Welcome Message from the BMI Workshop Organizers

The 2018 IEEE International Conference on Systems, Man, and Cybernetics (SMC 2018) will be held in Miyazaki, Japan. SMC 2018 is the flagship conference of the IEEE Systems, Man, and Cybernetics Society. It provides an international forum for researchers and practitioners to report recent innovations and developments as well as exchange ideas and advances in all aspects of systems science and engineering, human machine systems, and cybernetics. Advances in systems science and engineering, human-machine systems, and cybernetics have increasing importance in the creation of intelligent environments involving technologies interacting with humans to provide an enriching experience and an improved quality of life.

The IEEE SMC 2018 8th Workshop on Brain-Machine Interface (BMI) Systems will be held on October 7–10, 2018 as part of the SMC 2018 program. The goal of the Workshop is to provide a forum to present research results and facilitate the interaction and intellectual exchange between researchers, developers, and consumers of BMI technology. Contributions report the latest advances, innovations, and applications in the field of BMI, including affective BMIs, hybrid BMIs, deep learning for BMIs, BMI-controlled robots, neurorehabilitation, and other real-world applications. These topics represent both challenges to the field and a tremendous opportunity for collaborative and multidisciplinary research, thus requiring expertise in systems engineering, human-machine systems, cybernetics, neuroscience, medicine, robotics, and other disciplines. This year's theme is *International Brain Initiative: Bringing Together Disciplines and Countries*. We welcome all SMC 2018 delegates who are involved or interested in learning more about the state-of-the-art and future challenges in BMI-related topics including sensors, machine learning, big data, neurorehabilitation, and standards to attend this Workshop.

A meeting of Global Current and Emerging Brain Initiatives will be held October 9, 2018 as part of the BMI Workshop and SMC2018. The IEEE SMC Society and the IEEE President, James Jefferies, are proud to invite you to a special meeting of global current and emerging Brain Initiative leaders and representatives from other groups working on large-scale multi-year brain projects from Australia, Canada, China, Europe (HBP), Japan, Korea, New Zealand, Poland, Russia, and US (NSF and NIH). Also participating are representatives from the IEEE Brain Initiative, International Neuroethics Society, industry, and other stakeholders. IEEE, as a new participant, welcomes collaborative discussions with all stakeholders to better align and integrate IEEE with other existing brain efforts. IEEE is a global technical community of 420,000+ professionals across multiple technology domains, many active in global brain projects. *Participation is free and open to all SMC 2018 delegates.*

Topics will include status of global brain projects and the International Brain Initiative; the IEEE Brain Initiative and other relevant activities; future collaborations and cooperation among Brain Initiatives, industry, and funding agencies; translational neuroscience and neural engineering, including standards development; neuroethics; sharing of brain data; open discussions, and other topics. The Workshop should attract engineers, scientists, programmers, mathematicians, quantitative analysts, and others to the multi-disciplinary field of neuroscience.

The 2018 BMI Workshop will also feature a Panel on Standards for Neurotechnologies, the BR41N.IO BCI Hackathon, a tutorial, three panels, a number of prominent invited speakers, and presentations of contributed papers. The Workshop is organized by the *IEEE SMC Technical Committee on Brain-Machine Interfaces Systems* and is technically co-sponsored by the *IEEE Brain Initiative* and *IEEE Standards*.

Papers
The goal of the Workshop is to provide a forum for researchers to present research results and facilitate the interaction and intellectual exchange between researchers, developers, and consumers of BMI and brain-research technology. This year, we have 92 papers accepted after careful peer-review by at least three experts in BMI-related fields and will be presented across **15 regular and special sessions** in: human-machine systems (HMS) and cognitive cybernetics; novel approaches to improve functional diagnosis/prognosis; tools, metrics and databases; invasive BCIs; multimodal HMS; passive/affective BMIs; BMI and robotics; deciphering cortical representations for BMIs; deep learning for BMIs; real-world applications: SSVEP and spellers; automotive and exoskeletons; novel BMI paradigms; BMI modeling, analysis, and performance; BMIs for neurorehabilitation and body augmentation; and brain-inspired systems and unconventional BMI applications.

We are also pleased to have two outstanding BMI keynote speakers:

- Mitsuo Kawato (Director of Brain Information Communication Research Laboratory, ATR, Japan): *Brain Science Demonstrates Consciousness as a Key for Future AI*
- Andrzej Cichocki (Skolkovo Institute of Science and Technology, Russia): *Brain Computer Interface and Recognition of Human Emotions Using Multiway Component Analysis*

We also have five excellent BMI invited speakers giving seven invited talks:
- Jan Bjaalie (Leader, Neuroinformatics Platform, EU Human Brain Project): *The EU Human Brain Project: advancing knowledge in neuroscience, computing, and brain-related medicine*
- Tomasz (Tomek) M. Rutkowski (RIKEN AIP, Japan): *Multisensory BCIs in applications for robotics, VR/AR, art and dementia monitoring*
- Christoph Guger (CEO, g.tec medical engineering GmbH, Austria): (1) *An overview of BCI approaches and how to use BCI technology for communication, motor rehabilitation and cognitive assessment: demonstration;* (2) *Current and future applications of BCIs,* and (3) *How to run a real-time BCI application successfully*
- Kyousuke Kamada (Asahikawa Medical University, Japan): *Non-invasive and invasive Brain-Computer Interfaces for medical application and research projects*
- Paul Sajda (Chair, IEEE Brain Initiative): *BCIs for labeling our environment*

BR41N.IO Brain-Computer-Interface Hackathon
Hackathons are two-day brainstorming and collaborative marathons that create an environment supporting the rapid production of working prototypes. SMC 2018 attendees and non-SMC 2018 attendees interested in BCI/BMI and related technologies may participate in the **free** *Brain Computer Interface Hackathon* organized by the BMI Workshop to be held on Sunday, October 7th and Monday, October 8th, 2018. There are over $4,200 in cash and hardware prizes donated by the sponsors and organizers. Register at the 2018 IEEE SMC Brain Hackathon website or email Christoph Guger at <guger@gtec.at> if you have questions.

Standards Meeting, Tutorial, and Panels
Other highlights of the Workshop include a Panel on Standards for Neurotechnologies (October 8, 16:00 – 18:00, Crystal room) to advance and identify current needs and challenges for standardization of neurotechnologies. Representatives from industry, academia, technologists, and other stakeholders will be present, including members from the IEEE Industry Connections group on neurotechnologies, IEEE Standards Association, and the IEEE Brain Initiative. The possibility of deploying and commercializing BMI-based solutions with human users requires researchers, manufacturers, and regulatory agencies to ensure these devices comply with well-defined criteria for their safety and effectiveness. Consequently, there is an increased interest in development of appropriate standards for BMI systems and related neurotechnologies.

BMI tutorial will be held on October 7, 2018:
- How to Improve Performance in Brain-Computer/Machine Interface

The Workshop will also feature three **Panels**:
- *Future Research Opportunities and Funding in Brain Research and BMI*
- *Important Issues in Designing and Building Real World Neurotechnologies: What is New?*
- *Minds and Machines: Integrating AI with current Brain Research and Future Neurotechnologies*

We will close the Workshop with an open discussion on October 10, 2018 on "*What Have We Learned, Where Do We Go From Here?*" at 15:10 followed by a poster session and a reception at 16:00-17:00. All are welcome.

Organization Committee and Sponsors

We would like to thank the many organizations and individuals who worked hard in organizing this Workshop, including the Technical Program Chairs and Co-Chairs: *Masayuki Hirata, Jun Morimoto, Ricardo Chavarriaga, Jing Jin, Riki Matsumoto, and Yingxu Wang*; Special Session Chair and Co-Chairs: *Kyousuke. Kamada, Keiichi Kitajo, Yaoping Hu, Tim Mullen, Shinji Nishimoto, Vino. Prasad, Ivan Volosyak, Fei-Yue Wang, and Dongrui Wu*; Publicity and Sponsorship Chairs: *Yu-Fei Huang and Margaret Thompson*; Media Relations Chair: *Sara Breinbauer, Technical Editor, Start Mason Dambort* as well as the Brain Hackathon organizers: *Christoph Guger, Tiago H. Falk, Kyousuke Kamada,* and *Tim Mullen* and the Hackathon student competition Chairs: *Kojiro Matsushita* and *Takeshi Ogawa*.

A special thank you also to all those who helped make the Brain Initiatives Meeting a reality, including the IEEE President and CEO *James A. Jefferies* for hosting the meeting, and the leaders of Global Current and Emerging Brain Initiatives, as well as allied organizations, including: *Nick B. Langhals*, National Institute of Neurological Disorders and Stroke (NIH/NINDS, USA);); *James Deshler*, National Science Foundation; *Mitsuo Kawato*, ATR, Japan; *Jan Bjaalie*, EU Human Brain Project; *Bo Xu*, China Brain Project, Chinese Academy of Sciences; *Jeong-woo Sohn*, Korea Brain Initiative; *Sharath Sriram*, Australian Brain Alliance; *Yingxu Wang*, Hotchkiss Brain Institute, Canada; *Cliff Abraham* and *Peter Thorn*, Brain Research New Zealand; *Andrzej Cichocki*, SKOLTECH, Russia; *Wlodzislaw Duch*, Polish Brain Initiative, *Henry T. (Hank) Greely*, International Neuroethics Society; *Randy Schekman*, Aligning Science Across Parkinson's Initiative; *Dimitar Filev*, Ford Motor Company; *Paul Sajda*, IEEE Brain Initiative; *Edward Tunstel*, IEEE SMC Society; *Konstantinos Karachalios*, IEEE Standards Association; and *Ricardo Chavarriaga*, IEEE. We also thank the BMI Workshop and Brain Hackathon sponsors and supporters for their generous funding and support.

We look forward to meeting you in Miyazaki!
Michael H. Smith, Ljiljana Trajkovic, Tiago H. Falk, and Christoph Guger, Workshop Chair and Co-Chairs
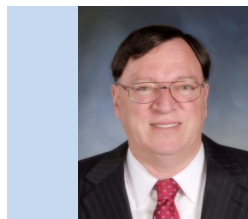
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