Workshops
Wednesday, June 1, 2016   9:00 a.m. – 12:00 p.m.

W-1   BCIs for stroke rehabilitation – Heather

Speakers: Christoph Guger, José del R. Millán, Donatella Mattia, Junichi Ushiba, Surjo Soekadar, Vivek Prabhakaran and Natalie Mrachacz-Kersting

Lately, BCI systems are increasingly used in the context of stroke rehabilitation. Many BCI systems are based on motor imagery activity recorded from the sensorimotor cortex, which is translated into continuous control signals for rehabilitation devices. Some devices use Virtual Reality to allow users to observe an avatar's limb movement. Other successful applications with patients use different brain stimulation techniques and/or robotic devices (such as exoskeletons or functional electrical stimulators) attached to patients' paralyzed limbs. The workshop will review current stroke rehabilitation programs from different research labs and will provide insight into technology, experimental setups, results and outcomes of patient studies.

W-2   Passive BCI and Neuroadaptive Technologies – Nautilus W

Speakers: Thorsten Zander, Patrick Britz, Martijn Schreuder, Mike Chi, Laurens Krol and Lena Andreessen

Passive BrainComputer Interfaces (pBCIs) provide a tool to assess and interpret information about the cognitive and affective user state in real time, and to adapt a technical system accordingly. The resulting implicit interaction loop can be used for new types of input, augmenting existing forms of HumanMachine Interaction as well as enabling completely novel interactive control paradigms. The resulting Neuroadaptive Technology (NAT) holds the potential to revolutionize our current concept of communication between human beings and technical systems. In the first part of this session we will summarize the state of the art in research about pBCIs and NAT in a presentation with a follow-up discussion. This part aims at providing a common baseline and perspective about the progress in this field for all participants of the workshop. The second part will be a brainstorming about hurdles to take for applying Neuroadaptive Technology in realworld scenarios. Here, questions about usability, reliability and safety will be discussed as well as needs from the scientific perspective how hardware should be designed and built to overcome previously identified hurdles. Following up, representatives from different companies, both from the audience and the workshop organizers, will provide their perspectives on the previously identified problems and ideas. The third and final part of the session will be moderated, plenary discussion. All participants are invited to discuss previously mentioned topics or share their ideas and concerns. The moderator will track this discussion and prepare a mind map as an outcome of the discussion.

W-3   BCIs for Artistic Expression - Curlew

Speakers: Anton Nijholt, Chang S. Nam, Loic Botrel, Grace Leslie, Femke Nijboer, Tim Mullen, Pepe Contreras-Vidal and Vojkan Mihajlovic

Artists have been using BCIs for artistic expression since the 1960s. Their interest and creativity is now increasing because of the availability of affordable BCI devices and software that does not require them to invest extensive time in getting BCI to work or tune it to their application. Designers of artistic BCIs are often ahead of more traditional BCI researchers in ideas on using BCI in multimodal and multiparty contexts, where multiple users are involved, and where robustness and efficiency are not the main matters of concern. The aim of this workshop is to look at current (research) activities in BCIs for artistic expression and to identify research areas that are of interest for both BCI researchers and artists/designers of BCI applications.

W-4   Decoding Speech Processes using Intracranial Signals - Marlin
Speakers: Christian Herff, Jon Brumberg, Dean Krusienski, Emily Mugler, Tanja Schultz, David Conant,
                   Zac Freudenberg, Nima Mesgerani and Stephanie Martin

Speech provides a natural and efficient means of communication that is mostly unharnessed in current Brain-Computer Interfaces. Intracranial recordings allow for high spatial and temporal resolution recordings of cortical activity during speech process without the contamination by motion artifacts and thus enable in-depth analysis of the complex dynamics of speech processes.

In this workshop, we will present the current state-of-the-art in decoding of speech processes in intracranial signals. Talks will cover various representations of speech production (e.g. phonetic, phonological and articulatory) and their decoding into a variety of modalities including written text, articulatory configurations and direct generation of acoustic speech. Additionally, speech perception and the direct decoding of acoustic speech streams will be presented. The invited speakers will explain current results and major milestones towards clinical devices based on speech processes.   In a discussion among all presenting experts, we will identify future directions and open research questions to further understand speech production and perception.

W-5   Clinical Applications of Brain-Computer Interfaces in Neurorehabilitation – Merrill Hall
Speakers: An H. Do, Zoran Nenadic, Marc Slutzky, Surjo Soekadar and Charles Liu

Brain-computer interfaces have increasingly been studied as a means to help those affected by neurological injuries (e.g. stroke, spinal cord injury [SCI], or traumatic brain injury [TBI]) to improve their functional outcome. In the clinical setting, BCI systems have attempted to restore motor functions that have been completely lost, or to help improve upon motor functions that are impaired, but still partially preserved. However, BCI-based rehabilitation is still very much an experimental approach. The first part of this workshop will provide an overview of the state of the field through short lecture presentations. The second part of this workshop will engage participants to discuss controversies in mechanisms underlying BCI-based rehabilitation, establish areas where the field requires more research, and propose the direction of research that is necessary in the near future in order for the field to make meaningful progress. This may include the identification of novel neural repair mechanisms that can be facilitated by BCIs and unmet clinical needs, as well as determining the basic, translational, and clinical studies that need to be performed.

W-6   What's wrong with us? Roadblocks and pitfalls in designing BCI applications – Nautilus East
Speakers: Ricardo Chavarriaga, Sonja Kleih, Fabien Lotte and Reinhold Scherer

Research in brain-computer interfaces has achieved impressive progress towards implementing assistive technologies for restoration or substitution of lost motor capabilities, as well a supporting technologies for able-bodied subjects. Notwithstanding this progress, effective translation of these interfaces from proof-of concept prototypes into reliable applications remains elusive. As a matter of fact, current systems cannot be used independently for long periods of time by their intended end-users.

Multiple factors that impair achieving this goal have already been identified. However, it is not clear how do they affect the overall BCI performance or how should they be tackled. This is worsened by the publication bias where only positive results are disseminated, preventing the research community of learning from its errors.

This workshop is intended as a space to discuss these limiting factors. In particular we will encourage researchers to share their attempts to overcome them, even those that have failed. The workshop will be composed of several invited presentations (15 min) plus short spotlight presentations (5 min) from the attendance, complemented with plenty of time for discussions. We intend as outcome to have a set of guidelines of concrete research avenues that may take BCIs closer to real applications, usable by their intended end-users.

W-7   Technological Implant Developments - Sanderling
Speakers: Erik Aarnoutse Masayuki Hirata, Tim Denison, Arto Nurmikko and Fabien Sauter-Starace

Technical development of BCI implants involves many levels of research, from the basic materials to circuits, longevity requirements and from the lab into the home. The speakers are directly involved in one or more of the levels and will give insight into the world of BCI implants.

Attendants will become aware of the many considerations from a bringing-to-market perspective, and will be informed about the state of art in implant design, from developers across the world. Plenty of room is planned for discussions on the technical hurdles in developing implants.

W-8   Studying Learning with BCIs - Triton
Speakers: Marc Schieber, Ben Engelhard, Karunesh Ganguly, Aaron Batista and Vivek Athalye

Brain-Computer Interfaces offer distinct advantages for studying the neural basis of learning. First, in a BCI setting, we can establish a direct, causal link from the neural activity we record to the movement of the prosthesis (e.g., computer cursor or robotic limb). Second, we can manipulate the mapping from neural activity to movement. This allows us to observe how animals learn to generate new patterns of population neural activity to restore control the prosthesis. These advantages put within reach the neural basis of classical phenomena in motor and cognitive learning, including adaptation, exploration, rapid re-learning, interference, and skill learning. BCI learning appears to engage many of the same brain areas that are engaged during motor learning, so there is reason to believe that the BCI framework can help reveal the neural mechanisms of motor learning.

Thursday, June 2, 2016   9:00 a.m. – 12:00 p.m.

M-1   BCIs for assessment of locked-in and DOC patients - Nautilus West
Speakers: Christoph Guger, Damien Coyle, Donatella Mattia, Marzia De Lucia, Leigh Hochberg, Betts Peters, Chang S. Nam, Damien Cruse and Quentin Noirhomme

Some patients diagnosed as vegetative are reclassified as (at least) minimally conscious when assessed by expert teams. A further subset of potentially communicative non-responsive patients might be undetectable through standard clinical testing. Other patients might have transient periods of relative wakefulness, but remain unaware of their surroundings. The workshop will provide an overview of groups that aim to use BCI technology to identify non-responsive patients that might be able to communicate and use the technology as an assessment tool.

In the workshop recent experiments, analysis methods and results with EEG, fNIRS and fMRI will be shown and discussed. The goal of the workshop is to identify the most important trends of the last years and to facilitate interaction between participants.

M-2   Therapeutic Applications of BCI Technologies - Scripps
Speakers: Dennis McFarland, Leonardo Cohen, Janis Daly, Chadwick Boulay, and Michael Luehrs

Brain-computer interface (BCI) technology can restore communication and control to people who are severely paralyzed. There has been speculation that this technology might also be useful for a variety of diverse therapeutic applications (Daly & Sitaram, 2012). This workshop considers possible ways that BCI technology can be applied to motor rehabilitation following stroke, Parkinson's disease, and Psychiatric disorders. These diverse applications all share a reliance on state-of-the-art neuroimaging and signal processing technologies. At the same time, each presents a series of unique challenges.

M-3   Pathways to effective BCI communication and computer interaction for people with disability - Sanderling

Speakers: John Simeral, Shankai Gao, Theresa Vaughn, Beata Jarosiewicz, Frank Willett, Chethan Pandarinath and Vikash Gilja

Although BCI platforms may rely on different neural signals to derive command signals (EEG, SSVEP, ECoG, intracortical spikes or LFPs), all are progressing along roadmaps toward use as assistive technology for communication or computer interaction by people with motor disability. Progress could be facilitated for each of these platforms by synergistic communication regarding challenges, insights, objectives, and experiences. This workshop aims to provide a forum for direct, effective and efficient communication and debate regarding technical approaches, successes and barriers, priorities, and long range vision from experts in each of these respective BCI domains. Short talks by experts in surface, intracranial, and intracortical recording approaches will summarize the current state of the art in BCI communication. Challenges and envisioned solutions regarding each technology will be discussed among workshop speakers and attendees to alleviate misconceptions and highlight shared challenges and solutions. Next, speakers will discuss a few innovative techniques under investigation to advance BCI performance and reliability. As a community, we will finish with all-hands discussion to summarize and highlight our Society's progress across all of these technologies as presented by the speakers, and identify critical steps on the roadmap toward viable home use by people with disability.

M-4   Non-invasive BCI-control of FES for grasp restoration in high spinal cord injured humans – Acacia

Speakers: Gernot Müller-Putz and Rüdiger Rupp, Matthias Schneiders, Joana Pereira, Andreas Schwarz and Patrick Ofner

The bilateral loss of the grasp function associated with a complete or nearly complete lesion of the cervical spinal cord severely limits the affected individuals' ability to live independently and retain gainful employment. Any improvement of a lost or limited function is highly desirable not only from the patients' point of view, but also for economic reasons. Motor neuroprostheses based on Functional Electrical Stimulation (FES) provide a non-invasive option for functional improvement of the upper extremity function. In particular, hybrid-FES systems consisting of FES and active orthotic components are effective in restoration of everyday manipulation capabilities.

EEG-based Brain-Computer Interfaces represent a valuable component of a neuroprosthetic user interface. A major advantage over other assistive devices is that it can be operated independently from residual motor functions. Motor imagery-based BCIs have enormous implications providing natural control of a grasping and reaching neuroprosthesis in particular in individuals with a high spinal cord injury by relying on volitional signals recorded from the brain directly involved in upper extremity movements.

This workshop will present the current state of the application of non-invasive grasp neuroprostheses in end users and will include a combination of invited talks together with targeted discussions and sharply focused debates.

M-5   Exploiting cognitive processes for brain-machine interaction – Merrill Hall

Speakers: Iñaki Iturrate, Richard Andersen, Benjamin Blankertz, Ricardo Chavarriaga and José del R. Millán

Besides decoding of brain activity for direct control of external devices, brain-machine interfaces can be used to identify correlates of cognitive processes such as motor planning, error awareness, or visuospatial attention, among others. Recent works have demonstrated the possibility of decoding these processes using both invasive and non-invasive approaches. Some examples include the extraction of information from motor intention and goals from intra-cortical recordings; the decoding of anticipatory processes during car-driving; or the use of error-related cortical potentials –in combination with reinforcement learning- to control neuroprosthetic arms. This workshop follows on the success of the one we organized during the 2013 Asilomar meeting. It will allow attendees to review the evolution of research efforts on this topic, as well as the most recent trends, and potential research avenues worth to be explored in the following years.

M-6   Out of the lab - acquiring high quality EEG during mobile application - Heather
Speakers: Reinhold Scherer, Stefan Debener, Martijn Schreuder and David Ojeda

With the rising interest in neurorehabilitation and real-world applications of BCI, obtaining high quality data during ambulatory / mobile use is of crucial importance for BCI technology to deliver real solutions to the community. But at the same time it stretches the abilities of most current hard- and software solutions. Measuring high quality data under such conditions is highly challenging, as (movement) artifacts as well as dynamic environments make it very difficult to analyze the data.

Recent advances in EEG hardware and software development have pushed this boundary, allowing the acquisition of good quality signals. In this workshop we will review some of these recent advances. We will also touch upon some of the current lines of research for which mobile EEG is essential, and will share tricks that will get you set for your own, out-of-the-lab experience!

Half of the workshop will be dedicated to gaining hands-on experience with both software and hardware tools. Several mobile EEG systems from different manufacturers will be available. During the workshop, participants will be able to gain hands-on experience with several applications, including smartphone-based readiness potentials during free walking, unobtrusive long-term EEG acquisition with cEEGrid electrodes, and wireless motor imagery neurofeedback.

M-7   BCI Research and Development for Children - Curlew
Speakers: Disha Gupta, Scott Makeig, Patricia Davies, William Gavin, Walid Soussou and Jewel Crasta

Established BCI applications have largely focused on neurological disorders, traumatic brain injuries or stroke occurring in adults. Emerging non-clinical applications have also generally targeted healthy adults to showcase a working BCI system. This is understandable as EEG features are better characterized in adults and there are fewer challenges to acquiring robust data. However, BCI applications are also potentially useful in pediatric populations— in neurodevelopmental disorders (e.g. autism, ADHD), neurodegenerative disorders (e.g. SMA) or sports-related injuries. In many such disorders there are limited interventional avenues. A mechanism for BCI-based replacement or enhancement of an impaired function could improve the quality of life of these children and even prevent the progression of a disorder. But it is not straightforward to translate adult studies to pediatric studies; less so in a neurologically impaired group. Early brain injury can lead to endogenous brain reorganization and compensation that is difficult to track. Challenges are compounded in younger children due to data acquisition artifacts, tuning paradigm complexity, barriers in communicating instructions, eliciting appropriate/repeatable behavioral responses, or maintaining attention in monotonous experiments. We propose that BCI research in children be nurtured collaboratively in parallel with adult studies, and not simply assumed to be a translation from adult studies.

M-8   BCI implants: medical, ethical, regulatory and commercial issues - Marlin
Discussion Coordinator: Nick Ramsey
Panel Participants: Jon Wolpaw, Jane Huggins, Tim Denison, Spencer Kellis, Cristin Welle, Eran Klein and
                             Takufumi Yanagisawa

This BCI Implant workshop is set up as a discussion workshop with an expert panel and several linked topics, with active inclusion of the attendants.

Topic 1:   What are the surgical risks?
This topic deals with the health risks involved in implanting. The discussion includes temporary implant for research, and permanent implant for restoration of communication and motor control (including robot limbs). Issues include risk assessment and approaches to minimize them.

Topic 2: When is surgery justified?
This topic deals with the arguments against and in favor of implanting. When does a person qualify for an implant, what particular clinical populations are the target populations. What regulations and guidelines would be needed (if any) in this part of the BCI field. What needs can be met with implants and are they different from non-invasive solutions.

Topic 3: What research is needed to bring implants to market?
This topic addresses the approaches needed to bring implants to market. What research is required in terms of medical efficacy, clinical trials, and comparisons between implants. What numbers of patients, is multicenter research required and if so, what numbers of patients, duration of inclusion, which patients/indications. How do we deal with regulatory and reimbursement hurdles. What do we need to overcome those hurdles.

M-9   Algorithms and Performance Using Implanted Devices – Nautilus East
Speakers: Steven Chase, Hansjoerg Scherberger, Maryam Shanechi, Josh Merel and Paul Nuyujukian

The clinical efficacy of BCI technologies depends in large part on improvements in the algorithms that decode the user's motor intent. Implanted devices that record the spiking activity of dozens of neurons in the cortex of nonhuman primates provide a valuable testbed for the development of new algorithms. This workshop will present new algorithms developed in a basic-science context, along with quantifications of BCI system performance in a range of tasks relevant for the activities of daily living. The workshop has two goals: first, to foster interaction among basic-science BCI researchers working in parallel to improve BCI system performance; and second, to disseminate knowledge about the latest algorithmic approaches to clinicians and practitioners.

M-10   Improving BCI Usability through Transfer Learning Methods - Triton
Speakers: Michael Tangermann and Pieter-Jan Kindermans

Transfer learning (TL) approaches carry information (parameters, features, classifiers etc.) from earlier BCI sessions over to novel sessions or even to novel users. By effectively shortening the calibration intervals, TL methods can be (come) important building blocks to make BCIs more practical. Consequently, they can aid in getting the BCIs out of the research labs and to the end-users. Our workshop brings together TL experts and BCI practitioners to discuss existing and novel TL approaches.

The goals of this workshop are threefold. First, a brief overview of the current state of the art on TL methods for BCI will be presented, including invited talks on novel approaches. Goals are to bring all participants to a common level of knowledge. Second, we want to identify the prerequisites for the application of various TL methods, what are the success metrics for a practical application, and what the main challenges and the opportunities for further improvements are. Third, finding ways to increase the acceptance for TL methods by discussing and providing support on how to integrate existing TL methods into the BCI practitioner's toolboxes.

Thursday, June 2, 2016   2:30 p.m. – 5:30 p.m.

A-1   Understanding State Change and its Impact on BCI Performance - Scripps
Speakers: Brent Jason Lance, Tzyy-Ping Jung, Chin-Teng Lin, Li-Wei Ko, Yufei Huang and Vernon Lawhern

The performance of classification algorithms that underlie BCI technologies are strongly affected by changes in neural signals driven by changes in the underlying state of the individual using the BCI. As a result, BCI technologies tend to exhibit low robustness over time. The workshop will consist of an introductory talk that outlines the problem of state change and BCI performance within the space of extracranial, non-motor-imagery BCI, followed by a series of talks that describe potential solutions. These potential solutions will include methods for data-driven identification of neural state change, experimental exploration of state change at different time scales ranging from moment-by-moment to long-term adaptation, study of real-world factors that drive state change such as

stress and fatigue, novel algorithms that adapt to the individual or to state change over time, and feature extraction methods that are robust to state change. After completing the workshop, participants will be able to explain why changes in state lead to low robustness in BCI technologies, cite potential methods for better understanding the relationships between state change and BCI performance, and describe potential solutions for improving BCI performance across changing states.

A-2   Brain-Computer Interface based motor and cognitive rehabilitation after stroke – Nautilus West

Speakers: Donatella Mattia, Marco Molinari, Natalie Mrachacz-Kersting, Sonja Kleih and Floriana Pichiorri
Moderator: Andrea Kuebler

EEG based Brain-Computer Interfaces are a potential tool to support neuronal plasticity after stroke in the sub-acute, and even in the chronic state. Few randomized controlled trials demonstrated the positive effect on motor rehabilitation. Recent data also indicate that BCI training may improve cognitive rehabilitation. However, important questions remain to be addressed for implementing BCI based rehabilitation in clinical routine. This translational effort requires an interdisciplinary approach. In this workshop, we will overview the current state of the art in BCI based motor and cognitive rehabilitation, present a BCI setup shown to be effective, and discuss translational issues and barriers.

A-3   Combining BCI with non-invasive brain stimulation techniques - Heather

Speakers: Aureli Soria-Frisch, Giulio Ruffini, Surjo R. Soekadar, Ricardo Chavarriaga and Theodore Zanto

The combination of non-invasive brain stimulation techniques with brain-computer interfaces (BCI) is a topic of increasing interest. Various studies prove that non-invasive brain stimulation (NIBS) can improve BCI control, e.g. to move an exoskeleton or robotic arm. Moreover, neuroplastic changes strongly related to re-learning of impaired functions in rehabilitation become facilitated by noninvasive multi-level electrotherapy such as transcranial current stimulation (tCS) when applied during BCI training. This workshop covers the main insights on the combination of both technologies. It details tCS principles, combination of EEG signals with tCS, BCI-tCS rehabilitation protocols, and provides an overview of the benefits, disadvantages and difficulties of the BCI-tCS combination. Workshop attendance will familiarize BCI researchers with the use of tCS for improving BCI performance in general and with its efficacy in BCI neurorehabilitation applications.

A-4   Novel application fields for auditory BCIs – Nautilus East

Speakers: Martin Bleichner, Michael Tangermann, Benjamin Blankertz, Stefan Debener and Disha Gupta

Brain computer interfaces are increasingly used outside the classical communication and movement restoration applications. Auditory BCIs present intriguing possibilities in a variety of field - as they provide, for example, instantaneous metrics of a BCI user's auditory attention and auditory target/non-target discrimination. Auditory BCIs can have significant added value for a large population when transferred into novel research field like L2 language learning, music teaching, hearing devices and rehabilitation. In this workshop we will present auditory BCIs applications used in the respective field. We will discuss the advantages of the BCI loop for these applications and the beneficial effect of instantaneous feedback. In targeted group discussions we seek to identify novel use cases for auditory BCIs and exchange methods and approaches that are already used successfully. The objective of this workshop is to boost the emerging field of auditory BCI, to identify novel use cases, connect the respective research communities and discuss and define future research activities. We cordially invite all researchers and practitioners that are active or interested in auditory BCIs.

A-5   **Deep Learning and Other Machine Learning and Signal Processing Methods for Analyzing EEG in BCI Paradigms – Merrill Hall**

Speakers: Chuck Anderson, Elliott Forney, Dean Krusienski, Yalda Shahiari and Damien Coyle

Many advanced data analysis methods have been developed for EEG pattern recognition, but few have resulted in BCI performance that surpasses what is achieved with simple linear methods. The recent success of deep learning methods for difficult problems of image and speech recognition and similarities between such data and EEG signals suggest that deep learning might contribute to BCI advances. In this workshop, the deep learning framework will be introduced. Implementations in the Python programming language of some of the associated machine learning algorithms will be presented and demonstrated through applications to EEG signal classification in BCI paradigms.

A-6   **A framework for considering the voice of the users of BCI rehabilitation devices - Curlew**

Speakers: Denise Taylor, Nada Signal, Mads Jochumsen, Sylvain Cremoux and Imran Niazi

There is significant investment in the development of new medical technologies, including BCI devices, aimed at improving the lives of people with disabilities. Providing effective rehabilitation is a lynchpin in achieving independence for people with disabilities. This workshop highlights how clinician and user perspectives can influence the design and implementation of BCI devices for neurological rehabilitation. The aim is to elucidate how fundamental principles in rehabilitation can be considered and applied to improve the chances of successful implementation of BCI devices in clinical practice. Narrowing the engineering/clinician knowledge gap by overlaying the two bodies of knowledge can result in improved BCI devices. The International Classification of Functioning, Disability and Health Framework will be presented with a discussion around how this underpins clinical understanding and practice. The workshop encourages participants to reflect on their own approaches to design and how this might change with increased understanding of the language and principles underpinning rehabilitation clinical practice. The presenters are a mix of bioengineers and clinicians who have been working together to develop BCI interventions over the last 2 years.

A-7   **Restoration of Upper Limb Function through Implanted Brain-Computer Interfaces - Acacia**

Speakers: Jennifer Collinger, A. Bolu Ajiboye, Takufumi Yanagisawa, Richard Andersen and Robert Gaunt

This workshop seeks to highlight current work related to the restoration of upper limb function using implanted BCIs. Specifically the workshop will feature results from ongoing clinical trials using implanted electrocorticography grids and intracortical microelectrode arrays. We will discuss the restoration of upper limb function using robotics as well as functional electrical stimulation. We will discuss the role of autonomous robotics or vision-guided robotics in improving function. The workshop will highlight different approaches to restoring movement such as decoding detailed movement parameters versus high-level goals. Progress related to provision of somatosensory feedback will be highlighted. The workshop will conclude with a panel-led interactive discussion about limitations of the current approaches and how to best move forward towards the goal of restoring upper limb function through implanted BCI.

A-8   **ECoG decoding for BCI - Triton**

Speakers: Alan Degenhart, Nathan Crone, Mariana Pedroso Branco, Tatiana Aksenova and Nick Ramsey

This workshop focusses on the research that is needed to prove and implement ECoG-based BCI. Two talks address the decoding investigated with temporary implants, two others will present and discuss decoding in actual BCI implants. Attendants will learn about different BCI implant approaches and will better understand the nature of ECoG signals. Room is planned for discussions about the pros and cons of the intracranial surface electrodes.

A-9   Does BCI mean business for Augmentative and Alternative Communication? - Marlin
Speakers: Femke Nijboer, Melanie Fried-Oken, Douglas Robinson and Theresa Vaughan

In the EU and the US, BCI researchers have been holding meetings about the challenges and opportunities needed to form synergy between BCI and augmentative and alternative communication (AAC). Stakeholders, including experts from neuroscience, engineering, computer science, AAC, people with locked-in syndrome, progressive neuromuscular disorders and SCI, families, industry and the general public participated in structured conversations about what would bring BCI and AAC to market and to society. We now engage the international BCI expert community in these discussions to ensure that we design BCIs better, establish meaningful technology transfer, and impact BCI uptake by children and adults with complex communication needs and their caring communities. We must develop technology transfer plans that address international and crossvalue-chain perspectives. This workshop continues the multi-stakeholder perspective that characterized the US and Dutch initiatives, exploring multi-dimensional factors that shape the technology transfer process beyond technical dimensions. Issues such as establishing consensus measures across stakeholders, manufacturability and standards, regulations and norms, user values, business aspects and differences in healthcare settings will be elaborated, focusing on creating a healthy innovation landscape for invasive and non-invasive BCI that deliver societal and economic value.

A-10   Haptic Guidelines for BCI Research Principal - Sanderling
Speakers: Mounia Ziat, Jan van Erp, Manuel Cruz, Darrel Rohit Deo and Samir Menon

Although the haptic modality has been used in some BCI research, haptic-BCI research gets less attention from the BCI community as opposed to visual or auditory BCI. The aim of this workshop is to provide guidelines to BCI researchers by exposing them to the possibilities of haptic technology from simple cutaneous actuators to complex exoskeleton robots. After being exposed to the psychology and physiology of touch, the attendees will have the opportunity to hear experts in the field present an overview of haptics, state-of-the-art of haptic-BCI research, and live-demonstrations of some haptic devices.