Controlling a Computer With Thought

Nishat Hossain :BME/EE University of Rhode Island

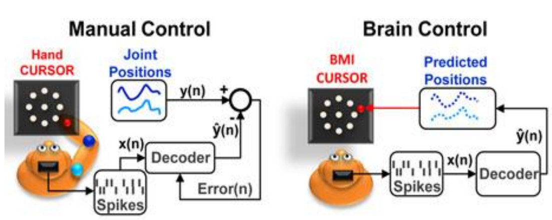
A functional human brain has the capability to adapt to extremely dynamic environments. This means that the brain may be under constant pressure to learn new skills to complete new tasks. The body is typically the main outlet for these new skills to be applied. This means when the body fails, this link from the brain to the outside world is broken. For years researchers have been searching for a way to reconnect the conscious brain with the world it exists in. The researchers at the University of California, Berkeley may have found the way to do exactly that.

The work being done today at the university includes demonstrating how rhesus monkeys can use their thoughts to control a computer curser, via electrodes implanted in their brains. They have shown that once the monkey can gain control of the mouse, they are able to repeat certain movements day after day. This shows that a monkey's brain has the capability of developing a motor memory that exists outside of its own body and is considered a crucial breakthrough in the world of neuroprosthetics.

In previous attempts at brain-machine interfaces, subjects had the ability to control a physical object but were unable to retain any skills after the session. Due to the complex nature of movement within a human body, motor memory is crucial to operation. These new methods allowed the subjects to immediately recall skills learned in a previous session.

Previous research attempted to utilize the existing connections between the brain and a real limb in order to control an artificial one. This new technique relies on a completely different section of the brain, in essence assimilating a new limb into the body. Unlike previous studies, researches relied on the same set of neurons throughout the three week long study.

Arrays of microelectrodes were implanted on the primary motor cortex, about 2-3 mm into the brain. The activity of these neurons was monitored using computer software. The result was a subset of 10-40 neurons who's activity remained constant from day to day.



The first stage of the test involved using the neurons while maintaining some motor activity. The monkeys arm was placed inside a robotic exoskeleton which could track its movement. The exoskeleton controlled a cursor on a screen watched by the monkey and the behavior of the neurons we monitored as the monkey moved the cursor.

Researchers recorded two sets of data; brain signals and corresponding cursor positions. This data was then translated into cursor movements using a decoder. The decoder was a mathematical model which multiplied the firing rates of the neurons by certain weights. Next, the researchers immobilized the arm and input the neuronal signals into the decoder. Within a week the monkey's performance reached 100%, where it remained for the duration of the experiment.

This evidence of consistent performance supports the idea that tracking the same set of neurons throughout testing is crucial for the formation of "cortical maps." In previous studies, the decoder would have to be reprogrammed every time a new cortical activity was introduced, thus preventing the creation of a cortical map (pattern of activity).

The researchers showed that with the formation of a strong cortical map, effective neuroprosthetics are possible. To further back this assertion; researchers repeated the process with a second decoder. Functionality was back up to 100% within three days.

In order to test this new development further, the same test was done but utilizing a shuffled decoder. This means that there was no connection between physical movements and cursor movements. With this random decoder, the monkey was able to repeat progression back up to 100% within 3 days.

These result may suggest that sometime in the future with the proper testing and execution, this method could be used to give the disabled an opportunity to control prosthetics through neural to machine connections.

Works cited:

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