NEUROMORPHIC COMPUTING: AFFORDABLE, PRECISE AND ENERGY-EFFICIENT ROBOTIC ARMS

VIDEO TRANSCRIPT

Speaker 1: Using neuromorphic computing to provide the onboard intelligence needed to control a wheelchair mounted robot arm, this Accenture sponsored work is being led by one of our university partners, Professor Elishai Ezra-Tsur, he directs the interdisciplinary neuro-biomorphic engineering lab at the Open University of Israel. Lazar Supic, a research scientist at our Labs at Accenture is working with Elishai's team. He will describe this inspiring application and illustrate why neuromorphic computing could play a crucial role in making it feasible.

Lazar Supic: For individuals with severe mobility impairments, activities such as eating and drinking, shopping, and simply arranging items in their surroundings can become very difficult, significantly reducing independence and quality of life. Studies suggest that assisted robotics can increase disabled users' sense of independence and reduce time needed from a caregiver. A wheelchair mounted robot arm could be used to grab and move objects, helping some users with mobility impairments do everyday tasks. However, it has been challenging to develop a wheelchair mounted robot arm that is functional and affordable for the real world users.

Accenture Labs is working with Intel Labs, The Open University of Israel and Alyn Hospital to overcome the challenges confronting existing solutions. Our innovations uses Intel's neuromorphic computing hardware, and then adaptive control algorithm developed by applied brain research. Moving a robot arm accurately to an object you want to pick up is both mechanically and computationally complex.

It involves precise position estimation and 3D motion planning. When the arm is carrying something where the weight can shift around, like a bottle of water, that makes accurate movement even more difficult. You can see that the added weight causes the arm to unintentionally run into the table.

When the arm is mounted on a moving wheelchair or is reaching towards a moving target, like a user's mouth, that requires the control algorithm to be continuously adjusted with very little delay. And for a wheelchair mounted device, the chip that controls the robot needs to be energy efficient to avoid draining the battery.

So even with the best robotic hardware,

position estimation and motion planning are never perfect in the real world, but the most precise, state of the art robot arms are very expensive, pricing out many people who need them. To help provide their population of users with the movement impairments, we want to use more cost-effective robotic arm, but that will mean a robot arm that is less mechanically precise.

To address these challenges, Open University of Israel designed a lower cost robot arm, and the project team is developing a prototype solution that uses adaptive control algorithms powered by Intel Loihi to enable the low cost arm to move precisely. Loihi is on chip learning, low power consumption, and the ability to drive streaming real time AI, can control a robot arm that performs everyday tasks more effectively, and without draining the onboard batteries too quickly.

With adaptive control powered by neuromorphic computing, the robot arm learns as it moves, it adapts to overcome movement errors with lifting heavy objects. In the simulation, the robot arm learns during the course of just a few moments to accurately reach a target position. Our collaborators are benchmarking this approach against an adaptive control algorithm running on a GPU, and against the traditional method of controlling a robot arm with a PID controller.

So far, these results suggest that neuromorphic proof of concept system can provide a better experience to the user with better accuracy, longer battery life and more responsive movements. The neuromorphic system could also learn efficiently over time to continuously improve the system. This project illustrates the potential for Intel's neuromorphic devices to enable accurate and flexible robotics with lower cost hardware. We can see that being extremely important in the future for our clients that are increasingly relying on the robots in the wild.

And it is extremely exciting to see how we might apply this technology to improve the quality of life for people with disabilities and use cutting edge AI for social good.