Processing of a Directionally Dependent Reward Signal in Motor and Somatosensory Units

Marib Akanda[1], David McNiel[1,2], Aditya Tarigoppula[1,2], Dr. Pratik Y. Chhatbar[3], Dr. Joseph Francis[1,2]

1: Dept. of Phys. & Pharm., State University of New York Downstate Med. Center, Brooklyn, NY
2: Graduate Program in Biomedical Engineering, New York University Polytechnic School of Engineering
3: MUSC Stroke Center, Dept. of Neurology & Neurosurgery, Med. Univ. of SC, Charleston, SC

Improving the control of neuroprosthetics to achieve biomimetic movements would significantly increase their utility and greatly improve the quality of life of their users. One potential addition to today's neuroprosthetics control systems would be an inclusion of the reward-based signal from motor or somatosensory cortex. The reward signal present in these cortices could indicate if a movement goal, such as reaching to and grasping a cup of coffee, was successful or not. Such a signal could be used as a component in reinforcement learning algorithms employed in brain-machine interfaces. This study seeks to determine the movement direction dependence of the reward signal. To accomplish this goal, we examined data recorded from the units of one bonnet macaque as it performed a center-out reaching task that has a fixed-probability reward assignment at the completion of a successful trial. By comparing the spiking neural activity with the actual receipt of reward, we examined if the change in firing activity can be attributed to the reward signal, and if this signal is also tied to the directionality of the movement. Including this information for reinforcement learning in brain-machine interfaces would bolster current efforts and lead to more realistic movement of neuroprosthetics.