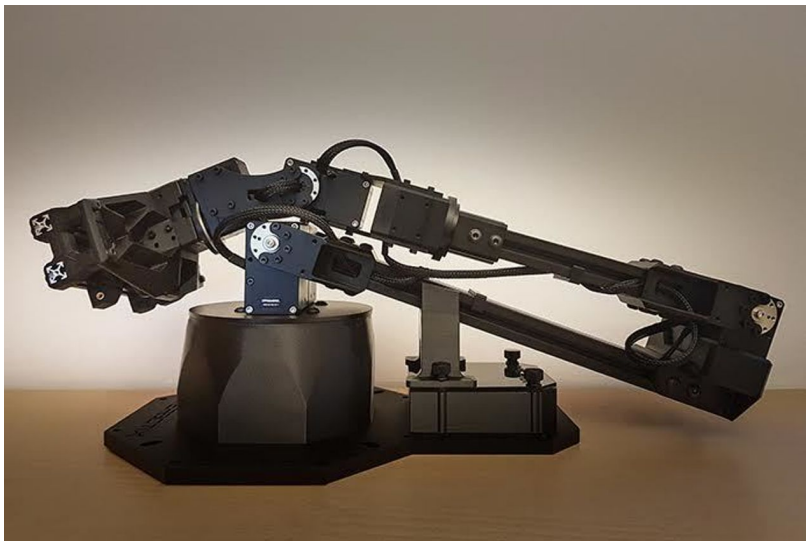
Eventually, a neuromorphic chip could help a robotic arm understand in real time how much force or pressure to use when picking up objects such as a cup of water, a pencil or a hairbrush, without relying on massive amounts of training data, computing power or expensive motor parts to work.

About 25 patients with limited mobility in their upper extremities will participate in the clinical trial, with the first group of five patients expected to begin using the robotic arm between April and June, Mr. Yekel said.

The researchers' neuromorphic computing system, which includes the chip and an adapted algorithm from neuromorphic technology company Applied Brain Research, is about 42 times lower power than it would be using an AI-tailored graphics processing unit, said Elishai Ezra Tsur, principal investigator of the neuro and biomorphic engineering lab at the Open University of Israel. Because less energy is used, the robotic arm would need to be charged less often, allowing wheelchair users to be more self-sufficient for longer periods without caretakers.

With neuromorphic computing, it is possible to train machine-learning models using a fraction of the data it takes to train them on traditional computing hardware.

That means the models learn similarly to the way human babies learn, by seeing an image or toy once and being able to recognize it forever.



A robotic arm can help wheelchair users with daily tasks like eating and drinking and pickup up objects.

PHOTO: ALYN HOSPITAL

Today, robotic arms in the manufacturing sector use AI algorithms that previously have been trained for specific tasks using massive amounts of data, or they operate automatically based on fixed rules and instructions. They can't adapt to changes in their environment in real time. "It's much harder to comb someone's hair with a robotic arm than to build a BMW," Dr. Tsur said.

In the clinical trial, researchers will start by testing how the neuromorphic computing system could be used to automatically identify where the robotic arm is in space and correct for an error in motion.

Patients will use their wheelchair's joystick to operate the robotic arm. The arm will contain a neuromorphic chip made by Intel Labs, named Loihi, and adapted algorithms from Applied Brain Research. The neuromorphic computing system can calculate data points such as where the arm is in space relative to the object, the wheelchair and the patient, and the trajectory of the moving object.

The system can automatically adjust the arm's trajectory and force as a patient operates it, for example by helping to bring a cup of water with a straw to a patient's mouth more smoothly.

In a year, the arm will be able to perform its own trajectory planning and be semiautonomous, through a 3-D camera that will be mounted onto the arm, Dr. Tsur said.

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— Elishai Ezra Tsur, principal investigator of the neuro and biomorphic engineering lab at the Open University of Israel

Neuromorphic computing is compensating for expensive motors and controllers that otherwise would be needed to perform these types of functions, said Mike Davies, director of the neuromorphic computing lab at Intel Labs.

Kinova makes a robotic arm for wheelchair users called Jaco, which doesn’t use artificial intelligence, said Jonathan Lussier, director of intellectual property and innovation at Kinova. Wheelchair users can operate the arm using joysticks, button arrays or other methods, and a controller located at the arm’s base handles all the computations required to manipulate the robot.

The company is paying close attention to technologies such as neuromorphic computing, he said.

Neuromorphic chips are expected to be among the dominant computing architectures for new, advanced forms of AI deployments by 2025, according to technology research firm Gartner .

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