"Standardization of Neural Interface Research to Accelerate Interoperability, Clinical Integration, and Commercialization of Neurotechnologies"

IEEE Systems, Man, & Cybernetics (SMC) Conference, 2019
Location: Bari, Italy – Nicolaus Hotel (Session SuBW3, Meeting Room 7)
Time: Sunday, October 6, 2019, 11:00-13:00

Workshop Organizers

- Zach McKinney, The BioRobotics Institute (Scuola Superiore Sant'Anna) – z.mckinney@ieee.org
- Luigi Bianchi, University of Rome Tor Vergata – luigi.bianchi@uniroma2.it
- Dennis McBride, Source America, NeuroRx – dr.denniskmcbride@gmail.com

Contact Information

Name: Zach McKinney

Title: [1]Post Doctoral Research Fellow; [2]IEEE Working Group Chair, P2794 – Reporting Standards for *in vivo* Neural Interface Research (RSNIR)

Affiliations: [1]The BioRobotics Institute (Scuola Superiore Sant'Anna, Pisa); [2]IEEE Standards Association

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Duration and Format

This is a two-hour workshop, comprising 100 minutes of presentation time, plus 20 minutes for panel discussion/Q&A regarding the themes and critical challenges identified in the presentations.

Workshop Abstract

Primary Relevance Area: Human-Machine Systems

Continued progress in the fields of neurotechnology and neurorehabilitation demand increasing functional integration between a broad spectrum of human-machine interfacing technologies, neural interfaces chief among them. However, the current lack of broad interoperability between various neural interfacing systems and the multitude of peripheral devices with which they are intended to interact poses an ongoing barrier to research, clinical, and commercial objectives alike. This Workshop will highlight a suite of current IEEE Standards Working Groups as a strategic means of aligning incentives and overcoming barriers to neurotechnology integration and development across a range of neurotech stakeholders, including researchers, commercial technology developers, medical device regulators, and public funding agencies.

In particular, presentations will include detailed overviews of IEEE Working Groups P2794 (Reporting Standards for in vivo Neural Interface Research) and P2731 (Unified Terminology for Brain-Machine Interfaces), including the WG objectives, scope of work, preliminary structure of our standard, and current activities. In addition, the workshop will feature a brief overview of IEEE the Standardization process (including how to participate), as well as presentations of several research projects highlighting critical challenges and strategies for system and data integration in multi-modal neural interface systems and studies.

The list of presenters and titles is as follows:

- **Zach McKinney** (Scuola Superiore Sant'Anna, Pisa) – "Standardization of neural interface research reporting as a framework for information integration and incentive alignment in neurotechnology development."
- **Sumit Soman** (Centre for Development of Advanced Computing (IN)) – "Standardization of biosignals in BCI systems - Need & Challenges"
- **Rodolfo Fiorini** (Polytecnico di Milano University) – "Advanced Ontological Uncertainty Management for In Vivo Neural Interface Research"
- **Carole Carey** (C3-Carey Consultants; IEEE EMBS Standards Committee) – "How to participate in IEEE standardization and pre-standardization activities (Overview)"
- **Luigi Bianchi** (University of Rome, Tor Vergata) – "Standardization of Brain-Computer Interfaces and Terminology: Sharing a Model to Share Methods and Tools"
- **Jorge Cardoso** (iMM Lisboa) - "Principles of Multisensory Dynamics Recorded in Oc2M – the Neural Syntax of Multisensory Integration"
- **Jean-Louis Divoux** (AIMD) – "Perspectives on the Role of Standards in Medical Device Development – A Testimony to EN 45502-2-3 and the Standardization of Cochlear Prostheses"

Workshop Organizer Biographies

Zach McKinney is a Post-Doctoral Research Fellow in the Wearable Robotics Lab at the BioRobotics Institute, of Scuola Superiore Sant'Anna (Pisa), where he manages the development and clinical evaluation of exoskeletal robotic systems for applications in both industry and neural rehabilitation. In addition, he is the chair of IEEE Working Group P2794, developing a Reporting Standard for in vivo Neural Interface Research (RSNIR), with the primary aims of promoting the use of rigorous experimental methodologies and comprehensive research reporting for a wide variety of neural interfacing modalities, towards the creation of a more open, interoperable ecosystem of multimodal human-machine interfacing technologies. With regard to brain-computer interfaces, he is also the leader of the user needs focus area of the IEEE Industry Connections Activity on Neurotechnologiess for Brain-Machine interfacing.

Prior to his current roles, Zach was a co-founder and Chief Science Officer at Spinal Singularity, developing a fully indwelling urinary prosthesis for males with neurogenic bladder dysfunction due to spinal cord injury and other neurological disorders. His PhD in biomedical engineering from the University of California, Los Angeles focused on the optimization of wearable tactile feedback systems for neurological and orthopedic (prosthetic) rehabilitation, prior to which he worked in various roles at Bioness, Inc, on the commercial development of both implantable and non-invasive neuromodulation systems for neural rehab. His undergraduate degree was in mechanical and bioengineering from Princeton University.

McBride earned his Ph.D. from the University of Georgia and M.S. from the Viterbi School of Engineering, University of Southern California. For the past 15 years, he has been a very active, affiliated faculty member at the Georgetown University School of Medicine. His co-authored and edited book, *Quantifying Human Information Processing* (Rowman & Littlefield) was instrumental in the creation of the national, $100M BRAIN project, currently orchestrated by NIH, DARPA, and NSF.

Luigi Bianchi is an assistant professor and researcher at the University of Rome Tor Vergata, where his primary research interest is in the field of EEG-based brain-computer interfaces. He has worked actively on the research and development of BCI systems since 1992, with roles as both a researcher and industry consultant. Bianchi has written the software (in C++) of several commercial products for EBNeuro S.p.A. (Florence, Italy) which have been installed world-wide and beyond, including a copy used in the International Space Station! Furthermore, he implemented the first European commercial digital video EEG system and the first Italian BCI. His free tools (mostly available at http://www.brainterface.com) have been downloaded in more than 100 countries world-wide. Finally, he takes great pride in his sizeable and continuing contribution to scientific and technical literature, having published more than 120 peer reviewed scientific papers and also a paper on the C/C++ Users Journal.

Dennis McBride is a behavioral neuroscientist. He has served at six national laboratories as a Naval Aerospace Experimental Psychologist, from bench scientist at the Naval Research Laboratory, to national leader of major programs at the Defense Advanced Research Projects Laboratory (DARPA). His programs included development of enduring research standards such as IEEE-1278 (for massively interactive simulation), and for the development of medical technologies such as hand-held ultrasound. McBride was elected to full professor with appointments in engineering as well as psychology at the University of Central Florida in 1999. Dennis is currently the Chief Strategy Officer and Senior Scientist for NeuroRx Pharma, developing small molecule compounds for PTSD and suicidal depression. For the past five years, Dr. McBride has led a project sponsored by DARPA that has demonstrated useful exploitation of highly sophisticated signal processing and EEG technologies to infer implicit speech patterns in the human cortex – a technology focused on providing communication capability for "locked-in" and other neurological patients who cannot otherwise communicate.