

**IEEE SMC 11<sup>th</sup> Workshop on Brain-Machine Interface Systems**  
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The IEEE SMC 11th Workshop on Brain-Machine Interface (BMI) Systems was held virtually from October 17-20 as part of SMC 2021, the flagship annual conference of the IEEE Systems, Man, and Cybernetics Society. The Workshop provided a forum for scientists to present research results, facilitate the interaction and intellectual exchange between researchers, developers, and consumers of BMI technology. The BMI Workshop was organized by the IEEE SMC Technical Committee on Brain-Machine Interface Systems and was technically co-sponsored by the IEEE Brain Technical Committee. Participation was free for all registered SMC 2021 attendees. The theme of this year's Workshop was: *Current Innovations in Neurotechnology, Human-Machine Systems, and the "Internet of Minds"*.

The 2021 BMI Workshop featured ten invited talks, one expert panel, four contributed paper sessions, a virtual BR41N.IO BCI Hackathon, and the 2021 International BCI Award. This year, 19 papers were accepted after peer-reviews by experts in BMI-related fields. They were presented in 4 oral sessions covering topics related to: (1) Passive BMIs, (2) Improving BMI accuracy and experience, (3) Motor imagery BMIs, and (4) New trends in BMIs. The BMI sessions were attended by approximately 120 registrants. Two best papers were awarded with financial support from the IEEE Brain Technical Community. Listed are the invited speakers and titles of presentations:

- Christoph Guger (g.tec, Austria): Current and future BCI applications
- Leo Schreiner (g.tec, Austria): (1) How to run a real-time BCI application and (2) Unicorn BCI demonstration
- Tim Mullen (Intheon, USA): LSL and NeuroPype tools and BCI applications
- Natalie Mrachacz-Kersting (Univ. Applied Sciences and Arts, Dortmund): BCIs for Replacement and Restoration of Lost Motor Function in Patient Populations
- Eli Kinney-Lang (University of Calgary, Canada): More than play: Challenges and benefits driving BCI for kids
- Charles Roy, Antoine Pépin, Yann Harej, and Felipe Almeida (LMDF Co., Canada): VFC Project: An Adaptive BCI Cinema Experience
- Maryam Alimardani (Tilburg University, Netherlands): Passive BCIs for Enhancement and Learning with Technology
- Yannick Roy (NeuroTechX, Canada): NeuroTechX: The International Neurotech Community, and
- Douglas Weber (CMU, USA): Injectable and Wearable Neural Interfaces

The expert panel focused on the theme of *"Developing neurotechnologies amidst a pandemic"*. Alex Castillo (Neurocity, USA), Mavi Ruiz-Blondet (Neurable, USA), and Christoph Guger (g.tec, Austria) shared their experiences in building new devices amidst a pandemic and provided the audience with hands-on insights and encouragement. The panel was moderated by Tiago H. Falk (INRS-EMT, Canada).

This was the sixth year that the IEEE SMC BMI Workshop hosted the br41n.io Brain-Computer Interface Hackathon. It was the second time it was held virtually. The BCI Hackathon was a brainstorming and collaborative marathon designed to rapidly produce fully functional BCI prototypes with team members spread out across the globe and/or to develop new signal processing pipelines using BCI data available online (for fully remote teams). The Hackathon was held October 17-18, 2021, had 23 registered teams worldwide, and had 251 registrants (over 115 were IEEE members). While many participated remotely, several teams participated through one of nine hosting institutions an experienced hands-on experimentation and in-person interactions. Three awards totalling USD\$3,000 were given to the top teams.

For the second consecutive year, the BMI Workshop hosted the International BCI Award Ceremony. The ceremony had 237 attendees where the top-12 nominees presented their projects. The three winning BCI Award projects are posted online at [www.bci-award.com](http://www.bci-award.com):

- 1st place: Stentrod from Synchron, Australia
- 2nd place: David Moses, USA, with a direct-speed BCI for decoding words
- 3rd place: Seong Hyeon Jo, Korea, with Individual finger movement classification with ultra-high density EEG.

Overall, over 600 attended the Workshop and 36 free educational hours were provided to participants.

Events planned for 2022 include:

- Hackathon at Spring School 2022:  
<https://www.br41n.io/Spring-School-2022>
- BCI & Neurotechnology Spring School 2022:  
<https://www.gtec.at/spring-school-2022/>
- BCI & Neurotechnology Master class (in Portuguese): <https://www.gtec.at/masterclass-portugal-2021/>

We hope to see you at the 12<sup>th</sup> BMI Workshop to be held in Prague, Czech Republic from October 9-12, 2022.