Title

Machine Learning – Current Challenges and Opportunities for Neuroprosthetics

Abstract

Brain-computer interfaces (BCIs) promise to be an alternative treatment for individuals with a disability, giving them a chance to regain their interaction capacity with the environment and with others. At the same time, Modern AI/ML techniques are changing paradigms in technology and in medicine.

In combination, BCIs and modern ML have the potential of revolutionizing the treatment of neurological conditions. Yet, when both technologies meet, there are still challenges to face. From decoding the mysteries of brain activity to the development of training tools, steps remain to be taken to harness the full power of AI and include the vibrant ML community in the creation of next-generation BCIs.

In this 4th webinar, we will talk about the challenges, and thus consequently, the opportunities in current intracortical BCI development. Departing from our own experience decoding brain activity, data science, and high-performance computing, as well as an example BCI study in human subjects, we will talk about what we believe ML can offer to advance BCIs. With this webinar, we also hope to provide some pointers on how some of you, as individuals with programming skills, can help bridge this gap.

Speakers

Paolo Viviani *PHD, Senior Researcher – LINKS Foundation*

Paolo Viviani earned a degree in theoretical physics and a PhD in computer science both at University of Torino. He is now Senior Researcher at LINKS Foundation.
His main interests are High-Performance Computing, Quantum Computing and systems for Machine Learning/AI. His current activity focuses on HPC and scientific computing topics like the acceleration of complex scientific and industrial workflows on large scale HPC infrastructures, optimization algorithms for near-term analog quantum hardware and the HPC/machine learning techniques for modern Brain-Computer Interfaces. He published several peer-reviewed papers, both to conferences and journals. He was also involved in several funded research projects in the field of HPC

Dr. Andres Agudelo-Toro *Neuro-Engineer - Deutsches Primaten Zentrum*

Dr. Andres Agudelo-Toro is a neuro-engineer working as a scientist at the Deutsches Primaten Zentrum, a core primate facility in Germany and part of the Leibniz Society. Following his goal to develop a high-accuracy neuro-prosthesis for grasping, he combines neural decoding, virtual environments, and robotics in experiments with primates. To prepare for this, Andres was trained in control systems, real-time distributed systems, and neuroscience at EAFIT (Colombia), Rutgers (USA), and the Max Plack Institute (Germany). Thanks to the advice of his mother and grandmother as a child, Andres chose education to support his family in the barrios of Medellin in times of Pablo Escobar's cartel. After a series of scholarships, he graduated with honors with a bachelor's degree in Computer Science and a master's degree in Applied Mathematics from Universidad EAFIT while working at the Sistemas de Control lab and Realidad Virtual lab and interning at the former CAIP center in Rutgers. He obtained his doctoral degree in Theoretical and Computational Neuroscience from Göttingen University and MPI-DS with his dissertation on theoretical models of brain stimulation.

Dr. Brian Dekleva, PhD *Research Scientist - University of Pittsburgh*

Dr. Brian Dekleva is a Research Scientist in the Rehab Neural Engineering Labs at the University of Pittsburgh. Brian received his PhD from Northwestern University, where he worked with Drs. Lee Miller and Konrad Kording to study decision-making and upper limb control in nonhuman primates. In 2018, Brian joined the Rehab Neural Engineering Labs at the University of Pittsburgh, first as a postdoc with Dr. Jennifer Collinger and now as a research scientist. He is involved in both basic and translational research, working with participants with tetraplegia who have enrolled in a clinical trial for intracortical brain-computer interfaces (BCIs). His work focuses on understanding cortical control of the arm and hand, and he leverages those scientific findings to develop novel BCI approaches for controlling computer cursors and robotic hands.