

## IEEE SMC 2019 Workshop Agenda

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### “Standardization of Neural Interface Research (RSNIR) to Accelerate Interoperability, Clinical Integration, and Commercialization of Neurotechnologies”

#### Session Information

- **Session ID:** SuBW3
- **Date & Time:** Sunday, Oct 6, 2019, 11:00-13:00, Room 7
- **Workshop Organizers:**
  - Zach McKinney, The BioRobotics Institute (Scuola Superiore Sant’Anna) – [z.mckinney@ieee.org](mailto:z.mckinney@ieee.org)
  - Luigi Bianchi, University of Rome Tor Vergata – [luigi.bianchi@uniroma2.it](mailto:luigi.bianchi@uniroma2.it)
  - Dennis McBride, Source America, NeuroRx – [dr.dennismcbride@gmail.com](mailto:dr.dennismcbride@gmail.com)
- **SMC Approved Workshops Website:** [http://smc2019.org/approved\\_workshop\\_tutorial.html](http://smc2019.org/approved_workshop_tutorial.html)
- **IEEE RSNIR Working Group Website:** <https://sagroups.ieee.org/2794/>

#### I. Presentations (~100 minutes)

[11:00-11:15]

##### **Zach McKinney – “Standardization of neural interface research reporting as a framework for information integration and incentive alignment in neurotechnology development”**

**Abstract:** This presentation will provide an overview of the scope and activities of IEEE Working Group P2794, currently developing a set of Reporting Standards for in vivo Neural Interface Research (RSNIR). The talk will summarize the WG motivation, scope of work (objectives), membership, WG organization and strategy, and the prospective structure of our standard. In particular, we will emphasize the strategic potential of this standard to create an aligned incentive serving all stakeholders in the neuroscience & neurotechnology ecosystem, thus promoting the efficient development and commercialization of innovative neurotechnologies.

[11:15-11:30]

##### **Sumit Soman: “Standardization of biosignals in BCI systems - Need & Challenges”**

**Abstract:** The growing scope of applications of Brain Computer Interface (BCI) based systems, including those driven by Electroencephalogram (EEG), Electromyogram (EMG), Electrooculogram (EOG) signals, among others, has mandated the need for standardization of data for conformance and interoperability. This has become important for both clinical as well as general user applications. This talk aims to discuss the key challenges faced and the broad objectives involved in developing standards for biosignals used in BCI systems. It also focuses on the recent IEEE Industry Connections Activity initiative on neurotechnology for brain-machine interfaces, specifically on the recommendations in the sub-group for data representation, storage and sharing.

[11:30-11:45]

##### **Rodolfo Fiorini: “Advanced Ontological Uncertainty Management for In Vivo Neural Interface Research”**

**Abstract:** Classical experimental observation processes, even in highly ideal, controlled operative conditions like those presently achieved at the most sophisticated and advanced experimental laboratories like CERN, can capture only a small fraction of the overall ideally available information from unique experiments. To obtain more resilient data, and to achieve more meaningful and reproducible results from EEG experiments, we present an adaptive

learning system reference architecture for an anticipatory smart sensing system interface, based on CICT (Computational Information Conservation Theory). To design, analyze, and test the system properties, a simulation environment called VEDA®, has been programmed in MATLAB. Due to its intrinsic self-adapting and self-scaling relativity properties, this system approach can be applied at any system scale, from single quantum system applications to full system development, governance strategic assessment policies, and beyond. In the near future, to solve the complex, arbitrary, multi-scale system problems at hand, we need a unified, integrated framework that can offer an effective, convenient, and universal mathematical approach. Such an approach should consider information not only on the statistical manifold of model states, but also on the combinatorial manifold of low-level discrete, directed energy generators and empirical measures of noise sources, related to experimental high-level overall perturbation. Then, homeostatic operating equilibria can emerge out of a self-organizing landscape of self- structuring attractor points.

[11:45-12:00]

**Carole Carey – “How to participate in IEEE standardization and pre-standardization activities (Overview)”**

**Abstract:** This presentation will provide an overview of IEEE Standards Association’s official processes for creating and maintaining Standards, from pre-standardization activities and Working Group formation through final Standard balloting and review. The talk will highlight the variety of ways in which members from all sectors of the neurotechnology community can participate and contribute to standardization-related activities, and will provide a brief overview of current neurotech-related standardization activities, including current working groups and other pre-standardization activities.

[12:00-12:15]

**Luigi Bianchi – “Standardization of Brain-Computer Interfaces and Terminology: Sharing a Model to Share Methods and Tools”**

**Abstract:** Standards play a fundamental role in communities as they provide clear specifications and procedures for describing or using systems that can be universally understood. This is even more true in a multidisciplinary research field such as that of the Brain-Computer Interfaces, where it is very common that experts with different backgrounds use different terminologies and methods to deal with the same issues. However, 20 years after the first BCI International Workshop, sufficient standardization in the field of BCIs is still lacking. Chief among the challenges to BCI standardization is the lack of consensus terminology to describe numerous aspects of BCI systems, usage, and performance. This presentation will provide an overview of past and current efforts to define a unified terminology for BCIs, with focus on a new IEEE working group (P2731) dedicated to this purpose.

[12:15-12:30]

**Jorge Cardoso - “Principles of Multisensory Dynamics Recorded in Oc2M”. (Neural Syntax of Multisensory Integration)**

**Abstract:** During the talk I would like to introduce the technical aspects, methods, namely in-vivo electrophysiology, chemogenetics, optogenetics and explain how those methods are being used today to unveil the underlying working principles and neurophysiology of the central nervous system. I want to highlight the existing constraints and limitations that make it harder to reproduce results and share data across different labs. Also, I will provide my own view on how this scenario is evolving in a near future where standards play a relevant role.

[12:30-12:45]

**Jean-Louis Divoux – “Perspectives on the role of Standards in Medical Device Development – a Testimony to EN 45502-2-3 and the Standardization of Cochlear Prostheses”**

**Abstract:** Standardization: Depending on who you ask, it's either a blessing or a curse. The 1990s and early 2000s brought the spawn and rapid proliferation of electronic and intelligent devices thanks to the internet bubble and rapidly expanding global access to digital technologies and networks. The medical devices field largely benefited from this wave of innovation, with the emergence of multiple new classes of commercial devices and applications, with neuromodulation systems such as the Cochlear Implant System (CIS) chief among them. Accordingly, the need for a large international consensus to provide basic assurance of safety [and efficacy] for both patients and users” was demanded by regulatory and clinical communities alike. This talk describes the long, tortuous, yet ultimately fruitful journey towards an international consensus standard for CIS, which has been widely adopted to date, leaving researchers and developers free to innovate creatively and flexibly, rather than having to continually reinvent the wheel.

[12:45-13:00]

**II. Open Panel Q&A with Presenters (~20 minutes):** Perspectives on the role of Standards in incentive alignment between industry and academia. Audience questions welcome!

**Questions and Topics for Discussion:**

- What aspects of neurotechnology system and/or study design are necessary to report in order to make the corresponding literature thoroughly interpretable and reproducible?
- What are your needs for data aggregation?
  - Which data modalities are required? ... *desired*?
  - At what scale is data aggregation necessary? (Multiple sessions for a single subject? Multiple subjects within a single study? Many subjects over a broad, multi-site study? ... or aggregation of data across multiple independent studies)
- Do your answers to the above question change when considering 1) the particular research/development interests of your entity, vs. 2) facilitating the commercialization of neurotechnology in your field?
- What are the requirements *at the point of data collection* in order to achieve the desired level of data aggregation?
  - Use of standard file formats?
  - Procedure
  - Etc.
- What are the current barriers and challenges to achieving the desired ability for data aggregation?
- What enabling infrastructures (standards, regulations, etc.) are necessary in order to facilitate the desired level of data aggregation?
- What are strategies that we, as individual research & commercial entities, can adopt in the meantime to facilitate this transition?