BCI SOCIETY

10th International BCI Meeting

Sonian Forest,
Brussels, Belgium

@BciSociety

#BCIMeeting

2023 BCI MEETING PROGRAM-AT-A-GLANCE

Time	Tuesday, June 6	Wednesday, June 7	Thursday, June 8	Friday, June 9
7:30	Registration & Information Desk Open 7:30-18:00	Breakfast 7:30-8:30	Breakfast 7:30-8:30	Breakfast 7:30-8:30
7:45				
8:00	Satellite Events (1-3) Job Offers & Career Opportunities Workshops 8:00-13:45	Registration & Inforamtion Desk Open 8:00-17:00	Registration & Information Desk Open 8:30-17:30	Registration & Information Desk Open 8:30-17:30
8:15				
8:30		Plenary Speaker #1 Andrea Kübler 8:30-9:30	Neuroethics Session 8:30-9:30	Plenary Speaker #3 Thomas Oxley 8:30-9:30
8:45				
9:00				
9:15				
9:30		Workshop Session 1 9:30-12:30	Workshop Session 2 9:30-12:30	Workshop Session 3 9:30-12:30
9:45				
10:00				
10:15				
10:30				
10:45				
11:00				
11:15				
11:30				
11:45				
12:00				
12:15				
12:30		Lunch/Lunch with Leaders (12:30-13:30)	Lunch/Lunch with Leaders 12:30-13:30	Lunch/Lunch with Leaders 12:30-13:30
12:45				
13:00				
13:15				
13:30		Plenary Speaker #2 Edward Chang 13:30-14:30	Research Session 1 13:30-15:30	Research Session 2 13:30-15:30
13:45				
14:00	BCI Tutorial 14:00-15:45			
14:15				
14:30		BCI Users Forum 14:30-15:30		
14:45				
15:00				
15:15				
15:30				
15:45		Posters & Exhibitor Demonstrations Session 1 15:45-17:15	Posters & Exhibitor Demonstrations Session 2 15:45-17:15	Posters & Exhibitor Demonstrations Session 3 15:45-17:15
16:00	BCI Fundamentals Didactic 16:00-16:45			
16:15				
16:30				
16:45				
17:00	Master Class 1 17:00-17:45			
17:15				
17:30				
17:45		Diversity in BCI Workshop 17:30-18:30	Early Career Awards 17:30-18:30	Lifetime Achievement Award 17:30-18:30
18:00	Funding & Investment Panel			
18:15				
18:30				
18:45				
19:00	Dinner 19:00-20:00	Dinner 19:00-20:00	Dinner 19:00-20:00	Al-Fresco Dinner & Closing Remark 19:00-21:00
19:15				
19:30				
19:45				
20:00				
20:15	Welcome, Town Hall & Tribute 20:15-21:15	Master Class 2 20:15 - 21:15	Master Class 3 20:15 - 21:15	
20:30				
20:45				
21:00				Trivia Night (20:15-21:15)
21:15	Bonfire Party #1 (21:15-23:15)	Movie Night (20:15-22:15)	Bonfire Party #2 (20:15 to 22:15)	
21:30				
21:45				
22:00				

Table of Content

Letter from the President

Dear Friends and Colleagues,

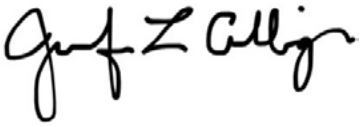
This year we celebrate the 10th International Brain-Computer Interface Meeting. I am very excited to resume our in-person conferences, the last of which was in 2018 in Asilomar, CA. Virtual events such as the vBCI conference in 2021, the Virtual Meet-up in 2022, and BCI Thursdays have kept us connected in the meantime, but I look forward to the opportunities that this in-person meeting will bring!

There has been much progress in recent years. Academic clinical trials have demonstrated remarkable progress in the ability to restore movement, sensation, and communication using BCI technology. Researchers have prioritized user-centered design focusing on delivering high-performance, reliable, and easy to use devices. Multiple companies are making significant investments in developing novel hardware and innovative algorithms. We have also begun to see industry-sponsored clinical trials that are gathering the safety and performance data required to bring BCI technology to market. The theme of the 10th International BCI Meeting, "Balancing Innovation and Translation", highlights the different efforts in the field. The conference program offers opportunities to learn about, discuss, and debate priorities related to: (1) translating BCI technology and its potential benefits to users as soon as possible, and (2) pursuing the scientific and engineering innovations that are necessary to develop BCIs of the future.

The mission of the Society is to foster research leading to technologies that enable people to interact with the world through brain signals. Members of the BCI Society represent a broad set of disciplines that are relevant to BCI, and the program committee aimed to be inclusive of that diversity when developing the program. The program includes 3 highly accomplished keynote speakers that will anchor our theme of "Balancing Innovation and Translation". Day 1 of the meeting includes sessions that are particularly geared towards trainees including the first job opportunities and career workshop, tutorial, and didactic sessions, and the first master class session, where trainees can get feedback from experienced scientists in a small setting. The meeting schedule also includes 3 poster sessions along with special sessions on neuroethics, user perspectives, funding opportunities, and diversity in BCI. We will also feature talks by the Lifetime Achievement Award and Early Career Award winners. Finally, the hallmark of the BCI meeting continues to be the interactive workshops that we hope will foster critical thinking, discussion, and innovation.

We are grateful for grant support from the National Institutes of Health, National Science Foundation, and Research Foundation- Flanders (FWO) that enabled us to offer trainee travel awards, financial hardship grants, and family care grants. Thank you also to the meeting sponsors and of course all the attendees and contributors that helped make this meeting a reality.

I hope that you enjoy the 10th International BCI meeting - meet new people, forge collaborations, and participate in discussions that will ultimately enable us to deliver BCIs that enable people to interact with the world through their brain signals!



Jennifer Collinger
President of the BCI Society

About the BCI Society

History

In 2013, at the Fifth International Brain-Computer Interface (BCI) Meeting in Pacific Grove, California, the attendees voted to establish a formal BCI society to oversee future meetings and conduct other BCI-related activities.

The BCI Society was formally established on March 13, 2015, as an international organization that is legally based in the Netherlands. It is led by a Board comprising members from all over the world.

Mission

The purpose of the BCI Society is "to foster research leading to technologies that enable people to interact with the world through brain signals." To serve this purpose, it will:

- Organize meetings
- Collaborate with other BCI-related organizations and individuals
- Share research and information among its members
- Provide BCI-related information and advice to scientific, technical, or clinical organizations, governmental or regulatory entities, scientific or popular media, and the general public
- Engage in other activities designed to achieve the central purpose of the Society

Society Membership

Membership in the BCI Society is open to all scientists, principal investigators, post docs, and students from around the world involved in the many research and practical aspects of BCI research. We welcome all involved in BCIs, including engineers, doctors, therapists, business people and users of BCI technology.

BCI Board of Directors

Officers

Jennifer Collinger	*President, University of Pittsburgh, USA*
Mariska Vansteensel	*Vice President, University Medical Center Utrecht, the Netherlands*
Gernot Müller-Putz	*Secretary/Treasurer, Graz University of Technology, Austria*
José del R. Millán	*Past President, University of Texas at Austin, USA*

Board Members

Dean J. Krusienski	*Virginia Commonwealth University, USA*
Donatella Mattia	*Fondazione Santa Lucia, Italy*
Natalie Mrachacz-Kersting	*Albert-Ludwigs-Universität Freiburg, Germany*
Reinhold Scherer	*University of Essex, United Kingdom*
Marc Slutzky	*Northwestern University, USA*
Davide Valeriani	*Google, USA*
Theresa Vaughan	*National Center for Adaptive Neurotechnologies, USA*
Yiwen Wang	*Hong Kong University of Science and Technology, Hong Kong*

2023 Meeting Executive Team

Conference Chair:
Jennifer Collinger *University of Pittsburgh, USA*

Conference Co-Chair:
Mariska Vansteensel *University Medical Center Utrecht, the Netherlands*

Scientific Program Committee Chair:
Natalie Mrachacz-Kersting *Albert-Ludwigs-Universität Freiburg, Germany*

Scientific Program Committee Co-Chair:
Donatella Mattia *Fondazione Santa Lucia, Italy*

Young Talent Committee Chair:
Davide Valeriani *Google, USA*

BCI Society Administration

Association Secretariat & Conference Management:
bci@podiumconferences.com

Podium Conference Services:
Cendrine De Vis,
Agathe Deacon-Erasmus,
Sebastien Lavoie

General Meeting Information

Meeting Venue

Dolce La Hulpe Brussels is an elegant retreat-style campus nestled in the heart of the Sonian Forest. With an outstanding view of the forest, all 264 non-smoking guest rooms integrate the year-round natural beauty of the surroundings into the interiors. All accommodations offer the ultimate in modern appointments, ranging from free wireless high-speed Internet access, voicemail enabled phones and cable flat screen television to the simple convenience of an oversized working desk.

The Sonian Forest that surrounds the conference center is one of the largest ancient beech forests in Europe. In 2017, part of the Sonian Forest was recognized as world heritage site by UNESCO. This ancient pristine forest consists mostly of beech and oak trees, some of them more than 200 years old, and is known as the beech cathedral. It includes five nature reserves, two forest reserves and two archaeological reserves that feature some of the oldest archaeological remains of Belgium. Its jogging and walking paths are easily accessible from the front door of the conference center and provide many opportunities for informal interactions among meeting participants.

Meal Times

Eating together in the Argan restaurant is an essential part of the BCI Meeting experience. Meals will be served buffet style.

Breakfast:	07:30 – 8:30
Lunch:	12:30 – 13:30
Dinner:	19:00 – 20:00

Permanent Break

Hot and cold beverages, fruits, baked goods, cereal bars, and other snacks will be available to delegates throughout the day in the “Refreshment Hub” located in E-coffee.

Thank you to Wyss Center for Bio and Neuroengineering for sponsoring the coffee breaks on Wednesday and Thursday.

WYSS CENTER

Name Badges

Kindly wear your name badge at all times as your admission to the sessions, Refreshment Hub, meals and special functions. At the end of the conference, you are encouraged to recycle your badge at the registration desk.

Registration and Information Desk

The registration/information desk, located at the Foyer Auditoria Canopée, is open daily during meeting session hours:

Tuesday, June 6	07:30 – 18:00
Wednesday, June 7	08:00 – 17:00
Thursday, June 8	08:30 – 17:30
Friday, June 9	08:30 – 17:30

Wireless Internet

Complimentary wireless internet is available to the delegates of the BCI Meeting throughout the Conference Center and facilities. Please note the complimentary Wi-Fi is ideal for checking emails and websites but is not strong enough for streaming videos or heavy social media use.

Staff

Staff from Podium Conference Specialists can be identified by the orange ribbons on their name badges. Feel free to ask any one of our staff for assistance or visit the registration desk.

BCI Society Code of Conduct

The BCI Society Code of Conduct listed below reflects our Society's values and our expectations for Society members and guests. This Code of Conduct is in effect while at the International BCI Meetings and any social event linked to the BCI Society.

Conduct should be free of biases regarding race, cultural background, religion (or lack thereof), country of origin, age, sex, sexual orientation, gender identity, disability, physical appearance, or other individual characteristics or expression.
No harassment will be tolerated.

Discussions should be respectful, civil, professional, and constructive reflecting tolerance for disagreements and recognition of opportunities to learn from each other.

BCI Society has zero tolerance for sexual harassment including: any verbal or physical behavior that reflects unwelcome sexual advances, or behaving in any way that another individual feel impinges on their boundaries.

If you are being harassed, notice that someone else is being harassed, or have any other concerns, please report it to us immediately. We value your attendance and will make every effort to ensure that you feel safe and welcome for the full duration of the Meeting.

You can make a report by directly emailing Jennifer Collinger, President and Mariska Vansteensel, Vice-President at codeofconduct@bcisociety.org.

Poster and Exhibitor Demonstration Sessions

Please visit our poster presenters and exhibitors during the poster and demonstrations sessions. Refreshments will be served during the sessions. Feel free to enjoy your beverage while reviewing the posters.

The posters are displayed throughout the Redwood Room. Information on Poster Authors, Poster Numbers and Poster Titles begins on page 41.

POSTER SESSION 1

Wednesday, June 7

Set Up: between 08:00 and 12:00
Session Time: 15:45 – 17:15
Tear Down: 17:15

Thanks for removing your poster immediately after the session.

POSTER SESSION 2

Thursday, June 8

Set Up: between 08:00 and 12:00
Session Time: 15:45 – 17:15
Tear Down: 17:15

Thanks for removing your poster immediately after the session.

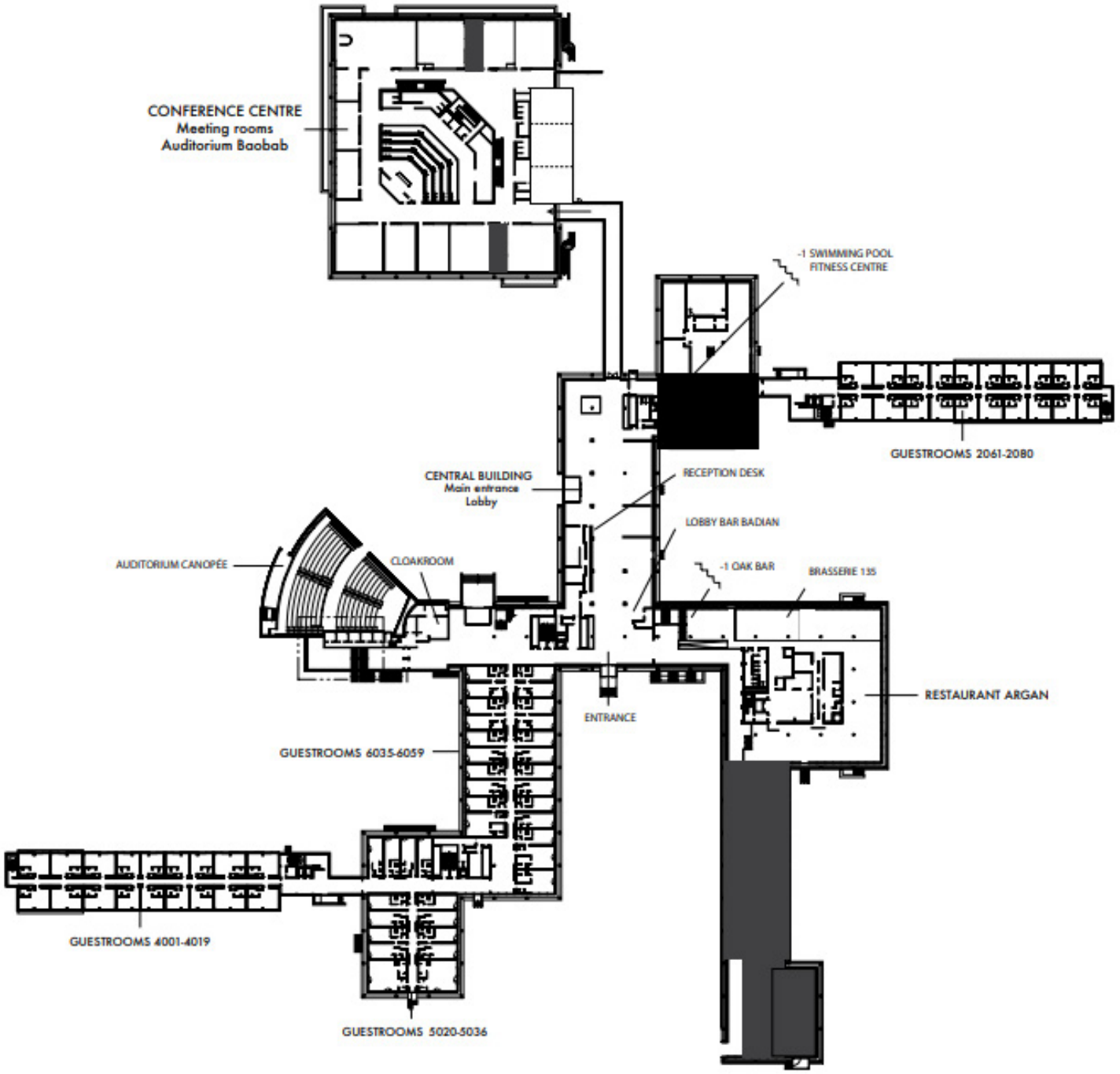
POSTER SESSION 3

Friday, June 9

Set Up: between 08:00 and 12:00
Session Time: 15:45 – 17:15
Tear Down: 17:15

Thanks for removing your poster immediately after the session.

Venue floor plan



Daily Schedule

Tuesday, June 6

08:00-13:45	Cocobolo	**SE1:** *Neurotechnologies for Mass Populations*
08:00-13:45	Cherry	**SE2:** *BCI2000: Open-Source Software for Real-Time Biosignal Acquisition, Processing, and Feedback*
09:00-12:00	Ginko	**SE3:** *Future of Brain Computer Interface Technology – How Ultra-High Density EEG Boosts BCI Applications and Gaming Opportunities*
09:00-12:00	Teck	**SE4:** *Job Offers and Career Opportunities Workshops*

Lunch is on your own, unless you are registered for Satellite Events #1 or #2, for which lunch will be provided in the Argan Restaurant at 11:00.

14:00-15:45	Teck	**BCI TUTORIAL**
16:00-16:45	Canopée	**BCI FUNDAMENTALS DIDACTIC SESSION** **Victoria Peterson**, *Consejo Nacional de Investigaciones Científicas y Técnicas* **Gernot Müller-Putz**, *Graz University of Technology*
17:00-17:45	Multiple rooms	**MASTER CLASS SESSION 1** for details page 17
	Cocobolo	**Master Class #1**
	Cherry	**Master Class #2**
	Ginko	**Master Class #3**
	Amarante	**Master Class #4**
	Teck	**Master Class #5**
	Flamboyant	**Master Class #6**
	Mahogany	**Master Class #7**
18:00-18:45	Canopée	**FUNDING AND INVESTMENT PANEL** **Enrique Claverol** **Sahana Kukke**, *National institute of Neurological Disorders and Stroke* **Isabella Tamagnini**
19:00-20:00	Argan Restaurant	**DINNER**

Tuesday, June 6

20:15-21:15	Canopée	**WELCOME, TOWN HALL AND TRIBUTES** *Hosted by* **Mariska Vansteensel**, *Vice President*
21:15-23:15	Terrace	**BONFIRE PARTY** *Sponsored by* Blackrock Neurotech

Wednesday, June 7

07:30-08:30	Argan Restaurant	**BREAKFAST**
08:30-09:30	Canopée	**PLENARY TALK #1** ***30 years of BCI research: People, Protocols, Publications, Pitfalls*** **Andrea Kübler**, *PhD, University of Würzburg, Institute of Psychology, Germany* *Sponsored by* Chen Institute, Tianqiao & Chrissy
09:30-12:30	Multiple rooms	**WORKSHOP SESSION 1** – for details see page 22
	Cocobolo	**W1:** ***Non-Invasive Motor Control***
	Cherry	**W2:** ***Multimodal Brain-Computer Interfacing***
	Ginko	**W3:** ***BCI State-of-the-Art: Demonstrations of BCIs Prototypes***
	Teck	**W4:** ***Building Consensus on Clinical Outcome Assessments (COAs) for BCI Devices***
	Amarante	**W5:** ***Offline and Online Tools for Real-World BCI Applications***
	Imbuia	**W6:** ***Learning from Small Datasets***
	Flamboyant	**W7:** ***Designing Speech BCIs that Facilitate User-Agency***
12:30-13:30	Argan Restaurant	**LUNCH/LUNCH WITH LEADERS**
13:30-14:30	Canopée	**PLENARY TALK #2:** ***Speech Neuroprosthesis: Words and Beyond*** **Edward Chang**, *PhD, University of California, San Francisco, USA*
14:30-15:30	Canopée	**BCI USERS FORUM** **François Cabestaing**, *Université de Lille* **Damien Perrier** **Phillip Ziebell**, *University of Würzburg* *Sponsored by* NeuroAbilities, G3ict

Wednesday, June 7

15:45-17:15	Redwood	**POSTER & EXHIBITOR DEMONSTRATIONS SESSION 1**
17:30-18:30	Canopée	***Diversity in BCI Workshop: What is Equality, Diversity and Inclusion... and why me?*** **Louise Wright**, *EDI Advisor (FMS), Newcastle University, UK* *Sponsored by* Caltech Tianqiao and Chrissy Chen Institute for Neuroscience
19:00-20:00	Argan Restaurant	**DINNER**
20:15-21:15	Multiple room	**MASTER CLASS SESSION 2** for details see page 17
	Cocobolo	**Master Class #8**
	Cherry	**Master Class #9**
	Ginko	**Master Class #10**
	Teck	**Master Class #11**
	Amarante	**Master Class #12**
	Imbuia	**Master Class #13**
	Flamboyant	**Master Class #14**
20:15-22:15	Canopée	**MOVIE NIGHT**

Thursday, June 8

07:30-08:30	Argan Restaurant	**BREAKFAST**
08:30-09:30	Canopée	**NEUROETHICS PANEL DISCUSSION** *Moderator:* **Pim Haselager**, *Donders, Radbound Universiteit* *Panelists:* **Dave Marver**, *ONWARD* **Elizabeth Waite**, *Blackrock* **Heather Dean**, *FDA* **Nick Ramsey**, *UMC Utrecht* *Sponsored by* Blackrock Neurotech

Thursday, June 8

09:30-12:30	Multiple rooms	**WORKSHOP SESSION 2** for details see page 22
	Cocobolo	**W8:** *Preserving Privacy and Cybersecurity of BCI Applications*
	Cherry	**W9:** *BCI Applications for Active Living: Discussion and Hands-on Activity*
	Ginko	**W10:** *Invasive Brain Computer Interface Technology? Open Loop and Closed loop Decoding Applications*
	Teck	**W11:** *Technological Development and Implementation of BCIs for Home Use*
	Amarante	**W12:** *Transfer Learning Toward Plug-and-Play BCI*
	Imbuia	**W13:** *Challenges in BCI-based Neurofeedback Applications for Neurological Disorders*
	Flamboyant	**W14:** *Finding Consensus on BCI Standards: How to Proceed?*
12:30-13:30	Argan Restaurant	**LUNCH/LUNCH WITH LEADERS**
13:30-15:30	Canopée	**RESEARCH ORAL PRESENTATION SESSION 1**

Misako Komatsu, *Tokyo Institute of Technology*

The whole-cortical ECoG reveals association cortices contribute multimodal intentional decoding

Motoshige Sato, Akito Yoshida, Joji Tsunada, Shuntaro Sasai

Ilaria Quattrociocchi, *Sapienza university of Rome*

EEG-based quantitative measures to support the clinical prognosis of disorders of consciousness

Angela Riccio, Mariagrazia D'Ippolito, Marta Aloisi, Rita Formisano, Donatella Mattia, Jlenia Toppi

Xuan Ma, *Northwestern University*

Aligning M1 neural activity with Cycle-GAN to stabilize brain computer interface.

Fabio Rizzoglio, Lee Miller, Ann Kennedy

Stephanie Cernera, *University of California*

At-home, embedded closed-loop deep brain stimulation using data-driven neural physiomarkers alleviates residual motor symptoms in Parkinson's disease

Carina Oehrn, Lauren Hammer, Jiaang Yao, Maria Shcherbakova, Amelia Hahn, Sarah Wang, Caroline Belkoura, Jill Ostrem, Clay Smyth, Simon Little, Philip Starr

Thursday, June 8

13:30-15:30	Canopée	**John Downey**, *University of Chicago* ***Coordinated arm movements are better represented in motor cortex than isolated movements*** Nicholas Hatsopoulos, Lee Miller, Jennifer Collinger, Matthew Kaufman, Sliman Bensmaia **Andres Agudelo-Toro**, *German Primate Center* ***Accurate neuroprosthetic control via neural manifold shaping*** Jonathan Michaels, Wei-An Sheng, Hansjörg Scherberger
15:45-17:15	Redwood	**POSTER & EXHIBITOR DEMONSTRATIONS SESSION 2**
17:30-18:30	Canopée	**EARLY CAREER AWARD TALKS** ***How To Make BCIs Usable and Actually Used of? A Few Insights from a Decade-Long Journey*** **Camille Jeunet**, *PhD, University Bordeaux & CNRS, France* ***Decoding Handwriting, Speech, and Multi-Limb Movement from People with Paralysis*** **Frank Willett**, *PhD, Stanford University, USA* *Sponsored by* Cyborg and Bionic Systems — A SCIENCE PARTNER JOURNAL
19:00-20:00	Argan Restaurant	**DINNER**
20:15-21:15	Multiple room	**MASTER CLASS SESSION 2** for details see page 17
	Cocobolo	**Master Class #15**
	Cherry	**Master Class #16**
	Ginko	**Master Class #17**
	Teck	**Master Class #18**
	Amarante	**Master Class #19**
	Imbuia	**Master Class #20**
	Flamboyant	**Master Class #21**
20:15-22:15	Terrace	**BONFIRE PARTY** *Sponsored by* OpenBCI

Friday, June 9

07:30-08:30	Argan Restaurant	**BREAKFAST**
08:30-09:30	Canopée	**PLENARY TALK #3:** ***Early Clinical Experience for Participants with Paralysis to Control Digital Devices with an Endovascular Motor Neuroprosthesis*** **Thomas Oxley**, *MD, PhD, Synchron, USA*
09:30-12:30	Multiple rooms	**WORKSHOP SESSION 3** for details see page 22
	Mahogany	**W15:** ***Understanding and Utilizing The Neural Basis of Speech: From Basic Science to Neuroprostheses***
	Cherry	**W16:** ***Examining Alternative Keyboards and Language Modeling Software for Message Generation by BCI End-users***
	Ginko	**W17:** ***Designing Naturalistic Sensory Feedback for Closed-Loop Brain-Computer Interfaces***
	Amarante	**W19:** ***Requirements for Future Brain Implants***
	Imbuia	**W20:** ***Building for Pediatric Populations: Real-World Lessons, Initiatives, and Imperatives to Empower Children to Use BCI Systems***
	Flamoyant	**W21:** ***Dimensions of Invasiveness, The User's Dilemma***
12:30-13:30	Argan Restaurant	**LUNCH/LUNCH WITH LEADERS**
13:30-15:30	Canopée	**RESEARCH ORAL PRESENTATION SESSION 2** **Angela Riccio**, *Fondazione Santa Lucia* ***Detecting Fluctuation of Responsiveness in Minimally Conscious State Patients*** Valentina Caracci, Quattrociocchi Ilaria, Valentina Galiotta, Pietro Aricò, Gianluca Di Flumeri, Jlenia Toppi, Mariagrazia D'Ippolito, Rita Formisano, Febo Cincotti, Donatella Mattia **Whitney Griggs**, *Caltech* ***A functional Ultrasound Brain-Machine Interface: Real-Time Decoding of Direction and Task State*** Sumner Norman, Thomas Deffieux, Florian Segura, Bruno Félix Osmanski, Geeling Chau, Vasileios Christopoulos, Charles Liu, Mickael Tanter, Mikhail Shapiro, Richard Andersen

Friday, June 9

13:30-15:30	Canopée	**Floriana Pichiorri**, *Fondazione Santa Lucia* ***Identifying The Best Candidates for a Rehabilitative BCI Targeting Upper Limb Motor Recovery*** Jlenia Toppi, Emma Colamarino, Elena Mongiardini, Andrea Ranieri, Matteo Lorusso, Federica Tamburella, Febo Cincotti, Donatella Mattia **Michael Wimmer**, *Know-Center* ***Toward hybrid BCI: EEG and Pupillometric Signatures of Error Perception in an Immersive Navigation Task in VR*** Nicole Weidinger, Eduardo Veas, Gernot Müller-Putz **Léa Pillette**, *University of Rennes* ***An Online Tool to Facilitate the Assessment of BCI Acceptability*** Elise Grevet, Claire Dussard, Franck Amadieu, David Gasq, Emeline Pierrieau, Jacques Py, Hakim Si-Mohammed, Nathalie George, Camille Jeunet **Evandro Cunha**, *Universidade Federal de Minas Gerais (UFMG)* ***Mapping Research on Brain-Computer Interfaces for Augmentative and Alternative Communication Across the Globe***
15:45-17:15	Redwood	**POSTER & EXHIBITOR DEMONSTRATIONS SESSION 3**
17:30-18:30	Canopée	***Lifetime Achievement Award Talk: Brain-Computer Interfaces Create Synthetic Heksors*** **Jonathan R. Wolpaw**, *M.D., National Center for Adaptive Neurotechnologies, USA* *Sponsored by* CHEN TIANQIAO & CHRISSY INSTITUTE
19:00-21:00	Terrace	**AL-FRESCO DINNER & CLOSING REMARKS** *Sponsored by* synchron
20:15-21:15	Canopée	**TRIVIA NIGHT**

Satellite Events

SE1: *Neurotechnologies for Mass Populations*

Over the past several decades, neuroscience has provided thousands of demonstrations that specific brain signal recordings can provide meaningful information about a person's brain or mind. However, to date, with very few exceptions, this research has not resulted in solutions that can improve brain- or mind-related function of large numbers of people. After an initial and highly successful workshop in Shanghai in September 2022, we are now proposing a Satellite Event that is dedicated specifically to the question of how to bring neuroscientific achievements to mass populations. In this series, world-reknown speakers from academia and industry discuss: 1) neurotechnologies and their historical context, 2) opportunities of neurotechnologies for mass populations, 3) scientific, technical, financial, and regulatory challenges, and 4) the design, implementation, and optimization of neurotechnologies that can successfully address the needs of mass populations. We expect that this event will contribute to the definition of the current state and future of an important new class of technologies that will have a major impact on people's lives in the 21st century.

Presented by:

Gerwin Schalk, *Chen Frontier Lab for Applied Neurotechnology, China*

Olga Dragoy, *National Research University, Russia*

Andrew Jackson, *Newcastle University, Newcastle, United Kingdom*

Ramses Alcaide, *Neurable, USA*

Peng "Phoenix" Lei, *NeuroXess, China*

Conor Russomanno, *OpenBCI, USA*

SE2: *BCI2000: Open-Source Software for Real-Time Biosignal Acquisition, Processing, and Feedback*

The focus of this workshop will be training individuals to use BCI2000 and introducing new features to existing users. BCI2000 is an open-source, general-purpose software for real-time biosignal acquisition, processing, and feedback. BCI2000 gives users the ability to develop tightly controlled experiments and facilitates collaboration through its consistent data structure and thorough documentation. BCI2000 has been requested by over 4000 users worldwide and cited in hundreds of peer-reviewed papers.

Presented by:

James Swift, *Washington University School of Medicine, USA*

Peter Brunner, *Washington University School of Medicine, USA*

SE3: *Future of Brain Computer Interface Technology – How Ultra-High Density EEG Boosts BCI Applications and Gaming Opportunities*

This workshop will present novel techniques of Brain-Computer Interfaces and allow spectators to try out several applications in a Hands-On Session Ultra High-Density electrodes (up to 1048 channels) can open new opportunities in BCI applications. The detection of individual finger movements, as well as complex EMG detection on a stump, increases the degree of freedom to control external devices or interact in immersive game environments. Hence, we will talk about how Gaming can reach new users and how game developers get access to new plug and play BCI solutions without the need to program complicated real-time processing.

Presented by:

Christoph Kapeller, *g.tec medical engineering, Austria*

Francisco Fernandes, *g.tec medical engineering, Austria*

SE4: *Job offers and career opportunities workshops*

Careers within the brain-computer interface (BCI) community can span a variety of organizations including academia, industry, or government. However, how to successfully navigate careers across different organizations is an important topic that is not frequently discussed. In this workshop, presenters will be from across career sectors, such as industry, academia, or government, and will share an introductory talk presenting current open positions and desired candidates. The panel will then be immediately followed by breakout sessions in which trainees may then independently follow up with the presenters for informal or informational interviews, or to complete and submit applications. This workshop provides a direct opportunity for trainees to learn about various career paths in BCI and to find a career in BCI, even potentially leaving the meeting with a job. This workshop will satisfy both the interests of trainees and participating organizations. The need was identified through the Postdoc and Student Committee's BCI Thursday career panels, in which ongoing efforts have focused on trainees learning about the many career paths in BCI, however, for the BCI meeting, we wanted to have a more active approach by bringing these various career paths to fruition for trainees.

Funding and Investment Panel

The panel will start with brief introductions by each funding officer with the top funding priorities for their agencies, the answers to pre-submitted questions and/or a few "I bet you didn't know" facts about their agency.

Enrique Claverol

Sahana Kukke, *National institute of Neurological Disorders and Stroke*

Isabella Tamagnini

Master Classes

Each masterclass will have a 'master', i.e. a senior researcher, and one or two students depending on the session. Anyone else is free to attend and contribute but only 2 students get to present their work. Each student presents his/her research (10-15 minutes), then the master provides wise and constructive comments and discussion is encouraged with the audience. The masterclass is informal and is intended to give students access to senior expertise and get good tips for their research.

Tuesday, June 6

SESSION 1 - 17:00-17:45

Richard Csaky, *University of Oxford*

Inner Speech Decoding from EEG and MEG

Richard Csaky, Mats W. J. van Es, Oiwi Parker Jones, Mark Woolrich

Matthias Dold, *Radboud University Nijmegen*

Platform for Closed-Loop Deep Brain Stimulation Research: DAREPLANE

Matthias Dold, Joana Pereira, Bastian Sajonz, Volker A Coenen, Mark L Janssen, Michael W Tangermann

Florencia Garro, *Italian Institute of Technology – University of Genoa*

Effects of Robotic-Assistance in ERP Modulation for Upper-Limb Exoskeleton Control

Florencia Garro, Elena Fenoglio, Inna Forsiuk, Lorenzo De Michieli, Stefano Buccelli, Michela Chiappalone, Marianna Semprini

Tan Gemicioglu, *Georgia Institute of Technology*

Transitional Gestures for Enhancing ITR and Accuracy in Movement-based BCIs.

Tan Gemicioglu, Yuhui Zhao, Melody Jackson, Thad Starner

Kelly Kadlec, *Caltech*

Distinct Patterns of Whole-body Representation in Human Motor Cortex and Posterior Parietal Cortex

Kelly M Kadlec, Tyson Aflalo, Jorge Gamez, Charles Guan, Emily Rosario, Nader Pouratian, Richard A Andersen

Christoph Kapeller, *g.tec medical engineering*

Increased Spatial Resolution Reveals Separated EEG Activation of Individual Finger Movements

Christoph Kapeller, Leonhard Schreiner, Sebastian Sieghartsleitner, Christoph Guger

Dion Kelly, *University of Calgary / Hotchkiss Brain Institute*

The Effect of Gamified Calibration Environments on P300 and Mi Bci Performance in Children

Dion M Kelly, Brian Irvine, Eli Kinney-Lang, Daniel Comadurán Márquez, Adam Kirton

Araz Minhas, *University of Calgary*

Does my Child Know I'm Here? EEG Signatures of Parental Comfort for Disorders of Consciousness in Critically Ill Children

Araz Minhas, Adam Kirton

Mousa Mustafa, *TU Berlin*

Decoding Invasive Brain Signals Using Deep Learning

Mousa S Mustafa, Timon Merk, Richard Köhler, Meera Chikermane, Jonathan Vanhoecke, Katharina Faust, Gerd-Helge Schneider, Andrea A Kühn, Benjamin Blankertz, Wolf-Julian Neumann

Sotirios Papadopoulos, *University of Lyon*

What is the Exact Relationship Between Beta Band Activity and Hand Motor Imagery?

Sotirios Papadopoulos, Maciej j Szul, Marco Congedo, James J Bonaiuto, Jérémie Mattout

Juliana Gonzalez Astudillo, *Inria*

Network Features for Motor Imagery-Based Brain-Computer Interfaces

Juliana Gonzalez Astudillo, Fabrizio De Vico Fallani

Ceci Verbaarschot, *University of Pittsburgh*

The Effect of Artificially Created Sensory Feedback on Motor Cortex Activity During Task Performance

Ceci Verbaarschot, Albert Monscheuer, Brian Dekleva, Jennifer L Collinger, Robert A Gaunt

Angela Vujic, *MIT*

Joie: An Affective Brain-Computer Interface (BCI) for Learning Mental Strategies for Positive Affect

Angela Vujic, Shreyas Nisal, Ashley Martin, Pattie Maes

Wednesday, June 7

SESSION 2 - 20:15-21:15

Yahia Ali, *Emory University and Georgia Tech*

BRAND: A Platform for Real-Time Deep Network Inference in Closed-Loop BCIs

Yahia H Ali, Kevin Bodkin, Mattia Rigotti-Thompson, Kushant Patel, Bareesh Bhaduri, Samuel R Nason-Tomaszewski, Domenick M Mifsud, Xianda Hou, Claire Nicolas, Shane Allcroft, Leigh R Hochberg, Nicholas Au Yong, Sergey D Stavisky, Lee E Miller, David M Brandman, Chethan Pandarinath

Julia Berezutskaya, *Brain Center, University Medical Center Utrecht*

Optimizing Feature Selection for Word Decoding With High-Density ECoG

Julia Berezutskaya

Yiyuan Han, *University of Essex*

Offline Prediction of Prolonged Acute Pain by Means of Convolutional Neural Network Model Applied to Electroencephalographic Oscillatory Connectivity

Yiyuan Han, Elia Valentini, Sebastian Halder

Marcel Hinss, *ISAE-SUPAERO / ENAC*

Labeling Mental Fatigue for Passive BCI Applications: Accuracy vs Applicability Tradeoff

Marcel F Hinss, Emilie S Jahanpour, Anke M Brock, Raphaëlle N Roy

Kriti Kacker, *Carnegie Mellon University*

Spectral Features of EEG Signals Recorded from a Stentrode in Human Motor Cortex

Kriti Kacker, Nikole Chetty, James Bennet, Peter Yoo, Abbey Sawyer, Ashley Dalrymple, Dev Sarma, Dailyn Despradel, Noam Harel, David Lacomis, Shahram Majidi, Raul Nogueira, Katharine (Katya) Hill, Jennifer Collinger, Adam Fry, Nicholas Opie, Thomas Oxley, David Putrino, Douglas Weber

Satyam Kumar, *The university of Texas at Austin*

Transfer Learning Promotes Acquisition of Individual BCI Skills

Satyam Kumar, Hussein Alawieh, Frigyes S Racz, Rawan Fakhreddine, José R Millán

Maria Pfeiffer, *University of Würzburg*

Riemannian vs. Linear P300 Classification for a Tactile Brain-Computer-Interface in an End-User Single-Case Study

Maria Pfeiffer, Matthias Eidel, Wolfgang Tröger, Thomas Giesler, Andrea Kübler

Ronja Ronnback, *Tilburg University*

How Do Ethical Concerns Differ in Active and Passive Brain-Computer Interfaces?

Ronja Ronnback, Fenna Blom, Maryam Alimardani

Isabelle Rosenthal, *California Institute of Technology*

Biological Relevance of Visual Stimuli Modulates the Temporal Binding Window Between ICMS and vision.

Isabelle A Rosenthal, Luke Bashford, David Bjånes, Kelsie Pejsa, Brian Lee, Charles Liu, Richard A Andersen

Mushfika Sultana, *University of Essex*

Assessing the Impact of Transcranial Direct Current Stimulation (tDCS) on the Enhancement of Race Driving Skills.

Mushfika Sultana, Lucian Gheorghe, Serafeim Perdikis

Daniel Polyakov, *Ben-Gurion University*

Recruiting Neural Field Theory for Motor Imagery Data Augmentation

Daniel Polyakov, Oren Shriki

Venkata S Aditya Tarigoppula, *Synchron*

Early Safety Data for Retrieval of a Stent-Based Endovascular Neural Recording Array

Venkata S Aditya Tarigoppula, Gil S Rind, Stephen M Ronayne, Andrew Stent, Calvin D Eiber, Thomas J Oxley, Nicholas L Opie

Joanna Keough, *University of Calgary*

Mechanisms and Impacts of Brain-Computer Interface Fatigue in Children

Joanna R Keough, Brian Irvine, James Wrightson, Daniel Comaduran Marquez, Adam Kirton, Eli Kinney-Lang

Maxime Verwoert, *School for Mental Health and Neuroscience, Maastricht University*

Evaluating Implant Locations for a Minimally Invasive Speech BCI

Maxime Verwoert, Maarten C Ottenhoff, Joaquín Amigó-Vega, Sophocles Goulis, Louis Wagner, Pieter L Kubben, Christian Herff

Thursday, June 8

SESSION 3 - 20:15-21:15

Nibras Abo Alzahab, *Università Politecnica delle Marche*

Effect of Auditory Stimuli on Electroencephalography-Based Authentication

Nibras Abo Alzahab, Angelo Di Iorio, Marco Baldi, Lorenso Scalise

Valerie Marissens Cueva, *Université de Lorraine*

Contrastive Self-Supervised Learning for Motor Imagery: Impact of the Embedding Size

Valerie Marissens Cueva, Laurent Bougrain

Sara Ahmadi, *Radboud university, Donders Center for Cognition*

A Model-based Dynamic Stopping Method for c-VEP BCI

Sara Ahmadi, Peter Desain

Naomi du Bois, *Ulster University*

Detecting Threat Detection

Naomi du Bois, Leah Hudson, José Sanchez-Bornot, Niall McShane, Damien Coyle

Marie Øverby, *Norwegian University of Science and Technology*

EEG Channel Selection Based on Feature Importance for Epileptic Seizure Classification.

Marie Øverby, Luis A Moctezuma, Marta Molinas

Simon Geukes, *UMC Utrecht Brain Center*

Ultra-High Density Electrocorticography Recordings of the Human Sensorimotor Cortex

Simon Geukes, Simon H Geukes, Mariana P Branco, Giovanni Piantoni, Erik J Aarnoutse, Nick F Ramsey

Jose Gonzalez Espana, *University of Houston*

NeuroExo: A Low-Cost Non-Invasive Brain Computer Interface for Upper-Limb Stroke Neurorehabilitation at Home

Jose Gonzalez Espana, Alex Craik, Ayman Alamir, Jeff Feng, Jose Luis Contreras-Vidal

Tomko Settgast, *University of Wuerzburg*

The Detection of Windows of Consciousness in Locked-in Patients

Tomko Settgast, Andrea Kübler, Federico Zilio

Milena Korostenskaja, *The Institute of Neuroapproaches*

A Study on Detection of Frustration Threshold Using EEG-Based Brain-Machine Interface

Milena Korostenskaja, Svetlana Blashchuk

Horacio Londoño Ramírez, *KU Leuven, Imec, Nerf*

Actively Multiplexed µECoG Array Based on Thin-Film Electronics for High-Resolution Brain Mapping

Horacio Londoño Ramírez, Xiaohua Huang, Jordi Cools, Anna Chrzanowska, Paoline Coulson, Clément Brunner, Marco Ballini, Nick Van Helleputte, Carolina Mora Lopez, Jan Genoe, Sebastian Haesler

Alexander McClanahan, *University of Arkansas for Medical Sciences*

Decoding Visual Scenes from Visual Cortex Spikes Using Deep Learning

Alexander McClanahan, Matthew Moench, Brian Kim

Valeria Spagnolo, *UNL-CONICET*

Co-Adaptive BCI Based on Supervised Domain Adaptation: Results in Motor Imagery Simulated Data.

Valeria Spagnolo, Catalina M Galvan, Nicolás Nieto, Diego H Milone, Ruben Spies, Victoria Peterson

Michael Wimmer, *Know Centre*

Toward Hybrid BCI: EEG and Pupillometric Signatures of Error Perception in an Immersive Navigation Task in VR

Michael Wimmer, Nicole Weidinger, Eduardo Veas, Gernot R Müller-Putz

Farzaneh Taleb, *Robotics, Perception and Learning Division, EECS, KTH Royal Institute of Technology, Stockholm, Sweden*

Robust Representation Learning from Corrupted EEG with Contrastive Learning

Farzaneh Taleb, Miguel Vasco, Nona Rajabi, Danica Kragic

Workshops

Wednesday, June 7

WORKSHOP SESSION 1

W1: *Non-Invasive Motor Control*

Donatella Mattia, *Fondazione Santa Lucia*
Gernot Müller-Putz, *Graz University of Technology*
Joana Pereira, *University Medical Center Freiburg*
Hannah Pulferer, *Graz University of Technology*
Andreea Sburlea, *University of Groningen*
Nitikorn Srisrisawang, *Graz University of Technology*

With this workshop we aim to address state-of-the-art approaches in non-invasive motor control and discuss future perspectives. We will discuss novel approaches for natural motor control. Here we also plan to present findings and learnings of hybrid BCIs in this context. Further, we plan to present our findings in leveraging the low-frequency amplitude neural information for natural control. We will then highlight findings about error processing during continuous motor control and discuss whether features from source localization can improve motor decoding. Moreover, we will touch upon the relevance of BCIs in post-stroke rehabilitation in clinical settings. All speakers will give a stimulating statement and we will discuss presented aspects with the audience.

W2: *Multimodal Brain-Computer Interfacing*

Chuck Anderson, *Colorado State University*
Walter Besio, *University of Rhode Island*
Emma Colamarino, *Sapienza University of Rome*
Tomasz Rutkowski, *RIKEN*
Yalda Shahriari, *University of Rhode Island*

To date there are still a lot of uncertainties regarding noninvasive BCI systems especially those relying on electroencephalography (EEG)–the most common type of noninvasive brain signal to control and monitor BCIs. There have been reports of improved understanding when combining EEG with other neuroimaging modalities, including functional near-infrared spectroscopy (fNIRS) and the integration of peripheral nervous system signals. To this matter, despite great advances in the field, there are a lot of challenges, including technical issues when combining modalities together, possible artifacts that contaminate the signals of interest, signal processing and data analysis approaches that need to be addressed. The aim of this workshop is to improve understanding of multimodal techniques in the context of BCI applications. The workshop covers topics ranging from basics of fNIRS, electromyography (EMG), and methods to improve signal quality including concentric ring electrodes. Multimodal BCIs including peripheral signals such as those derived from electromyography (EMG) as control features have mostly been developed to improve classification performance (e.g. assistive BCI). We will discuss EEG-EMG approaches designed to train both brain and peripheral activity in a top-down framework, in which volition, that is brain control over muscular activation, is reinforced together with correct muscular activation patterns.

W3: *BCI State-of-the-Art: Demonstrations of BCIs Prototypes*

Jose L. Contreras-Vidal, *University of Houston*
Francisco Fernandes, *g.tec medical engineering*
Gerard Francisco, *The University of Texas Health Science Center at Houston*
Katya J. Hill, *University of Pittsburgh*
Jane E. Huggins, *University of Michigan*
Nataliya Kosmyna, *Massachusetts Institute of Technology*
Theresa Vaughan, *National Center for Adaptive Neurotechnologies*

BCIs are proliferating and becoming increasingly available. Many laboratories have developed their own intriguing variants with unique features and usability improvements. Yet, BCIs are not widely available and most of these prototypes are only available by visiting each other's labs, so usually only one BCI can be seen at a time. This workshop will provide an opportunity for the organizers and attendees to show off their own BCI systems, see the features that we have only read about in each other's papers, and discuss the advantages and disadvantages of the different innovations. After the demonstrations, we will discuss clinical usability challenges for independent home use of BCIs, specifications for BCIs for specific usage scenarios, and brainstorm about what features from the demonstrations or inspired by the demonstrations would be most useful. The organizers invite anyone with a BCI prototype to contact them in advance and join in the demonstration session.

W4: *Building Consensus on Clinical Outcome Assessments (COAs) for BCI Devices*

Heather Dean, *US Food and Drug Administration*
Melanie Fried-Oken, *Oregon Health & Science University*
Leigh Hochberg, *Brown University*
David McMullen, *US Food and Drug Administration*
Jacek Eisler, *TÜV SÜD*

This workshop is intended to give participants an overview of how the US Food & Drug Administration (FDA) can help the BCI community develop safe and effective devices for patients. Regulators oversee clinical trials from first-in-human studies to pivotal clinical trials for implanted devices and make regulatory decisions on what testing and oversight might be required for marketed devices. They are in a unique position to understand BCI devices and the clinical outcomes and study designs that provide data on safety and effectiveness. Join regulators, industry, and clinical research stakeholders for presentations on potential approaches to evaluate device safety and effectiveness for motor and communication BCIs. The panel discussion will focus on how regulators and the BCI community might best work together to ensure that studies are most likely to result in data useful in demonstrating safety and effectiveness, including reaching consensus on clinical outcome assessments (COAs) that represent clinically meaningful benefits that can support regulatory and payor requirements.

W5: *Offline and Online Tools for Real-World BCI Applications*

Sylvain Chevallier, *Université Paris-Saclay*
Pierre Clisson
Marie-Constance Corsi, *Inria*
Arthur Desbois, *Inria*
Pedro L. C. Rodrigues, *Inria*

The ecosystem of open-source tools for brain signal analysis has greatly matured in recent years and has been essential in many instances of modern research. In this workshop, we will show to which extent the BCI community can benefit from open science practices. We will notably present four tools for developing new experimental setups, doing feature selection for classification tasks, and favoring reproducibility and replicability. During the first part, participants will receive hands-on instructions on how to extract and

select features from EEG signals with HappyFeat and how to pre-process and classify them with pyRiemann. The second part will focus on online BCIs: attendees will learn the core concepts driving Timeflux, how to describe processing pipelines, how to create interfaces, and how to easily develop their own plugins. They will also discover how to synchronize EEG data and stimuli without any complicated or expensive setup. In the third and final part, participants will learn how to evaluate ERP classification methods via approaches that favor reproducibility and replicability with MOABB. Lastly, during a general discussion panel, attendees will discuss ways to use these tools for their own research and how to contribute to the development of these open-source tools.

W6: *Learning from Small Datasets*

Sylvain Chevallier, *Université Paris-Saclay*
Matthias Dold, *Radboud University*
Pierre Guetschel, *Radboud University*
Alexandre Gramfort, *Meta Reality Labs*
Moritz Grosse-Wentrup, *University of Vienna*
Reinmar Kobler, *Advanced Telecommunications Research Institute*
Joana Pereira, *University Medical Center Freiburg*
Theo Papadopoulo, *Inria*
Michael Tangermann
Jordy Thielen, *Radboud University*

Training up a decoding model based on as few possible training data points as possible is a desirable goal, as it can be pivotal for the usability of a BCI application with patients, for the acceptance by healthy users, or to realize fast adaptations during non-stationary recordings or for transferring between sessions. Our workshop addresses the latest proposed techniques to train classification or regression machine learning models with small datasets, embracing approaches from both, traditional machine learning approaches and deep learning approaches. In addition to talks and discussions, we will have a hands-on programming session in Python to benchmark different classification models.

W7: *Designing Speech BCIs that Facilitate User-Agency*

Zac Freudenburg, *UMC Utrecht*
Christian Herff, *Maastricht University*
David Moses, *University of California San Fransisco*
Maartje Radstaake, *Radboud University*
Erika Versalovic, *University of Washington*

As BCI technology moves closer to the point of widespread use, the attention being given to the ethical issues surrounding BCIs is steadily growing within and outside of the BCI research community. Due to the novelty of the possibilities that BCIs open up and the uncertainty of how far the technology can go, the conversation around their responsible use is just beginning and the list of possible topics of discussion is long. We agree with Maslen and Rainey [Maslen et. al 2020] that the use case of BCIs as assistive and augmented communication devices (AACs) deserves specific attention, as unique ethical issues arise from the inseparable relationship between what a user wants to say and how the user, assisted by the BCI, says it. In this workshop we aim to explore some of these unique issues and formulate recommendations for the research on and real-world implementation of speech BCIs. We will focus this workshop on the concept of user-agency, which we broadly define as the user's capacity to perform an intentional action. For users of speech-BCIs, this means their capacity to translate their intention to speak into the action of speaking. User-agency can be approached from three angles, namely: 1) agency as intentional action (i.e., the ability to translate an intention to an action), 2) sense of agency (i.e., having the experience that what is said was intentional and represents the user), 3) relational agency (i.e., the distribution of agency between a user, the technology, and caregivers).

Thursday, June 8

WORKSHOP SESSION 2

W8: *Preserving Privacy and Cybersecurity of BCI Applications*

Nibras Abo Alzahab, *Università Politecnica delle Marche*
Tonio Ball, *Albert-Ludwigs-Universität Freiburg*
Ricardo Chavarriaga, *EPFL*
Aldo Faisal, *Imperial College London*
Marina Kapitonova, *Albert-Ludwigs-Universität Freiburg*
Manousos Klados, *University of York*

Brain-Computer Interfaces (BCIs) have the potential of far-reaching impact in domains ranging from medical over industrial to artistic, gaming, and security. Today, BCI applications are typically still at early technology readiness levels, but because BCIs create novel, technical pathways of communication to the human brain, they have raised privacy and security concerns. As brain data contain personal information, adversaries may compromise the security of BCIs and hence, brain privacy. There are first publications demonstrating empirical proofs-of-principle that such privacy-directed attacks on BCIs may be possible. To mitigate such threats and the associated risks, both BCI-specific and generic countermeasures have been proposed in the literature, but many open questions remain. In particular, how privacy and security of BCI applications can be protected by design, i.e., already as an integral part of the early BCI design process, in a systematic manner, and allowing suitable depth of analysis for different contexts such as commercial BCI product development vs. academic research and lab prototypes, has only recently attracted increasing attention. In the present workshop we have assembled experts covering all relevant aspects of BCI privacy. The workshop is structured in four parts, starting by overview lectures on foundational aspects of BCI privacy and security. In Part 2, the more specialized but highly relevant topic of (EEG-)BCIs and their relation to biometrics will be addressed. In Part 3, a hands-on exercise in privacy threat modeling (Interactive hands-on application of LINDDUN privacy engineering methodology) to a selected BCI use-case will be conducted as collaborative work and discussed. This discussion will be complemented by an open, general panel discussion (Part 4). Together, these different components will provide in-depth and up-to-date both theoretical and practical knowledge on privacy-preserving concepts and techniques for BCI applications.

W9: *BCI Applications for Active Living: Discussion and Hands-on Activity*

Strahinja Dosen, *Aalborg University*
Camille Jeunet and **Margaux Izac**, *Université de Bordeaux*
Natalie Mrachacz-Kersting, *Albert-Ludwigs-Universität Freiburg*
Silvia Orlandi, *University of Bologna*
Luca Tonin, *University of Padua*

In the last years, brain-computer interfaces have shown their potential as an assistive and rehabilitation technology. This workshop aims at broadening the application field by investigating and discussing BCI driven solutions for active living with a particular angle on sport activities and robotic devices. Short talks will contextualize the topic with respect to the current state-of-the-art and will present the latest research and results in the field. Furthermore, a group discussion on specific needs for active living, on available technical solutions and on the urgency of standard infrastructure for BCI will be carried out. Finally, the workshop will close with a practical activity on the development and implementation of a closed-loop BCI based on ROS-Neuro. The workshop aims at providing a general overview of BCI applications for active living and at identifying the most urgent end-users' needs outside the lab. Furthermore, attendees will be aware of the urgency of a common research infrastructure, and they will be introduced to ROS-Neuro, an open-source, research and development framework for BCI applications.

W10: *Invasive Brain Computer Interface Technology? Open Loop and Closed loop Decoding Applications*

Peter Brunner, *Washington School of Medicine*
Nuri Ince First, *University of Houston*
Aysegul Gunduz, *University of Florida*
Christoph Kapeller, *g.tec medical engineering*
Kai Miller, *Mayo Clinic Rochester*

Invasive electroencephalographic (iEEG) signals, such as electrocorticography (ECoG) or stereo EEG, contain information with high spatial and temporal resolution, including very localized high-gamma activity. Hence, ECoG can be used for closed loop control of prosthetic limbs, avatars, or cursors, but can also be used in open loop decoding to identify the eloquent cortex of a patient in preparation for resective brain surgeries. The concept of open loop electrical brain stimulation for neuromodulation has been widely used in clinical applications such as functional brain mapping. Closed loop stimulation based on iEEG signals opens a variety of clinical applications, including treatment of movement and neuropsychiatric disorders. The workshop will show state-of-the art experiments of open and closed loop decoding and neuromodulation, and describes how the data acquisition, device synchronization, signal processing and experimental setup is done based on practical examples with a guidance through important processing and design steps in MATLAB/Simulink.

W11: *Technological Development and Implementation of BCIs for Home Use*

Brian Dekleva, *University of Pittsburgh*
Spencer Kellis, *Blackrock Neurotech*
Nick Ramsey, *UMC Utrecht*
John Simeral, *Brown University*

An important objective for BCI research is to advance promising assistive BCI technologies from the research lab to the home. Home use of a BCI requires hardware and software evolved beyond the prototype stage, which focuses on the research experience, to more refined systems focused on the user and caregiver experiences and the ability to operate these systems independently. This workshop will address trends and challenges in the technological development, implementation, and deployment of in-home BCIs. Relevant topics include calibration, user interface design, physical design, system robustness and reliability, and wireless operation. Workshop attendees will learn about requirements of a BCI system designed for home use and advances in the research community working toward these requirements. Participants will be able to view and/or interact with demo BCI components or systems that exhibit features designed for home use, then participate in a group discussion with the speaker panel to review best practices for in-home BCI use and how to identify and meet user expectations ("requirements"). With a focus on design and development for independent use of BCI systems in the home, this workshop complements other workshops focused on BCI user needs.

W12: *Transfer Learning Toward Plug-and-Play BCI*

David Friedenberg, *Battelle Memorial Institute*
Brianna M. Karpowicz, *Emory University*
Xuan Ma, *Northwestern University*
Emily Oby, *University of Pittsburgh*
Fabio Rizzoglio, *Northwestern University*

Repeated calibrations are often required to counteract the performance drop of BCI systems over time caused by neural recordings instabilities. The dynamics of these new decoders need to be learned from scratch, likely imposing additional time and cognitive burden on users. Furthermore, decoders need to be

calibrated for each user using data collected during specific tasks, a process that is not always feasible for a paralyzed human. Recent research have shown that motor intent can be inferred from the dynamics embedded in a low-dimensional manifold that can be discovered in M1 neural population activity. These dynamics tend to be stable over time and even share task-related similarities across individuals. Transfer learning techniques allow us to align the neural manifolds estimated from different data sources, thereby providing fixed BCI decoders that are stable over long periods of time and even across subjects. The alignment itself requires little data, raising the possibility of applying decoders requiring large, labeled datasets to humans, where data collection and time-consuming calibration is difficult or impossible. This workshop will present transfer-learning-based BCI decoder techniques, ranging from classical linear algebra to novel AI-based ones, and engage the audience in a discussion of their theoretical and clinical implications.

W13: *Challenges in BCI-based Neurofeedback Applications for Neurological Disorders*

Paolo Belardinelli, *University of Trento*
Marie-Constance Corsi, *Inria*
Tomas Ross, *University of Geneva*
Huiling Tan, *University of Oxford*
Michael Tangermann, *Radboud University*
Lin Yao, *Zhejiang University*

BCI-based neurofeedback (NFB) is a promising tool for counteracting neurological symptoms and informing neurorehabilitation strategies. Efforts have been made to improve BCI usability, by providing guidelines and predictors of performance. Yet, neurofeedback remains barely used in clinical settings and by patients in their daily life. In this workshop, we will tackle the current challenges in clinical BCI research by identifying and discussing the key methodological and psychobiological aspects to foster its efficacy. We will deal with conceptual biases in clinical protocol designs. The workshop will be split into two parts. In the first part, the foremost clinical applications of BCIs/NFBs will be presented with a focus on the key issues that need to be addressed (e.g.: instructions, number of sessions, lesion localization...). The second part will be dedicated to recommendations when designing and conducting BCI/NFB clinical protocols. Each block will be followed by a panel discussion formed by the speakers, and discussions will be guided by a selection of pre-arranged questions. We will propose to the participants to fill a document with their questions beforehand in order to structure the discussions in direct line with the challenges faced by the community.

W14: *Finding Consensus on BCI Standards: How to Proceed?*

Mathew Abrams, *International Neuroinformatics Coordinating Facility*
Luigi Bianchi, *Tor Vergata University*
Martijn de Neeling, *UMC Amsterdam*
Sahana N. Kukke, *NIH - National Institute of Neurological Disorders and Stroke*
Jiangbo Pu, *Chinese Academy of Medical Sciences*

Brain-Computer Interfaces research evolved significantly in the last decades, during which new applications, paradigms, and technologies were proposed or adopted. The intrinsic multidisciplinary nature of this research field has attracted researchers from different domains to contribute to its progress. This richness of expertise, however, can represent an obstacle if different objectives, methods, and terminology are used because it could be difficult, if not impossible, to compare systems and reuse freely available datasets and tools. Some details considered important by some stakeholders are negligible for others. This is confirmed by meta-analyses studies that have reported that many BCI publications lack the necessary information to compare systems and impede aggregating a larger amount of data to test more powerful methods or statistical analyses. This problem is arising in recent years, and several actions aimed at providing standards in the BCI field were started. All of them, however, are still in a work-in-progress stage, with limited or absent interaction among groups, a fact that could cause overlaps and the definitions of

different and incompatible standards on the same topic, thus generating confusion. Thus, we propose a Workshop where each of these groups that are working on the definition of BCI standards describes its vision, strategies, and objectives, shares ideas, and coordinates its activities with the others. Subsequently a document will be drafted describing the workings of the different standardization stakeholders and how different standards may align and contribute to the FAIR principles. A framework will be developed to easily interpret different standardisation initiatives, understand the similarities and differences between existing initiatives and identify gaps in standardization. Overlap with the previous roadmap on neurotechnologies for Brain-Machine-Interfacing and similar standardization documents will be avoided.

Friday, June 9

WORKSHOP SESSION 3

W15: *Understanding and Utilizing the Neural Basis of Speech: From Basic Science to Neuroprostheses*

Miguel Angrick, *JHU Cognitive Neurophysiology and BMI Lab*
Julia Berezutskaya, *UMC Utrecht*
Christian Herff, *Maastricht University*
David Moses, *University of California – San Francisco*
Maitreyee Wairagkar, *University of California - Davis*
Sarah Wandelt, *Caltech*
Frank Willett, *Stanford University*

Since the last BCI Society meeting in 2020, which had a well-attended workshop titled “From speech decoding to speech neuroprostheses”, there has continued to be accelerating progress in the basic neuroscience of speech and applied brain-computer interfaces for restoring lost speech. Novel research directions have matured, including continued expansion of studying speech with electrocorticography and new work using intracranial EEG and single-neuron resolution multielectrode arrays. These studies have contributed to our understanding of how speech is encoded across multiple brain areas, and we’ve witnessed speech decoding transfer from offline to early online demonstrations. This area has also benefited from more open sharing of datasets, which was a major action item take-way from the last workshop. This year’s workshop will provide an opportunity to hear about state-of-the-art recent work and discuss ongoing challenges with an eye to opportunities for collaboration and collective action towards the important humanitarian goal of restoring speech to patients. We anticipate having approximately 6 persons from different labs in this workshop (i.e., three more groups in addition to us three).

W16: *Examining Alternative Keyboards and Language Modeling Software for Message Generation by BCI End-users*

Chris Gibbons, *Smartbox*
Melanie Fried-Oken, *Oregon Health & Science University*
Betts Peters, *Oregon Health & Science University*
Keith Vertanen, *Michigan Technological University*
Will Wade, *Ace Centre*

As non-invasive brain-computer interface becomes a communication access method for individuals with severe speech and physical impairments, attention must be paid to the design of alternative keyboards, visual displays, and language modeling for message generation. Five alternative keyboards will be presented with various signal acquisition methods and language modeling features. Each presentation will include video of system trials with end-users and data about speed, accuracy, and user experience. The

alternative keyboards and signal acquisition techniques include: (1) RSVP Keyboard with EEG access, (2) RSVP Keyboard with Inquiry Preview for EEG and single switch access https://www.cambi.tech/, (3) Shuffle Speller with EEG and eye gaze access https://www.cambi.tech, (4) Nomon https://nomon.app/, (5) updated, open-source Dasher https://dasher.acecentre.net/about/, and (6) Grid 3 software for non-Roman alphabet users with various access methods https://thinksmartbox.com/product/grid-3/. Participants will discuss benefits, challenges, design criteria, and future development options for these alternative keyboards and access methods, based on the needs of end-users. Discussion will center around potential BCI user profiles submitted by participants, with the goal of designing new, and customizing available, message generation interfaces that address users' individual needs and preferences.

W17: *Designing Naturalistic Sensory Feedback for Closed-Loop Brain-Computer*

Jeremy Brown, *Johns Hopkins University*
Emily Graczyk, *Case Western Reserve University*
Bouke van Balen, *Maastricht University*
Antonio Lozano, *Netherlands Institute for Neuroscience*
Natalya Shelchkova, *University of Chicago*
Michael Tangerman, *Radboud University*
Cecile S. Verbaarschot, *University of Pittsburgh*

In this workshop, we will bring together experts in brain-computer interfaces (BCIs) with experts in philosophy of mind, neuroscience, and multi-sensory integration to discuss how to convey "natural" sensations through electrical stimulation of the brain. The last 5-8 years have seen considerable new interest in sensory BCIs, e.g.: tactile feedback during prosthetic control via intracortical microstimulation of the somatosensory cortex, visual cortex stimulation in people with blindness, or determining the optimal settings of a cochlear implant in infants who cannot yet verbalize their experiences. The more naturalistic the sensory feedback is, the less training and cognitive load is expected to be required to process it, enhancing the intuitiveness of using a BCI. Despite demonstrations and proof-of-principle experiments from multiple labs in humans, there is no consensus about how to use the term "natural", how to measure naturalness, or even whether naturalness is an important or necessary goal to achieve. During the workshop, participants will learn about the state-of-the-art research providing auditory, visual and tactile feedback via electrical brain stimulation during closed-loop BCI control, discuss and define what it means for a stimulus to be considered "natural", and design novel strategies to assess the quality and experience of artificially-evoked sensory feedback.

W19: *Requirements for Future Brain Implants*

Erik J Aarnoutse, *UMC Utrecht*
Riki Banerjee, *Synchron*
Tim Denison, *University of Oxford*

This workshop will feature presentations from leaders from academic BCI / neurotechnology research as well as leaders from companies developing and manufacturing neurotechnology. Added to this are technology institutes working on smart additions and improvements of implant technology. In academia much knowledge is gathered to envision a perfect implantable BCI. Companies strive to develop the best products within technological and economic constraints. Presenters will have backgrounds from fundamental neuroscience to electrical engineering to clinical trials. This combined knowledge will be the input of a discussion where (new) requirements are discussed and the (im)probabilities that these will develop into new products for research and therapy for patients. The outcome will hopefully be new developments in implant technology and an ever-closer collaboration between academia and industry.

W20: *Building for Pediatric Populations: Real-World Lessons, Initiatives, and Imperatives to Empower Children to Use BCI Systems*

Mariana Branco, *UMC Utrecht*
Beverly Collisson, *University of Calgary*
Dion Kelly, *University of Calgary*
Eli Kinney-Lang, *University of Calgary*
Adam Kirton, *University of Calgary*
Jason Leung, *Holland Bloorview Kids Rehabilitation Hospital*
Corinne Tuck, *Holland Bloorview Kids Rehabilitation Hospital*
Susannah Van Damme, *Holland Bloorview Kids Rehabilitation Hospital*
Mariska J. Vansteensel, *UMC Utrecht*

BCI systems are not made equal for all end-users. Early-life injury or disease can leave children with significant physical and communication impairments. These children could benefit from using BCI technology for rehabilitation, communication, mobility, or other activities of daily living. However, since BCI designs are typically based on adult brains and behavior, these children have no such recourse. This gap in technology presents an opportunity within the BCI community to design, develop and implement standards in pediatric BCI systems and unify the community building BCI for children. In this workshop, we will look to "provoke" attendees to uncover what is most needed to move pediatric BCI systems forward. The workshop will explore existing initiatives from leaders and key stakeholders with presentations from engineering, clinical, community, and innovation drivers of pediatric BCI research and implementation. Presentations will include provocative questions intended to spur small-group discussions around critical questions. Then we will move into a social networking break with opportunity for attendees to foster collaborations and discussion. We will conclude with an open-forum panel with all presenters. With input from participants, we will propose standards for design, development, and implementation of BCI for children creating a roadmap for the next generation of pediatric BCI development.

W21: *Dimensions of Invasiveness, The User's Dilemma*

Tonio Ball, *University Medical Center Freiburg*
Katya Hill, *University of Pittsburgh*
Masayuki Hirata, *Osaka University*
Jane E. Huggins, *University of Michigan*
Takuma Nakamura, *Osaka University*
Nick Ramsey, *UMC Utrecht*
Mariska J. Vansteensel, *UMC Utrecht*

As BCIs move into clinical use, urgency is developing around practical questions of integrating them into daily life. People with severe disability conditions face a serious dilemma between motivation to live, anxiety about losing all communication, and caregiver burden. The dilemma may appear very different based on differing cultural perspectives and different medical diagnoses producing disability. BCIs may eventually start to impact this dilemma. The extent to which that occurs will, however, depend on the design of the BCI (including whether sensors are placed inside the head or outside of the head), but also on other dimensions of invasiveness, such as the way in which a BCI affects the life of a user, the manner in which it intrudes in their physical living environment, or the burden it places on their caregivers for setup and equipment maintenance. This workshop focuses on the needs of BCI users and the factors affecting the user's dilemma. Panel discussions and a historical perspective on neuroprosthetic commercialization will promote consideration of multiple perspectives. Our goal will be to develop a strategy for user-centered design that satisfies each user's needs and sustainably provides them with BCIs.

Plenary Talks and Keynote Sessions

All Plenary Talks and Keynote Sessions will take place in the Canopée Auditorium.

PLENARY TALK #1

Andrea Kübler, *PhD, University of Würzburg, Institute of Psychology, Germany*

30 years of BCI research: People, Protocols, Publications, Pitfalls

Bio: Prof. Kübler, PhD, Biologist and Psychologist, is Associate Professor at the University of Würzburg, Institute of Psychology, and her major research topics within the field of BCI are psychological aspects, and neuroscientific basis of BCI control and studies with patients in the field. She is working on using neurofeedback for communication, rehabilitation, and therapy, i.e., for replacing and improving lost or impaired function. Besides being an expert in the clinical application of BCI she is a trainer of mindfulness-based stress reduction and mindfulness-based pain management. She is investigating different aspects of the mindfulness concept from basic questions on how to define mindfulness to mindfulness-based interventions in chronic disease, such as COPD, Fibromyalgia or Parkinson's disease. In 2022 she was ranked 37/100 best female scientists in Germany and 904/1000 worldwide.

PLENARY TALK #2

Edward Chang, *PhD, University of California, San Francisco, USA*

Speech Neuroprosthesis: Words and Beyond

Abstract: Recent scientific advances in our understanding of articulatory speech mechanisms have greatly accelerated BCI applications for restoring communication for people living with paralysis. In my talk, I will review new discoveries on the functional organization and representation of speech movements and planning in the pre- and post-central gyrus, as well as premotor areas. I will then discuss key speech neuroprosthesis outcomes from the ongoing BRAVO clinical trial, with improvements in accuracy, speed, and robustness. Finally, I will discuss opportunities to expand from speech neuroprosthesis to related communication applications.

Bio: Edward Chang is the Joan and Sanford Weill Chair and Jeanne Robertson Distinguished Professor of Neurological Surgery at the University of California, San Francisco. Dr. Chang's clinical expertise is surgical therapies for epilepsy, pain, and brain tumors. He specializes in advanced neurophysiologic brain mapping methods, including awake speech and motor mapping, to safely perform neurosurgical procedures in eloquent areas of the brain. His research focuses on the discovery of cortical mechanisms of high-order neurological function in humans. Dr. Chang's laboratory has demonstrated the detailed functional organization of the human speech cortex and has translated those discoveries towards the development of a speech neuroprosthetic device to restore communication for people living with paralysis. Dr. Chang is the 2015 Blavatnik National Laureate in Life Sciences and member of the National Academy of Medicine.

PLENARY TALK #3

Thomas Oxley, *MD, PhD, Synchron*

Early Clinical Experience for Participants with Paralysis to Control Digital Devices with an Endovascular Motor Neuroprosthesis

Abstract: A minimally invasive motor neuroprosthesis (MNP) BCI (StentrodeTM, Synchron, Brooklyn, NY) reaches the brain by vascular access, removing the need for craniotomy and potentially providing deeper brain access than electrodes placed on the brain surface or in brain parenchyma. Transmission of signals associated with attempted movement restores motor intent through digital motor outputs (DMOs). To date, Synchron has harnessed DMOs for digital applications to restore instrumental activities of daily living. The endovascular MNP was implanted in four patients with paralysis in an Australian first-in-human trial (NCT03834857). The participants had no unanticipated adverse device effects (UADEs) at 12-month follow-up. Two participants who remain in active sessions with field clinical engineers (FCEs), with current average length of implant of 29.5 (SD 4.0) months, have had no UADEs. Participants learned to use the MNP to independently operate computers for communicating, shopping, finance, leisure activities, browsing the internet, and controlling smart home apps. Participants reported feeling empowered by regaining more independence and sense of meaning in their lives, and caregivers reported they could deliver care more effectively.

Bio: Associate Professor Thomas Oxley MBBS BMedSc FRACP PhD is a vascular and interventional neurologist and world expert in brain computer interfaces. He is Associate Professor and Laboratory Head of the Vascular Bionics Laboratory, University of Melbourne, Australia, as well as Clinical Instructor, Attending in the Department of Neurosurgery, Mount Sinai Hospital. Dr Oxley has performed over 1600 endovascular neurosurgical procedures, including cerebral aneurysm coiling and clot retrievals in acute stroke. Dr Oxley has published over 100 internationally peer reviewed articles in journals including JAMA Neurology, Nature Biotechnology, Nature Biomedical Engineering, New England Journal of Medicine, and The Lancet. Dr Oxley is the founding CEO of Synchron, a brain data transfer company based in Brooklyn, NY and has raised over $145M in both private funding and grants. Synchron is developing the leading endovascular implantable brain computer interface, StentrodeTM, a system that aims to provide a treatment for debilitating medical illnesses and enable patients to feel empowered by reconnecting online in ways that can dramatically improve their lives. In 2022, Dr Oxley and Synchron commenced a clinical trial on the Stentrode motor neuroprosthesis that is paving the way towards first FDA approval for marketing of implantable brain computer interfaces.

EARLY CAREER AWARD TALKS

Camille Jeunet, *PhD, University Bordeaux & CNRS, France*

How to make BCIs usable and actually used of? A few insights from a decade-long journey

Abstract: Exactly 10 years ago, I applied for a PhD grant that enabled me to start my BCI journey in Fabien Lotte's team in Bordeaux, working on the understanding and improvement of user training to improve control performances of active BCIs by healthy volunteers. I am back in Bordeaux, in a new lab, with a main focus on using EEG-based BCIs and neurofeedback training to improve or restore cognitive and motor abilities, both in patients (to enhance motor recovery in stroke patients or reduce motor symptoms in patients with Parkinson's disease), and in athletes (to optimize performance). Meanwhile, a lot has happened... Including 7 labs in 3 different countries, dozens of ideas of research projects (the soundness of which being, in hindsight, at least as variable as BCI performances), funding applications and rejected papers, and countless amazing students and colleagues to whom I was a supervisee and progressively became a fellow supervisor; not forgetting, of course, 1 husband, 1 son and the incremental appearance of white hair. With this talk, I would like to look back on some of the main

milestones of my (early) career. I will present some results we obtained recently, and also mention how a number of people and some seized opportunities enabled me to refine my research interests, create my own path and identity, learn and grow as a woman and as a researcher. Finally, I will try to provide some useful advice to young researchers based on my experience; fundamentally, to be curious, challenge ourselves, take advantage of opportunities, be happy and conscious of how lucky we are to have this job.

Bio: Camille Jeunet received her PhD in cognitive sciences in 2016 at the University of Bordeaux, France. After a post-doctoral fellowship in Inria (Rennes, France) and EPFL (Geneva, Switzerland), she was recruited as a tenured CNRS Research Scientist. She first joined the CLLE lab in Toulouse in 2018. In 2021, she has rejoined the institute for cognitive and integrative neurosciences (INCIA) in Bordeaux, where she leads interdisciplinary research on the use of EEG-BCIs to improve or restore cognitive and motor abilities, both for clinical (stroke patients and patients with Parkinson disease) and non-clinical (athletes) populations. She is particularly interested in studying the learning mechanisms underlying neurofeedback training as well as the acceptability of neurofeedback procedures and BCI technologies. Camille Jeunet has received 3 PhD awards, the European Label as well as 3 national fundings from the French research agency for her research. Since 2017, she is a board member of the French BCI association, CORTICO.

Frank Willett, *PhD, Stanford University, USA*

Decoding handwriting, speech, and multi-limb movement from people with paralysis

Abstract: To date, intracortical BCI research has largely focused on restoring gross movement of a single effector, such as reaching and grasping or point-and-click typing with a computer cursor. Here, I will discuss recent attempts we've made to expand the scope of intracortical BCIs, from decoding all four limbs of the body, to decoding finer behaviors such as handwriting and speech. For all tested movements, we found a rich and detailed neural population code in motor cortex that was still present years after paralysis, enabling high-performance decoding that set new records for BCI communication. Finally, I'll put these projects into a personal context: what led me to pursue these ideas, where I think the field can go next, and my career path.

Bio: Frank Willett is a Research Scientist working in the Neural Prosthetics Translational Laboratory at Stanford University. His work is aimed broadly at brain-computer interfaces and understanding how the brain represents and controls movement. Recently, Frank has developed a brain-computer interface that can decode attempted handwriting movements from neural activity in motor cortex. Frank has also worked on understanding how different body parts are represented in motor cortex at single neuron resolution. This work led to a surprising finding: what was previously thought to be "arm/hand" area of motor cortex contains an interlinked representation of the entire body. Prior to working at Stanford University, Frank earned his PhD in the Department of Biomedical Engineering at Case Western Reserve University.

LIFETIME ACHIEVEMENT AWARD TALK

Jonathan R. Wolpaw, *M.D. National Center for Adaptive Neurotechnologies, USA*

Brain-Computer Interfaces Create Synthetic Heksors

Abstract: BCIs enable the CNS to acquire skills produced by brain signals. BCI development can benefit from recent advances in understanding natural muscle-based skills. Each muscle-based skill is produced and maintained by a unique CNS entity, which we call a heksor. A heksor is a widely distributed network of neurons and synapses that changes itself as needed to ensure that its skill remains satisfactory. Heksors overlap with each other, they share neurons and synapses. Through their concurrent changes, heksors negotiate the properties of the neurons and synapses they all use, they keep the CNS in a state of negotiated equilibrium that enables each heksor to maintain its skill. These concepts are supported by animal and human studies, explain otherwise inexplicable

results, underlie promising new therapeutic strategies, and offer new answers to important neuroscientific questions (e.g., generation and function of spontaneous neuronal activity, etiology of muscle synergies, and control of homeostatic plasticity). These new concepts can also guide BCI development. A BCI creates what is best described as a synthetic heksor. A synthetic heksor is a network of neurons and synapses combined with adaptive software, network and software adapt to each other so as to acquire and maintain a skill produced by brain signals. Present interest focuses on three kinds of synthetic heksors. First, a BCI can create a therapeutic synthetic heksor that targets beneficial plasticity to a crucial site in a natural heksor that has been damaged by a stroke or other lesion (e.g., the locomotion heksor), this can trigger wider plasticity that helps restore the muscle-based skill. BCIs of this kind are entering clinical use. Second, a BCI can create a synthetic heksor that replaces a communication or control skill lost to injury or disease. BCIs of this kind have not yet attained the speed, accuracy, and – most important – the reliability of muscle-based skills. Their future depends on learning how to integrate synthetic heksors into an expanded negotiated equilibrium that enables both natural and synthetic heksors to maintain their skills. Finally, a laboratory BCI can create synthetic heksors that illuminate principles and mechanisms underlying negotiations among natural heksors in the healthy CNS.

Bio: Dr. Wolpaw is a neurologist who has devoted over 50 years to basic and clinical research. His group developed operant conditioning of spinal reflexes as a model for defining the plasticity underlying learning and went on to show that this conditioning can improve walking in animals and people with spinal cord injuries. This work introduced the new therapeutic method of targeted neuroplasticity. His group has also guided development of brain-computer interface (BCI) principles and methods and demonstrated the capabilities of noninvasive BCIs, they are now exploring BCI use for neurorehabilitation. Most recently, in response to the growing appreciation of the lifelong plasticity of the CNS, he has put forward a new paradigm for understanding how useful behaviors are acquired and maintained through life, a paradigm based on the new concepts of heksors and the negotiated equilibrium of CNS properties that heksors create. His group has been supported throughout by NIH, the Veterans Administration, and private foundations, the work has been recognized by national and international awards.

BCI USERS FORUM

The BCI Users' Forum seeks to include the experience and insights of actual and potential BCI Users to the BCI meeting. This year, we present observations from users and their research partners about applications that use electrical signals recorded from the scalp, the surface of the cortex, and from within the cortex, for applications that can replace, restore, and improve outcomes after injury and disease. We also explore the notion of a virtual Users' Forum, a venue that could encourage ongoing dialogue among all BCI stakeholders. to the BCI meeting.

Presented by:

François Cabestaing, *Université de Lille*

Damien Perrier

Phillip Ziebell, *University of Würzburg*

DIVERSITY IN BCI WORKSHOP

Louise Wright, *EDI Advisor (FMS), Newcastle University, UK*

What is Equality, Diversity, and Inclusion... and why me?

Abstract: The session will define terminology to increase understanding and awareness of Equality, Diversity, Inclusion and Equity concepts. The intention is to relate EDI practices into everyday experiences and increase awareness of how to embed these practices by empowering participants with strategies for their own environment. We will explore different views from our own and gain tools to help everyone achieve better EDI practices in their research environment.

Bio: Louise Wright is the Equality, Diversity, and Inclusion Advisor in the Faculty of Medical Sciences at Newcastle University in the UK. Louise has extensive experience working in the sector and across Higher Education, qualified to CIPD (Assoc.) and a B.A (Hons) in Business Management. Louise is a passionate strategic change facilitator working in the EDI sector, with a strong motivation to enhance the lived experience of all. A key driver for her is to hear the voice of those experiencing inequalities so she can be a better ally to marginalised groups and continue to work towards true equality. Louise has designed and implemented an intersectional Equality Project in her Faculty that will measure cultural change until 2029.

NEUROETHICS SESSION

Managing ethical concerns of maturing BCIs

Along with the maturing of the BCI research field, and the growing potential of BCIs in improving the lives of the healthy and diseased, there has been an increased recognition of ethical concerns. Topics such informed consent, privacy, agency, responsibility, equality, and personhood are making their way to the discussion tables of many BCI research teams and are increasingly considered during the design and execution of BCI research. In addition, BCI researchers are joining forces with ethicists and clinicians to develop recommendations on how to address these concerns in the future.

At the same time, some BCIs are starting to 'leave the house', moving away from academic and clinical settings, and are underway to become commercial products. The transition of BCIs from academic research tools to commercial products may affect the way in which the ethical concerns around them are addressed, and perhaps even amplify existing concerns or generate new ones. This raises the question what is necessary to make sure that existing and upcoming ethical issues are addressed appropriately when BCIs are commercialized. Do we need new rules and regulations, or can we rely on self-regulation? Who should be involved in developing any new regulations and oversee their application? And how to avoid that these are too strict, prohibiting progress, or too lenient, putting users at risk?

In this panel discussion, regulatory, academic, and industrial BCI stakeholders will explore the different perspectives on these questions.

Moderator: **Pim Haselager**, *Donders, Radbound Universiteit*

Panelists:

Dave Marver, *ONWARD*

Elizabeth Waite, *Blackrock*

Heather Dean, *FDA*

Nick Ramsey, *UMC Utrecht*

2023 Trainee Awards

The following are the recipients of the 2023 BCI Meeting Student Award. The award is sponsored by the National Institutes of Health NIDCD, NINDS and the National Science Foundation.

Yahia Ali, *Georgia Tech & Emory University*

Julia Berezutskaya, *University Medical Center Utrecht*

Mariana Branco, *University Medical Center Utrecht*

Stephanie Cernera, *University of California - San Francisco*

Xinlin Chen, *Duke University*

Nikole Chetty, *Carnegie Mellon University*

Maria de Araújo Vitória, *Maastricht University*

Stefan Ehrlich, *Harvard Medical School*

Matthias Eidel, *University of Würzburg*

Dylan Gaines, *Michigan Technological University*

Tan Gemicioglu, *Georgia Institute of Technology*

Julieth Gomez, *University of Florida*

Jose Gonzalez Espana, *University of Houston*

Elise Grevet, *Université de Bordeaux*

Whitney Griggs, *Caltech*

Jake Gusman, *Brown University*

Yiyuan Han, *University of Essex*

Taylor Hobbs, *University of Pittsburgh*

Alicia Howell-Munson, *Worcester Polytechnic Institute*

Brian Irvine, *University of Calgary*

Nazmun Nahar Khan, *Kansas State University*

Reinmar Kobler, *Advanced Telecommunications Research Institute International*

Deland Liu, *University of Texas at Austin*

Xuan Ma, *Northwestern University*

Alexander McClanahan, *University of Arkansas for Medical Sciences*

Benyamin Meschede-Krasa, *Stanford University*

Elena Mongiardini, *Sapienza University of Rome*

Natalya Shelchkova, *University of Chicago*

Prashanth Prakash, *Northwestern University*

Kara Presbrey, *University of California - San Francisco*

Ilaria Quattrocciocchi, *Sapienza University of Rome*

Alexander Remsik, *University of Wisconsin - Madison*

David Sabatini, *University of Chicago*

Hunter Schone, *National Institutes of Health*

Sarah Seko, *University of California - San Francisco*

Venkata S Aditya Tarigoppula, *Synchron*

Ceci Verbaarschot, *University of Pittsburgh*

Angela Vujic, *MIT*

Maitreyee Wairagkar, *University of California - Davis*

Meet the Sponsors and Exhibitors

ANT NEURO

www.ant-neuro.com
@ANTNeuro

ANT Neuro is a global corporation specialized in the development of medical and research applications. ANT Neuro was established in 1997, as a spin-off company of the University of Twente, Enschede. It now has offices located in Hengelo, The Netherlands; Berlin, Germany; London, UK; Philadelphia, USA; and Hong Kong, China. ANT Neuro specializes in being a single-source provider of high-performance products within neuroscience research and neurodiagnostics. Applications include BCI, EEG, EMG, TMS and MEG technology.

BRAIN PRODUCTS

www.brainproducts.com
@brain_products

Brain Products is dedicated to the research and understanding of the human brain and nervous system. By offering versatile hardware and software solutions, we aim to provide end-to-end solutions to positively impact the complex and fascinating field of neuroscience. As a result of this dedication, Brain Products has become a worldwide leading manufacturer of neurophysiological research solutions.

CORTICO

www.cortico.fr
@CORTICO13

CORTICO is the French Brain-Computer Interface (BCI) society that aims at bringing together researchers from different backgrounds and experience levels who work in the domain of BCI and Neurofeedback (NFB).

CREMEDICAL CORP.

www.cremedical.com

At CREmedical, we invent new technologies that help us understand the brain and diagnose and treat brain disorders. We are the pioneer of tripolar concentric ring electrodes (TCREs), which offer a radical improvement over the existing electrode configurations. Our TCRE based electroencephalography (tEEG) sets a new standard for physiological sensing and brain-computer-interface. Our TCRE based transcranial focal electrical stimulation (TFS) provides a new paradigm for neuromodulation. Our integrative tEEG+TFS platform creates new capacities to image brain function and modulate the brain state.

CYBORG AND BIONIC SYSTEMS, A SCIENCE PARTNER JOURNAL

spj.science.org/journal/cbsystems
@SPJournals

The Science Partner Journal Cyborg and Bionic Systems is an online-only Open Access journal published in affiliation with Beijing Institute of Technology (BIT) and distributed by the American Association for the Advancement of Science (AAAS). The journal publishes original, peer-reviewed articles based on fundamental, applied science, or their interaction. It also covers a wide range of fields related to cybernetic organisms (cyborg) and bionic systems (CBS), mainly including robotics, biomedical engineering, and neuro-engineering. spj.sciencemag.org/journals/cbsystems.

DYCONEX AG

www.mst.com/dyconex

Development and manufacturing of biocompatible flexible substrates for brain electrodes and other neural electrodes. Near-hermetic encapsulation of semiconductors in flexible substrates.

G3ICT - GLOBAL INITIATIVE FOR INCLUSIVE INFORMATION AND COMMUNICATION TECHNOLOGIES

www.g3ict.org
neuroabilities.org

NeuroAbilities is G3ict's dedicated program to explore the current state of assistive solutions based on advanced neurotechnologies, Brain-Computer Interfaces (BCI) and Artificial Intelligence (AI), enabling persons with disabilities and older persons to better interact with their environment. G3ict is the Global Initiative for Inclusive Information Communication Technologies, launched in 2006 at the initiative of the United Nations to promote the digital accessibility and assistive technologies provisions of the Convention on the Rights of Persons with Disabilities. Its division, the International Association of Accessibility Professionals, counts 5,800 members in 110 countries.

G.TEC MEDICAL ENGINEERING

www.gtec.at
@gtec_BCI

g.tec develops and produces high-performance brain-computer interfaces and neurotechnologies for invasive and non-invasive recordings for research or clinical purposes. g.tec's products are internationally used in clinical environments or for research purposes such as the analysis of the brain, heart or muscle activity, brain assessments of severe brain injuries and disorders of consciousness, motor rehabilitation after stroke, neuromarketing, deep brain stimulation, brain mapping, neuro prosthesis control, communication, painting and closed-loop invasive and non-invasive BCI experiments.

MBRAINTRAIN

mbraintrain.com
@mbraintrain

mbt is a mobile EEG company committed to bringing innovation in neuroscience. We are a team of 20, gathered around the vision of becoming the best brain technology company and inspiration to scientist to continuously move the boundaries of neuroscience. We are seated in Belgrade, but we are present all around the world gathering the community of the world's leading researchers and scientists.

NEURACLE TECHNOLOGY (CHANGZHOU) CO., LTD.

www.neuracle.cn

Neuracle Technology (Changzhou) Co., Ltd. was founded in November 2011, the core team is from Tsinghua University Neural Engineering Laboratory which is Top 5 Global Brain-Computer Intelligence Research Laboratories and medical market experts in the field of clinical neurology. Up to now, Neuracle has become a leading company in the field of brain-computer interface in China.

NEUROELECTRICS BARCELONA

www.neuroelectrics.com
@Neuroelectrics

Neuroelectrics is a Spanish company pioneer in brain stimulation and artificial intelligence technologies and therapies to alleviate neurological diseases. The company currently offers the best-in-class non-invasive and high-definition electrical brain stimulation technology for personalized neuromodulation. By measuring and modifying brain function, they aim to restore brain health, minimize disabilities, and create a better life for patients. Founded in 2011 and headquartered in Barcelona and Boston, Neuroelectrics distributes its products in more than 40 countries for basic neuroscience and clinical research in hundreds of universities and academic medical centers.

NEUROXESS

en.neuroxess.com

NeuroXess was founded in November 2021, at the early stage of its establishment, it received 100 million yuan or roughly 15 million US dollars in angel round funding from institutions such as Shanda and Sequoia. This is the largest early investment in the field. Our core technology was awarded the SAIL Award (Super Artificial Intelligence Leader Award), at the 2021 World Artificial Intelligence Conference in Shanghai. This April, after four months' operation, NeuroXess was selected by MIT Tech Review as one of the 50 smartest companies in the world, becoming the fastest company to be selected in history ever.

NIRX MEDIZINTECHNIK

nirx.net
@NIRx_NIRS

NIRx Medizintechnik GmbH is a leading provider of comprehensive solutions for functional near-infrared spectroscopy (fNIRS) research. Our non-invasive and user-friendly fNIRS technology enables the measurement of neural activity in the cortex and large-scale cortical networks, providing insights into the neural mechanisms underlying perception and cognition. Our complete range of research solutions includes a versatile multimodal hardware platform, advanced online and offline analysis software, expert technical and scientific support, and comprehensive training programs.

OPENBCI

openbci.com
@OpenBCI

OpenBCI creates open-source hardware and software for biosensing. OpenBCI's mission is to lower the barrier to entry for brain-computer interfacing, while ensuring that these technologies are adopted into the consumer landscape in an ethical way that protects user agency and mental health. Our latest project is called Galea. Galea is the first device that integrates EEG, EMG, EDA, PPG, and eye-tracking into a single headset.
www.galea.co

POSTDOC & STUDENT COMMITTEE - BRAIN COMPUTER INTERFACE SOCIETY

https://bcisociety.org/committees/
@BciSociety

The Postdoc & Student Committee is comprised of BCI members who are undergraduate and graduate students, postdoctoral fellows, or having an equivalent position in industry. The Committee will seek to enhance the experience of students and postdocs by organizing and overseeing initiatives answering their professional and career development needs in the context of BCI research. The Committee also aims to provide a voice within the BCI Society for students and postdocs, and serves as a venue to discuss issues of concern and interest to students and postdocs.

SCIENCE ROBOTICS /AAAS

www.science.org/journal/scirobotics

Science Robotics is a multidisciplinary research journal covering traditional disciplines of robotics as well as emerging technologies closely related to robotics.

SYNCHRON

synchron.com
@synchroninc

Synchron, a brain interface platform company, is a leader in the field of implantable neural interface technology. The clinical-stage company is developing a neuroprosthesis for the treatment of paralysis and the first endovascular implantable neuromodulation therapy. Future applications may include the potential to diagnose and treat conditions of the nervous system, including Parkinson's disease, epilepsy, depression, and hypertension. Headquartered in New York City, Synchron has offices in Silicon Valley, California and R&D facilities in Melbourne, Australia.

TIANQIAO & CHRISSY CHEN INSTITUTE

www.cheninstitute.org
@ChenInstitute

The Tianqiao and Chrissy Chen Institute (TCCI®) was created in 2016 by Tianqiao Chen and his wife Chrissy Luo, the founders of Shanda Group, with a US $1 billion commitment to help advance fundamental brain research around the world. TCCI® created TCCI for Neuroscience at Caltech in 2016. In 2017, the couple created the Tianqiao Chen Institute for Translational Research, a partnership with the Zhou Liangfu Foundation, Huashan Hospital and Shanghai Mental Health Ctr. In October 2020, TCCI opened the Chen Frontier Lab for Applied Neurotechnology and the Chen Frontier Lab for AI and Mental Health opened in July 2021.

TIANQIAO AND CHRISSY CHEN INSTITUTE FOR NEUROSCIENCE AT CALTECH

neuroscience.caltech.edu
@CaltechN

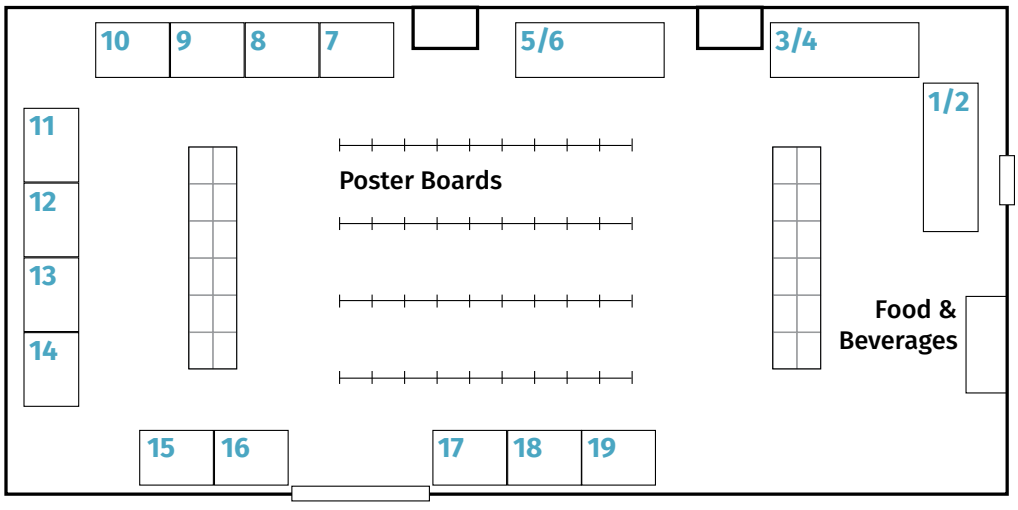
The Tianqiao and Chrissy Chen Institute for Neuroscience at Caltech was founded in 2016 with the generous support of philanthropists Tianqiao Chen and Chrissy Luo. It is a key component of a neuroscience initiative that is geared toward deepening our understanding of the brain's structure and how the brain works at its most basic level, as well as why and how it fails as a result of disease or through the aging process. The Institute draws upon Caltech's strengths across a broad range of disciplines, bringing together faculty from throughout Caltech's academic divisions, catalyzing interactions within a diverse community of researchers.

WYSS CENTER FOR BIO AND NEUROENGINEERING

www.wysscenter.ch
@Wysscenter

The Wyss Center is an independent, non-profit, research organization that accelerates innovative therapies to transform the lives of people with brain disorders. The Center pursues transformational technologies in artificial intelligence, bio- and neuroengineering to restore essential neural functions and deliver precision therapeutics for people with debilitating neurological and mental health disorders. Based at Campus Biotech in Geneva, Switzerland, the Wyss Center partners with faculty, clinicians, and industry, in Switzerland and internationally, to drive innovation and maximize clinical impact.

Exhibitor Floorplan



1/2 NIRx Medizintechnik
3/4 Brain Products
5/6 Wyss Center for Bio and Neuroengineering
7 CREmedical Corp.
8 NeuroXess
9 mBrainTrain
10 ANT Neuro
11 g.tec medical engineering
12 CORTICO
13 Neuroelectrics Barcelona
14 Dyconex AG
15 Tianqiao & Chrissy Chen Institute
16 Neuracle Technology (Changzhou)
17 Postdoc & Student Committee - Brain Computer Interface Society
18 BCI Society
19 OpenBCI

Poster Author Index

Name	Poster Numbers
Castellani, Filippo	1-D-38
Castillejo, Armand	3-A-1
Celik, Basak	2-F-57, 3-C-15
Celnik, Pablo	3-B-9
Chabardes, Stephan	1-A-2, 2-B-8, 3-A-1, 3-A-4
Chan, David	3-C-26
Chang, Edward F	1-A-8, 3-A-7
Charvet, Guillaume	1-A-2, 2-B-8, 3-A-1, 3-A-4
Chase, Steven M	1-A-6, 3-A-5
Chau, Tom	1-F-49, 3-F-44
Chen, Xinlin J	1-C-26
Chetty, Nikole	1-A-7, 2-A-4
Chevallier, Sylvain	1-F-58, 2-F-40, 3-C-23
Chiappalone, Michela	1-C-21
Chikermane, Meera	3-B-8
Chivukula, Srinivas	3-B-9
Choi, Kup-Sze	3-D-27
Christie, Breanne	3-B-9
Chrzanowska, Anna	2-E-39
Chugani, Karan	2-G-61
Cincotti, Febo	1-D-38, 1-D-42, 2-F-55, 3-D-34, 3-D-35
Clisson, Pierre	3-C-23
Coenen, Volker A	3-A-3, 3-D-33
Colamarino, Emma	1-D-38, 1-D-42, 3-D-34, 3-D-35
Collin, Thibault	1-A-2
Collinger, Jennifer L	1-A-3, 1-A-5, 1-A-6, 1-A-7, 1-B-10, 2-A-3, 2-A-4, 2-B-13, 2-B-14, 3-A-5
Collins, Leslie M	1-C-26
Colon, Albert	2-A-2
Comadurán Márquez, Daniel	1-D-40, 1-G-69, 2-F-43, 3-F-52, 3-G-66
Congedo, Marco	3-F-48
Contreras-Vidal, Jose L	2-F-46
Contreras-Vidal, Jose Luis	1-C-29
Cools, Jordi	2-E-39
Coquoz, Laure	1-A-2
Cornielje, Gijs	3-C-22
Corsi, Marie Constance	2-C-17
Corsi, Marie-Constance	2-F-40
Coulson, Paoline	2-B-10, 2-E-39
Courtine, Grégoire	1-A-2
Coyle, Damien	1-D-39
Coyle, Shirley	3-F-59
Craik, Alex	1-C-29
Crone, Nathan E	1-F-54, 3-B-9
Csaky, Richard	1-E-44
D'Ippolito, Mariagrazia	2-F-55
Daeglau, Mareike	1-C-25
Dagnino, Paulina	3-D-37
Dalrymple, Ashley N	1-A-7, 2-A-4
de Araújo Vitória, Maria	2-E-38
de Lucena, Diogo	2-B-15
De Michieli, Lorenzo	1-C-21
De Pauw, Kevin	1-D-37
de Ruyter van Steveninck, Jaap	2-B-9
de Seta, Valeria	1-D-38, 1-D-42
De Vico Fallani, Fabrizio	2-C-17, 2-F-40, 3-F-61
de Wit, Kim	1-C-22
Decker, Jennifer	1-C-25
Dekleva, Brian M	1-A-5, 1-A-6, 1-B-10, 2-A-3, 3-A-5
Demesmaeker, Robin	1-A-2
Denison, Tim	1-A-2
Desain, Peter	1-F-57, 3-C-22
Desbois, Arthur	2-C-17
Despradel, Dailyn	1-A-7, 2-A-4
Devigne, Louise	3-A-1
Di Iorio, Angelo	3-D-36
Di Rienzo, Franck	1-C-27
Dillen, Arnau	1-D-37
Dold, Matthias	3-A-3, 3-D-33
Dosen, Strahinja	3-D-29
Downey, John E	1-A-3, 1-A-5, 1-B-16
Dreyer, Pauline	3-E-41
Druckmann, Shaul	1-B-15, 1-C-28, 2-B-11
du Bois, Naomi	1-D-39
Dumont, Grégory	1-A-2
Dussard, Claire	1-G-67
Dybus, Aleksandra	1-G-60
Dürschmid, Stefan	2-F-50
Edwards, Grace	3-C-12
Ehrlich, Stefan K	2-D-28
Eiber, Calvin D	1-B-12
Eidel, Matthias	1-C-20, 1-G-62, 2-C-20
EL OUAHIDI, Yassine	3-F-60
Elisha, Reshef	1-C-28
Erdogmus, Deniz	3-C-15
Eskiizmirliler, Selim	3-C-13
Esser, Michael	3-D-39
Faes, Axel	3-F-49
Faivre, Olivier	1-A-2
Fakhreddine, Rawan	2-F-47, 3-C-18
Farina, Dario	2-D-33
Farrugia, Nicolas	3-F-60
Faust, Katharina	3-B-8
Felderhoff, Thomas	3-C-14
Feng, Jeff	1-C-29
Fenoglio, Elena	1-C-21, 1-G-61
Fernades, Jean-Claude	1-F-47
Fifier, Matthew	3-B-9
Figueiredo, Patricia	1-F-47
Fleck, Stéphanie	3-D-32
Flint, Robert D	2-B-12
Floreani, Erica D	1-D-40, 2-D-35, 2-G-66, 3-F-52
Fløtaker, Simen P	3-C-16
Fong, Khi Yung	1-B-13
Forge, Kylliam	2-G-64
Formisano, Rita	2-F-55
Forsiuk, Inna	1-C-21
Franz, Colin K	2-G-68
Freudenburg, Zac V	3-F-54
Freudenburg, Zachary V	1-B-14
Fried-Oken, Melanie	2-F-57, 2-G-62, 3-C-15

Name	Poster Numbers
Fry, Adam	1-A-7, 2-A-4
Gaines, Dylan	1-G-68
Galiotta, Valentina	2-F-55
Galván, Catalina M	2-C-22, 3-C-21
Galvez, Andrea	1-A-2
Galvin-McLaughlin, Deirdre	3-C-15
Gamboa von Groll, Valentina	2-G-63
Gamez, Jorge	3-A-2
Ganguly, Karunesh	1-A-8, 3-A-7
Garro, Florencia	1-C-21
Gasq, David	2-G-64
Gaunt, Robert A	1-B-10, 1-B-16, 2-B-13, 2-B-14
Gemicioglu, Tan	2-C-24
Gemoets, Darren E	3-F-63
Genoe, Jan	2-B-10, 2-E-39
George, Nathalie	1-G-67
Geukes, Simon H	1-B-14, 2-F-45
Geytenbeek, Joke	1-G-66
Ghaffari, Fakhreddine	1-D-37
Ghani, Usman	3-E-40
GHEORGHE, LUCIAN	2-D-32
Gherman, Diana E	1-D-35
Giesler, Thomas	2-C-20
Giff, Alexis	3-F-51
Gómez, Julieth	2-B-6
Gonzalez, Andres J	2-D-34
Gonzalez Astudillo, Juliana	3-F-61
Gonzalez Espana, Juan Jose	1-C-29
Goulis, Sophocles	2-A-2, 3-F-46
Grachev, Artem M	1-F-56
Grayden, David B	2-C-18
Greenspon, Charles M	1-A-5, 1-B-16, 2-B-13, 2-B-14
Grevet, Elise	2-G-64
Gripon, Vincent	3-F-60
Grosse-Wentrup, Moritz	1-D-43
Guan, Charles	3-A-2
Guan, Cuntai	2-F-49
Guarrera, Theresa	2-D-31
Guerreiro Fernandes, Francisco	2-E-38
Guetschel, Pierre	2-F-48
Guger, Christoph	3-E-43
Guillaud, Etienne	1-C-27
Guillot, Aymeric	1-C-27
Gulamhusein, Adam	2-F-44
Gunduz, Aysegul	2-B-6
Gusman, Jacob	2-B-15
Gusman, Jake T	2-B-15
Guy, Romain	2-B-8
Gwon, Daeun	1-D-32
Güçlü, Umut	2-B-9
Güçlütürk, Yağmur	2-B-9
Gyldenvang, Mona Bruun	3-E-40
Habibzadeh, Hadi	2-G-68
Haesler, Sebastian	2-B-10, 2-E-39
Hahn, Amelia G	
Halder, Sebastian	2-F-56
Hammond, Leah M	2-D-35, 2-G-65
Hamou, Soukaina	2-C-16
Han, Yiyuan	2-F-56
Harel, Noam	1-A-7, 2-A-4
Hargrove, Levi	3-C-12
Harte, Cathal	1-A-2
Harvey, Chase A	3-C-25, 3-C-26
Hatsopoulos, Nicholas G	1-A-3, 1-A-5
Haupt, Thorge	1-F-52
He, Qinpu	1-A-5
Healy, Graham	3-E-42
Heckman, Susan M	2-G-68
Henderson, Jaimie	1-B-15, 1-C-28, 2-B-11
Herff, Christian	1-D-36, 2-A-2, 2-B-7, 3-F-46, 3-F-50
Hernandez Gloria, Jose Jesus	2-F-52
Hernandez-Charpak, Sergio	1-A-2
Herrera Altamira, Gabriela	3-D-32
Hill, Jeremy	3-G-68
Hill, Katharine	2-A-4
Hill, Katharine (Katya)	1-A-7
Hinrichs, Hermann	2-F-50
Hinss, Marcel F	1-D-33
Hirata, Masayuki	2-B-5
Hitchcock, Edward C	2-G-68
Hobbs, Taylor G	1-B-16, 2-B-13, 2-B-14
Hochberg, Leigh R	1-B-15, 2-A-1, 2-B-11, 2-B-15, 3-A-6
Hockeimer, William	3-A-5
Hong, Eul-Seok	3-F-45
Hong, Sung Kwang	3-F-45
Hosman, Tommy	2-B-15
Hosni, Sarah M	3-F-62
Hou, Xianda	3-A-6
Howell-Munson, Alicia N	2-D-31
Hsieh, Jason	2-B-12
Hu, Zhenxing	3-D-28
Huang, Gan	3-D-28
Huang, Xiaohua	2-B-10, 2-E-39
Huber, Derek M	2-F-46
Hudson, Leah	1-D-39
Huggins, Jane E	3-C-25, 3-C-26
Hugueville, Laurent	1-G-67, 2-C-17
Idowu, Oluwagbenga P	2-F-44
Idowu, Oluwagbenga Paul P	2-F-44
Iida, Fumiya	2-C-19
Imbiriba, Tales	3-C-15
Interring, Nadine	1-A-2
Irvine, Brian	1-F-50, 1-G-69, 2-F-43, 2-F-44, 3-G-66
Ivanov, Nicolas	1-F-49
Ivucic, Gabriel	3-D-30
Iwane, Fumiaki	1-D-31
Izac, Margaux	1-C-27, 2-G-64
Jackson, Melody	2-C-24
Jahanpour, Emilie S	1-D-33

Name	Poster Numbers
Jalilpour, Shayan	3-D-31
Janssen, Mark L	3-A-3
Japee, Shruti	3-C-12
Jaramillo Gonzalez, Andres	2-F-52
Jaramillo-Gonzalez, Andres	3-C-14
Jeunet, Camille	1-C-27, 1-G-67, 2-G-64
Jochumsen, Mads	3-E-40
John, Sam E	2-C-18
Jonassen, Pauline M	1-F-48
Jorge, Carolina	1-F-47
Juillard, Violaine	3-A-1
Jun, Sung C	3-C-17
Jun, Sung Chan	1-D-32
Jørgensen, Helle R	3-D-29
Kacker, Kriti	1-A-7, 2-A-4
Kadlec, Kelly M	3-A-2
Kamdar, Foram	1-B-15, 2-B-11
Kameda, Seiji	2-B-5
Kanoh, Shin'ichiro	1-C-22
Kapeller, Christoph	3-E-43
Kapitonava, Anastasia	2-B-15
Karakas, Serpil	1-A-2, 3-A-1
Karpowicz, Brianna M	3-F-56
Karsten, Jan	2-D-34
Kawanabe, Motoaki	3-F-55
Keerthi, Prerana	2-G-68
Kellis, Spencer	3-B-9
Kelly, Dion M	1-G-69
Keough, Joanna R	1-F-50, 2-D-35, 3-F-52, 3-G-66
Keshtkaran, Mohammad Reza	3-F-56
Ketelaar, Marjolijn	1-G-66
Khan, Nazmun N	3-C-25
Khan, Nazmun Nahar	2-D-36
Kim, Brian	2-F-59
Kim, Heegyu	3-C-17
Kim, Hyun-Seok	3-F-45
Kim, Vella	2-G-66
Kim, Vella Shin-Hyung	3-F-52
Kinney-Lang, Eli	1-D-40, 1-F-50, 1-G-69, 2-D-35, 2-F-43, 2-F-44, 2-G-66, 3-D-39, 3-F-52, 3-G-66
Kinsella, Michelle	2-G-62, 3-C-15
Kiremitci, Ibrahim	1-B-11
Kirton, Adam	1-D-40, 1-F-50, 1-G-69, 2-D-35, 2-F-43, 2-F-44, 2-G-66, 3-D-39, 3-F-52, 3-G-66
Klee, Dan	3-C-15
Klee, Daniel P	2-F-41, 2-F-57
Klein, Eran	2-G-62
Kober, Silvia E	1-G-64
Kobler, Reinmar J	3-F-55
Kojima, Simon	1-C-22
Kokorin, Kirill	2-C-18
Komendzinski, Tomasz	3-F-64
Komi, Salif	1-A-2
Kondapavulur, Sravani	3-F-51
Korostenskaja, Milena	3-D-38
Kortenbach, Benjamin E	1-C-22
Kostoglou, Kyriaki	3-F-57
Kozyrskiy, Bogdan L	1-F-56
Kragic, Danica	2-F-51
Kranczioch, Cornelia	1-C-25
Krol, Laurens R	1-D-35
Kromm, Maria	2-F-58
Kroupi, Eleni	3-D-37
Krusienski, Dean	3-F-50
Kubben, Pieter L	2-A-2, 2-B-7, 3-F-46
Kumar, Chetan	2-F-54
Kumar, Mohit	1-C-18
Kumar, Satyam	2-C-21, 2-F-47, 3-C-18
Kumari, Radha	1-G-60
Kunigk, Nicolas G	1-A-3, 1-A-6, 3-A-5
Kunz, Erin M	1-B-15, 2-B-11
Kübler, Andrea	1-C-20, 1-D-30, 1-G-62, 2-C-20, 2-C-23
Kühn, Andrea A	3-B-8
Köhler, Richard	3-B-8
Lacomis, David	1-A-7, 2-A-4
Langar, Lilia	1-A-2
Lavrard, Brice	3-C-13
Lawhead, Matt	3-C-15
Lécuyer, Anatole	3-D-32, 3-F-53
Lee, Brian	1-A-1, 1-B-9, 3-B-9
Lee, Meng-Jung	2-D-33
Lee, Yeongjun	1-C-28
Leeb, Robert	3-F-47
Leeuwis, Nikki	2-G-63
Leinders, Sacha	1-B-14
Leung, Jason	3-F-44
Levin, Alisa D	1-B-15
Li, Haizhou	3-D-30
Li, Linling	3-D-28
Li, Songwei	2-D-27
Liang, Shuang	3-D-27
Liang, Xiaoqi	3-D-28
Liang, Zhen	3-D-28
Lim, Mervyn	1-B-13
Lim, Michelle	2-D-31
Lin, Hong-yi	1-B-13
Lioi, Giulia	1-D-41, 3-F-60
Liu, Charles	1-A-1, 1-B-9, 3-B-9
Liu, Deland	1-D-31, 2-C-21
Liu, Fang	1-A-6
Liu, Shijia	3-C-15
Lo, Jack	1-B-13
Lock, Blair	3-C-12
Londoño Ramírez, Horacio	2-B-10, 2-E-39
Lorach, Henri	1-A-2
Lotte, Fabien	1-F-58, 1-G-63, 1-G-65, 2-F-53, 2-G-63, 3-E-41
Louie, Kenneth	3-F-51
Lozano, Antonio	2-B-9
Lu, Rose	1-C-18
Lugrin, Claire	3-F-47
Luijten, Sofie	2-B-10
Luo, Shiyu	1-F-54
Lønvik, Helene T	1-F-48
Ma, Xuan	1-A-5, 3-F-56

Name	Poster Numbers
Macé, Marc J	3-F-53
Madera, Jonathon	2-C-21
Maeda, Makoto	2-B-5
Maes, Pattie	2-D-37
Mainsah, Boyla O	1-C-26
Majewicz Fey, Ann	2-C-21
Majidi, Shahram	1-A-7, 2-A-4
Makin, Tamar	3-C-12
Marissens Cueva, Valerie	1-F-53
Martel, Félix	1-A-2, 2-B-8, 3-A-1, 3-A-4
Martin, Ashley	2-D-37
Mattia, Donatella	1-D-38, 1-D-42, 2-F-55, 3-D-34, 3-D-35
Mattout, Jérémie	3-F-48
McClanahan, Alex	2-F-59
McClanahan, Alexander	2-F-59
McDermott, Eric J	1-D-43
McLinden, John P	2-F-54, 3-F-62
McShane, Niall	1-D-39
Mehring, Carsten	2-D-33
Memmott, Tab	2-F-41, 2-F-57, 3-C-15
Mendez-Orellana, Carolina	1-D-36
Menegatti, Emanuele	1-C-23, 3-C-19
Meng, Jianjun	1-C-19, 2-D-27
Mensi, Skander	3-F-47
Merk, Timon	3-B-8
Meschede-Krasa, Benyamin	2-B-11
Michelet, Thomas	1-C-27
Mifsud, Domenick M	3-A-6
Mihara, Masashi	2-B-5
Millán, José R	3-C-18
Millán, Jose del R	2-C-21, 2-F-47
Millan, Jose del R.	1-D-31
Miller, Lee E	1-A-5, 3-A-6, 3-F-56
Milone, Diego H	2-C-22, 3-C-21
Min, Byoung-Kyong	3-F-45
Minhas, Araz	3-D-39
Moctezuma, Luis A	2-D-25
Modde, Aurélie	1-G-62
Modrau, Boris	3-D-29
Moedano-Atristain, José	2-F-60
Moench, Matthew	2-F-59
Moliadze, Vera	3-D-37
Molinas, Marta	1-C-18, 2-D-25, 3-C-16
Molle, Rita	1-D-38
Moly, Alexandre	3-A-4
Mongiardini, Elena	3-D-34, 3-D-35
Moninghoff, Mae	3-C-12
Monscheuer, Albert	1-B-10
Mora Lopez, Carolina	2-B-10, 2-E-39
Moufassih, Mustapha	2-C-16
Mrachacz-Kersting, Natalie	1-G-62, 2-D-34, 2-F-52, 3-C-14, 3-D-29
Mu, Jing	2-C-18
Musso, Mariacristina	1-C-22
Mustafa, Mousa S	3-B-8
Müller-Putz, Gernot R	2-F-49, 3-C-20, 3-D-31, 3-F-57
Myny, Kris	2-B-10
N'Kaoua, Bernard	1-C-27, 2-F-53
Nair, Veena A	3-C-24
Nason-Tomaszewski, Samuel R	3-A-6
Natraj, Nikhilesh	1-A-8, 3-A-7
Neumann, Wolf-Julian	3-B-8
Neverlien, Embla S	1-C-18
Niazi, Imran Khan	3-E-40
Nickl, Robert	3-B-9
Nicolas, Claire	2-B-15, 3-A-6
Nieto, Nicolás	2-C-22
Nisal, Shreyas	2-D-37
Noble, Andy	2-F-46
Noble, Dionne	2-F-46
Nogueira, Raul	1-A-7, 2-A-4
Norton, James J	2-G-68, 3-F-63
Ofner, Patrick	2-D-33
Oken, Barry S	2-F-41, 2-F-57, 3-C-15
Okorokova, Elizaveta V	1-A-5
Omer, Karameldeen I	3-C-10
Opie, Nicholas L	1-A-7, 1-B-12, 2-A-4
Osborn, Luke	3-B-9
Ossadtchi, Alexey E	1-C-24
Ostaddabbas, Sarah	3-F-62
Otake-Matsura, Mihokio	3-F-64
Ottenhoff, Maarten C	2-A-2, 2-B-7, 3-F-46
Øverby, Marie	2-D-25
Oxley, Thomas J	1-A-7, 1-B-12, 2-A-4
Pacheco-Ramírez, Maxine A	2-F-46
Pahuja, Saurav	3-D-30
Palatella, Alessio	2-D-30
Pandarinath, Chethan	3-A-6, 3-F-56
Pantazis, Dimitrios	3-F-45
Papadopoulo, Théodore	1-F-51, 2-F-48
Papadopoulos, Sotirios	3-F-48
Parker Jones, Oiwi	1-E-44
Pasdeloup, Bastien	3-F-60
Pasteau, François	3-A-1
Patel, Kushant	3-A-6
Pejsa, Kelsie	1-A-1, 1-B-9, 3-B-9
Perdikis, Serafeim	2-D-32
Pereira, Joana	3-A-3, 3-D-33
Peters, Betts	2-F-57, 3-C-15
Peterson, Victoria	1-F-54, 2-C-22, 3-C-21
Petridou, Natalia	1-B-11
Pfeiffer, Maria	1-C-20, 2-C-20
Piantoni, Gio	1-B-11
Piantoni, Giovanni	2-F-45
Pichiorri, Floriana	1-D-38, 1-D-42, 3-D-34, 3-D-35
Pijnacker, Laura	2-B-9
Pillette, Léa	1-C-27, 1-G-67, 2-G-63, 2-G-64, 3-E-41, 3-F-53
Piozin, Corentin	3-C-13
Piper, Walter T	2-D-31
Polyakov, Daniel	3-C-11

Name	Poster Numbers
Pop, Florin	1-B-17
Postma, Marie	3-G-67
Pouratian, Nader	3-A-2, 3-B-9
Prabhakaran, Vivek X	3-C-24
Prakash, Prashanth R	2-B-12
Presbrey, Kara	3-F-51
Pulferer, Hannah S	2-F-49
Purcell, Mariel	1-G-60
Putrino, David F	1-A-7, 2-A-4
Py, Jacques	2-G-64
Quattrociocchi, Ilaria	2-F-55
Quellec, Charlotte	2-B-8
Rabbani, Qinwan	1-F-54
Rabbie-Baauw, Kim	1-G-66
Racz, Frigyes S	2-F-47, 3-C-18
Racz, Frigyes Samuel	2-C-21
Raemaekers, Mathijs	2-E-38, 2-F-58
Raggam, Philipp	1-D-43
Rahimi, Neela	2-F-54
Rajabi, Nona	2-F-51
Ramírez-Moreno, Mauricio A	2-F-46
Ramsey, Nick	1-B-11, 1-B-14, 2-E-38, 2-F-45, 2-F-58, 3-F-54
Ranieri, Andrea	3-D-34, 3-D-35
Ravier, Jimmy	1-A-2
Redmond, Peter	1-E-45
Reichert, Christoph	2-F-50
Remsik, Alexander B	3-C-24
Riccio, Angela	2-F-55
Richardson, Robert M	1-F-54
Rieth, Loren	3-B-9
Rigotti-Thompson, Mattia	3-A-6
Rimbert, Sébastien	2-D-29, 2-G-63, 3-E-41
Rind, Gil S	1-B-12
Rispoli, Beth	3-C-12
Roc, Aline	1-G-65, 2-G-63, 3-E-41
Rodríguez Fernández, María	1-D-36
Roelfsema, Pieter	2-B-9
Roland, Ellen	1-G-62
Romain, Olivier	1-D-37
Ronayne, Stephen M	1-B-12
Ronnback, Ronja	3-G-65
Rosario, Emily	3-A-2
Rosenow, Joshua	2-B-12
Rosenthal, Isabelle A	1-B-9
Rosipal, Roman	1-F-46
Rossignol, Eléa	1-C-27
Rowley, Danette	2-D-35, 2-G-66, 3-F-52
Roy, Raphaëlle N	1-D-33
Rutkowski, Tomasz M	3-F-64
Rückauer, Bodo	2-B-9
Sabatini, David A	1-A-4
Sachs, Adam	1-B-17
Saint-Bauzel, Ludovic	2-C-17
Sajonz, Bastian	3-A-3, 3-D-33
Sakr, Icare	1-A-2
Sanchez-Bornot, José	1-D-39
Sani, Omid	2-A-2
Sarma, Dev	1-A-7
Sarma, Devapratim	2-A-4
Sauter-Starace, Fabien	1-A-2
Savalle, Emile	3-F-53
Sawyer, Abbey	1-A-7, 2-A-4
Scalise, Lorenso	3-D-36
Schellekens, Wouter	1-B-11
Schippers, Anouck	1-B-14, 3-F-54
Schneider, Gerd-Helge	3-B-8
Schone, Hunter	3-C-12
Schreiner, Leonhard	3-E-43
Schultz, Tanja	3-D-30, 3-F-50
Schwerz de Lucena, Diogo	1-B-17
Sedler, Andrew R	3-F-56
Seko, Sarah	1-A-8, 3-A-7
Semprini, Marianna	1-C-21
Settgast, Tomko	1-D-30
Shahriari, Yalda	2-F-54, 3-F-62
Shanechi, Maryam	2-A-2
Shao, Ming	2-F-54
Sharma, Akshat	2-C-19
Shelchkova, Natalya	1-B-16
Shenoy, Krishna V	1-B-15, 1-C-28, 2-B-11
Shih, Jerry	3-F-50
Shishkin, Sergei L	1-C-24
Shishkin, Sergey L	1-F-56
Shriki, Oren	1-F-46, 3-C-11
Si-Mohammed, Hakim	2-F-42
Sieghartsleitner, Sebastian	3-E-43
Simeral, John D	2-B-15
Simon, Catherine	3-C-13
Simonyan, Kristina	2-D-28
Slutzky, Marc W	2-B-12
Smedemark-Margulies, Niklas	2-F-57, 3-C-15
Sobinov, Anton R	1-A-5
Soler, Andres	3-C-16
Soria-Frisch, Aureli	2-G-61, 3-D-37
Sosulski, Jan	3-F-58
Spagnolo, Valeria	1-A-2, 2-C-22
Spencer, Kevin M	2-F-54
Spies, Ruben D	2-C-22, 3-C-21
Splittgerber, Maike	3-D-37
Srisrisawang, Nitikorn	3-C-20
Stanley, David	2-D-31
Starner, Thad	2-C-24
Starr, Philip A	3-F-51
Stavisky, Sergey D	2-A-1, 3-A-6
Stent, Andrew	1-B-12
Stevens, Ian	2-G-62
Stevensen, Andrew J	3-D-29
Struber, Lucas	1-A-2, 3-A-1
Stuldreher, Ivo	1-D-34
Sultana, Mushfika	2-D-32
Susnoschi-Luca, Ioana	2-D-26
Suzuki, Katsuyoshi	2-B-5
Svejgaard, Benjamin J	3-D-29

Name	Poster Numbers
Sweet, Taylor	3-C-25, 3-C-26
Szul, Maciej j	3-F-48
Tadiello, Sébastien	2-G-64
Taleb, Farzaneh	2-F-51
Tangermann, Michael W	1-C-22, 2-F-48, 3-A-3, 3-D-33, 3-F-58
Tarahi, Ousama	2-C-16
Tarigoppula, Venkata S Aditya	1-B-12
Tate, Matthew C	2-B-12
Tenore, Francesco	3-B-9
Thielen, Jordy	3-C-22
Thompson, David E	2-D-36, 3-C-25, 3-C-26
Tittel, Franziska	2-F-50
Tonin, Luca	1-C-23, 2-D-30, 3-C-19
Toppi, Jlenia	1-D-38, 1-D-42, 2-F-55, 3-D-34, 3-D-35
Tortolani, Ariana F	1-A-3
Tortora, Stefano	1-C-23, 2-D-30, 3-C-19
Tougas, Garrett	2-D-28
Trocellier, David	2-F-53
Trombin, Edoardo	1-C-23
Tröger, Wolfgang	2-C-20
Tuck, Corinne	2-D-35, 2-G-65
Udeozor, Malcolm	3-C-12
Valentini, Elia	2-F-56
Valeriani, Davide	2-D-31
Valle, Carlos	1-D-36
Valle, Giacomo	2-B-13
van den Boom, Max	2-E-38
Van Den Kerchove, Arne	2-F-42
van der Grinten, Maureen	2-B-9
van der Werff, Floris	3-C-22
van Driel-Boerrigter, Marieke	1-G-66
Van Driesche, Ashley	1-A-5
van Erp, Jan	1-D-34
van Gerven, Marcel	2-B-9
Van Helleputte, Nick	2-E-39
Van Hulle, Marc M	2-F-42, 3-F-49
van Kan, Peter L.E.	3-C-24
van Nes, Ilse	1-A-2
van Wezel, Richard	2-B-9
Vanderborght, Bram	1-D-37
Vandersea, James	3-C-12
Vanhoecke, Jonathan	3-B-8
Vansteensel, Mariska J	1-B-14, 1-G-62, 1-G-66, 3-F-54
Vargas-Irwin, Carlos E	2-B-15
Vasco, Miguel	2-F-51
Vasilyev, Anatoly N	1-C-24
Vat, Molywan	1-A-2
Vaughan, Theresa M	1-G-62, 2-G-68, 3-F-63
Venot, Tristan	2-C-17
Verbaarschot, Ceci	1-B-10
Verbaarschot, Cecile	1-B-16
Verberne, Malinda	1-B-14, 1-G-66
Vertanen, Keith	1-G-68
Verwoert, Maxime	2-A-2, 2-B-7, 3-F-46
Vissani, Matteo	1-F-54
Vourvopoulos, Athanasios	1-F-47
Vuckovic, Aleksandra	1-G-60, 2-D-26
Vujic, Angela	2-D-37
W. J. van Es, Mats	1-E-44
Wagner, Diana	2-B-15
Wagner, Louis	3-F-46
Wairagkar, Maitreyee	2-A-1
Walsh, Conor	2-B-15
Wandelt, Sarah K	1-A-1
Wang, Doris	3-F-51
Wang, Fan	1-C-19
Wang, Xu	1-C-19
Wang, Yuhang	1-B-13
Ward, Tomas	1-E-45, 3-E-42, 3-F-59
Warschausky, Seth	3-C-25
Waszak, Florian	3-C-13
Watrin, Anne	1-A-2
Weber, Douglas J	1-A-7, 2-A-4
Welter, Marc	1-G-63
Wester, Brock	3-B-9
Willems, Marike	1-G-66
Willett, Francis R	1-B-15
Willett, Frank	2-B-11
Wilson, Guy H	1-C-28
Wimalasena, Lahiru N	3-F-56
Wolpaw, Jonathan R	2-G-68
Won, Kyungho	3-C-17
Wood, Guilherme	1-G-64
Woodward, Kristine	3-D-39
Woolrich, Mark	1-E-44
Wrightson, James	3-G-66
Yamamoto, Maria Sayu	1-F-58
Yan, Tianfang	2-B-5
Yáñez-Suárez, Óscar	2-F-60
Yashin, Artem S	1-C-24
Ye, Joel	1-F-59
Yeo, Tseng Tsai	1-B-13
Yger, Florian	2-F-40
Yoo, Peter E	1-A-7, 2-A-4
Zabolotniy, Alexey Y	1-C-24
Zander, Thorsten O	1-D-35
Zanganeh Soroush, Pedram	3-F-50
Zeitlin, Debra J	2-G-68
Zewdie, Ephrem	1-D-40
Zhang, Li	3-D-28
Zhang, Minsu	1-D-31
Zhang, Zhiguo	3-D-28
Zhao, Yuhui	2-C-24
Zheng, Yu	1-C-19
Zhu, Qianyun	3-D-28
Zhu, Shaotong	3-F-62
Zhuo, Yan	1-C-19
Zich, Catharina	1-C-25
Ziebell, Philipp	1-C-20, 1-G-62
Ziemann, Ulf	1-D-43
Zilio, Federico	1-D-30
Zrenner, Christoph	1-D-43

Poster Sessions

SESSION 1 Wednesday, June 7 15:45-17:15
SESSION 2 Thursday, June 8 15:45-17:15
SESSION 3 Friday, June 9 15:45-17:15

The poster board numbers work in the following way: Session - BCI Area - Board number (e.g. 1-4-1)

BCI Areas

A **BCI Implant - Control**
B **BCI Implant - Other**
C **BCI Non-Invasive - Control**
D **BCI Non-Invasive - Other**
E **Signal Acquisition**
F **Signal Analysis**
G **User Aspects: Experience, Ethics**

SESSION 1
Wednesday, June 7 15:45-17:15

1-A-1 ***Decoding speech and internal speech on the single unit level from the supramarginal gyrus in a tetraplegic human***

Sarah Wandelt[1], David Bjanes[1], Kelsie Pejsa[1], Brian Lee[2], Charles Liu[2], Richard Andersen[1]

[1]California Institute of Technology, [2]Keck School of Medicine of USC

1-A-2 ***Brain spine interface to restore walking after spinal cord injury***

Henri Lorach[1], Henri Lorach[1], Andrea Galvez[1], Valeria Spagnolo[2], Félix Martel[3], Serpil Karakas[4], Nadine Interring, Molywan Vat, Olivier Faivre, Cathal Harte[1], Salif Komi[1], Jimmy Ravier[1], Thibault Collin[1], Laure Coquoz[1], Sergio Hernandez-Charpak[1], Icare Sakr[1], Edeny Baaklini[1], Grégory Dumont[1], Rik Buschman, Nicholas Buse, Tim Denison, Ilse van Nes, Anne Watrin, Lucas Struber[5], Fabien Sauter-Starace, Lilia Langar, Vincent Auboiroux, Stefano Carda, Stephan Chabardes[3], Tetiana Aksenova[6], Robin Demesmaeker, Guillaume Charvet[3], Jocelyne Bloch, Grégoire Courtine[1]

[1]EPFL, [2]Instituto de Matemática Aplicada del Litoral, [3]Université Grenoble Alpes, [4]CEA, [5]French Alternative Energies and Atomic Energy Commission, [6]Swiss Federal Institute of Technology Lausanne

1-A-3 ***How different immersive environments affect intracortical brain computer interfaces***

Ariana Tortolani[1], Ariana Tortolani[1], John Downey[1], Nicolas Kunigk[2], Jennifer Collinger[2], Sliman Bensmaia[1], Nicholas Hatsopoulos[1]

[1]University of Chicago, [2]University of Pittsburgh

1-A-4 ***DeMaND: using neural dynamics to decode reach kinematics***

David Sabatini[1]

[1]University of Chicago

1-A-5 ***Grasp force is encoded in dynamical patterns of activity in the motor cortex of monkeys and humans***

Elizaveta Okorokova[1], Elizaveta Okorokova[1], Anton Sobinov[1], John Downey[1], Xuan Ma[2], Qinpu He[3], Ashley Van Driesche[1], Charles Greenspon[1], Brian Dekleva[4], Nathan Brantly[4], Jennifer Collinger[4], Lee Miller[2], Nicholas Hatsopoulos[1], Sliman Bensmaia[1]

[1]University of Chicago, [2]Northwestern University, [3]Princeton University, [4]University of Pittsburgh

1-A-6 ***BCI performance is influenced by motor imagery strategy and somatotopic constraints***

Nicolas Kunigk[1], Brian Dekleva[1], Fang Liu[1], Steven Chase[2], Michael Boninger[1], Jennifer Collinger[1]

[1]University of Pittsburgh, [2]Carnegie Mellon University

1-A-7 ***Spectral features of EEG signals recorded from a stentrode in human motor cortex***

Kriti Kacker[1], Kriti Kacker[1], Nikole Chetty[1], James Bennet[2], Peter Yoo[2], Abbey Sawyer[3], Ashley Dalrymple[1], Dev Sarma[1], Dailyn Despradel[1], Noam Harel[3], David Lacomis[4], Shahram Majidi[3], Raul Nogueira[4], Katharine (Katya) Hill[5], Jennifer Collinger[4], Adam Fry[2], Nicholas Opie[2], Thomas Oxley[2], David Putrino[3], Douglas Weber[1]

[1]Carnegie Mellon University, [2]Synchron Inc, [3]Mount Sinai Hospital, [4]University of Pittsburgh, [5]UPMC

1-A-8 ***Flexible regulation of sensorimotor neural representations in high degree of freedom neuroprosthetic control***

Nikhilesh Natraj[1], Sarah Seko[1], Edward Chang[1], Karunesh Ganguly[1]

[1]University of California - San Francisco

1-B-10 ***The effect of artificially created sensory feedback on motor cortex activity during task performance***

Ceci Verbaarschot[1], Albert Monscheuer[1], Brian Dekleva[1], Jennifer Collinger[1], Robert Gaunt[1]
[1]University of Pittsburgh

1-B-11 ***Fingermapping in sensorimotor cortex with ECoG***

IBRAHIM KIREMITCI[1], Gio Piantoni[1], Wouter Schellekens[1], Natalia Petridou[1], Nick Ramsey[2]
[1]UMC Utrecht, [2]UMC Utrecht Brain Center

1-B-12 ***Early safety data for retrieval of a stent-based endovascular neural recording array.***

Venkata S Aditya Tarigoppula[1], Gil Rind[1], Stephen Ronayne[1], Andrew Stent[1], Calvin Eiber[1], Thomas Oxley[2], Nicholas Opie[2]
[1]Synchron, [2]Synchron Inc

1-B-13 ***A systematic review of invasive brain-computer interfaces in humans: current state-of-the-art and features associated with accuracy of an invasive BCI task***

Mervyn Lim[1], Mervyn Lim[1], Jack Lo[1], Hong-yi Lin[2], Yuhang Wang[2], Khi Yung Fong[2], Tseng Tsai Yeo[1]
[1]National University Hospital, [2]National University of Singapore

1-B-14 ***Lessons learned on implantable BCIs for home use***

Mariana Branco[1], Sacha Leinders[2], Zachary Freudenburg[2], Anouck Schippers[1], Simon Geukes[1], Malinda Verberne[1], Erik Aarnoutse[1], Nick Ramsey[1], Mariska Vansteensel[1]
[1]UMC Utrecht Brain Center, [2]UMC Utrecht

1-B-15 ***Broca's Area: a single-Unit recording perspective***

Erin Kunz[1], Francis Willett[1], Alisa Levin[1], Foram Kamdar[1], Leigh Hochberg[2], Shaul Druckmann[1], Jaimie Henderson[1], Krishna Shenoy[1]
[1]Stanford University, [2]Massachusetts General Hostpital

1-B-16 ***The spatial resolution of artificial touch via intracortical microstimulation and its neural determinants***

Natalya Shelchkova[1], Natalya Shelchkova[1], Charles Greenspon[1], Taylor Hobbs[2], Cecile Verbaarschot[2], Ev Berger-Wolfe[3], John Downey[1], Robert Gaunt[2], Sliman Bensmaia[1]
[1]University of Chicago, [2]University of Pittsburgh, [3]Middlebury College

1-B-17 ***A dynamic spiking data simulator for iBCI development***

Diogo Schwerz de Lucena[1], Chad Boulay[2], Adam Sachs[2], Florin Pop[1]
[1]AE Studio, [2]Ottawa Hospital Research Institute

1-B-9 ***Biological relevance of visual stimuli modulates the temporal binding window between ICMS and vision***

Isabelle Rosenthal[1], Luke Bashford[1], David Bjånes[1], Kelsie Pejsa[1], Brian Lee[2], Charles Liu[2], Richard Andersen[1]
[1]California Institute of Technology, [2]Keck School of Medicine of USC

1-C-18 ***EEG-based automatic emotion recognition using machine learning***

Rose Lu[1], Embla Neverlien[1], Mohit Kumar[1], Marta Molinas[1]
[1]Norwegian University of Science and Technology

1-C-19 ***Unilateral movement decoding of upper and lower limbs using magnetoencephalography (MEG)***

Xu Wang[1], Xu Wang[1], Yu Zheng[2], Fan Wang[2], Yan Zhuo[2], Jianjun Meng[1]
[1]Shanghai Jiao Tong University, [2]Chinese Academy of Sciences

1-C-20 ***Recording the tactile P300 with the cEEGrid - good, but not yet perfect***

Matthias Eidel[1], Matthias Eidel[1], Maria Pfeiffer[1], Philipp Ziebell[1], Andrea Kübler[1]
[1]University of Würzburg

1-C-21 ***Effects of robotic-assistance in ERP modulation for upper-limb exoskeleton control***

Florencia Garro[1], Elena Fenoglio[2], Inna Forsiuk[2], Lorenzo De Michieli[2], Stefano Buccelli[2], Michela Chiappalone[1], Marianna Semprini[2]
[1]Italian Institute of Technology - University of Genoa, [2]Italian Institute of Technology

1-C-22 ***The influence of pitch modulation on the performance of a BCI-based language training system.***

Simon Kojima[1], Mariacristina Musso[2], Crispijn Aalberts[3], Benjamin Kortenbach[3], Sara Milo?evska[3], Kim de Wit[3], Shin'ichiro Kanoh[1], Michael Tangermann[3]
[1]Shibaura Institute of Technology, [2]University Medical Center Freiburg, [3]Radboud University

1-C-23 ***Towards adaptive gait generation for BMI-driven lower limb exoskeleton***

Emanuele Menegatti[1], Edoardo Trombin[2], Stefano Tortora[1], Luca Tonin[1]

[1]University of Padova, [2]The Univ. of Padua

1-C-24 ***Quasi-movements as a model of attempted movements: an alternative to motor imagery in brain-computer interfaces***

Sergei Shishkin[1], Sergei Shishkin[1], Daniil Berdyshev[2], Artem Yashin[1], Alexey Zabolotniy[3], Alexey Ossadtchi[3], Anatoly Vasilyev[1]

[1]Moscow State University of Psychology and Education, [2]Moscow Institute of Physics and Technology, [3]Higher School of Economics

1-C-25 ***Do nature documentaries affect event-related desynchronization (ERD) induced by motor imagery neurofeedback?***

Jennifer Decker[1], Jennifer Decker[1], Mareike Daeglau[1], Catharina Zich[2], Cornelia Kranczioch[1]

[1]University of Oldenburg, [2]University of Oxford

1-C-26 ***Online information-based stimulus optimization for P300-based brain-computer interfaces***

Xinlin Chen[1], Leslie Collins[1], Boyla Mainsah[1]

[1]Duke University

1-C-27 ***What brain patterns should we reinforce during BCI training procedures targeting motor imagery abilities?***

Margaux Izac[1], Margaux Izac[1], Eléa Rossignol[1], Léa Pillette[2], Franck Di Rienzo[3], Etienne Guillaud[1], Aymeric Guillot[3], Thomas Michelet[1], Bernard N'Kaoua[1], Camille Jeunet[1]

[1]University of Bordeaux, [2]University of Rennes, [3]University of Lyon

1-C-28 ***Leveraging deep state-space models for silent speech decoding***

Guy Wilson[1], Reshef Elisha[1], Tyler Benster[1], Yeongjun Lee[1], Krishna Shenoy[1], Jaimie Henderson[1], Zhenan Bao[1], Shaul Druckmann[1]

[1]Stanford University

1-C-29 ***NeuroExo: a low cost non invasive brain computer interface for upper-limb stroke neurorehabilitation at home***

Juan Jose Gonzalez Espana[1], Alex Craik[1], Ayman Alamir[1], Jeff Feng[1], Jose Luis Contreras-Vidal[1]

[1]University of Houston

1-D-30 ***The detection of windows of consciousness in locked-in patients***

Tomko Settgast[1], Tomko Settgast[1], Andrea Kübler[2], Federico Zilio[3]

[1]University of Wuerzburg, [2]University of Würzburg, [3]University of Padova

1-D-31 ***Brain-computer interface training fosters perceptual learning***

Deland Liu[1], Deland Liu[1], Fumiaki Iwane[1], Minsu Zhang[1], Jose del R. Millan

[1]University of Texas at Austin

1-D-32 ***Event-related potential to visual cues in motor imagery brain-computer interface***

Daeun Gwon[1], Daeun Gwon[1], Minkyu Ahn[1], Sung Chan Jun[2]

[1]Handong Global University, [2]Gwangju Institute of Science and Technology

1-D-33 ***Labeling mental fatigue for passive BCI applications: accuracy vs applicability tradeoff***

Marcel Hinss[1], Emilie Jahanpour[2], Anke Brock[3], Raphaëlle Roy[4]

[1]ISAE-SUPAERO / ENAC, [2]ISAE-SUPAERO, [3]ENAC, [4]University of Toulouse

1-D-34 ***Interpersonal physiological synchrony based BCI: a perspective***

Anne-Marie Brouwer[1], Anne-Marie Brouwer[1], Ivo Stuldreher[1], Jan van Erp[1]

[1]TNO

1-D-35 ***Detecting bluffing in a two-player game with passive brain-computer interfaces: implications for human-machine interaction***

Diana Gherman[1], Laurens Krol, Thorsten Zander

[1]Chair of Neuroadaptive Technology at Brandenburg University of Technology

1-D-36 ***Improving EEG brain-to-text models with transfer learning from spoken audio data***

Carlos Valle[1], Carlos Valle[1], Carolina Mendez-Orellana[1], Christian Herff[2], María Rodríguez Fernández[1]

[1]Pontificia universidad católica de chile, [2]University of Maastricht

1-D-37 ***Calibration methods during EEG signal acquisition and their impact on motor imagery decoding***

Arnau Dillen[1], Arnau Dillen[1], Fakhreddine Ghaffari[2], Olivier Romain[2], Bram Vanderborght[1], Kevin De Pauw[1]

[1]Vrije Universiteit Brussel, [2]CY Cergy Paris Université

1-D-38 ***Cortico-muscular coupling to control a hybrid brain-computer interface for upper limb motor rehabilitation***

Valeria de Seta[1], Valeria de Seta[1], Floriana Pichiorri[2], Emma Colamarino[1], Rita Molle[3], Filippo Castellani[3], Febo Cincotti[1], Donatella Mattia[2], Jlenia Toppi[1]

[1]Sapienza University of Rome, [2]Fondazione Santa Lucia, [3]Neuroelectrical Imaging and BCI Lab Fondazione Santa Lucia, Rome, Italy

1-D-39 ***Detecting threat detection***

Naomi du Bois[1], Leah Hudson[1], José Sanchez-Bornot[1], Niall McShane[1], Damien Coyle[1]

[1]Ulster University

1-D-40 ***Comparison of BCI headsets for at-home use by children with complex needs***

Eli Kinney-Lang[1], Eli Kinney-Lang[1], Daniel Comadurán Márquez[2], Erica Floreani[1], Adam Kirton[1], Ephrem Zewdie[3]

[1]Alberta Children's Hospital & University of Calgary, [2]University of Calgary / Hotchkiss Brain Institute, [3]BCI4Kids, University of Calgary/Alberta Children's Hospital

1-D-41 ***EEG-SimpleConv, an efficient and fast architecture for motor imagery EEG classification***

Ghaith Bouallegue[1], Giulia Lioi[1]

[1]IMT Atlantique

1-D-42 ***Feature selection algorithms to optimize corticomuscular coherence-based BCI for hand motor rehabilitation***

Emma Colamarino[1], Emma Colamarino[1], Valeria de Seta[1], Floriana Pichiorri[2], Jlenia Toppi[1], Donatella Mattia[2], Febo Cincotti[1]

[1]Sapienza University of Rome, [2]Fondazione Santa Lucia

1-D-43 ***Predicting high-quality movements in post-stroke motor rehabilitation from EEG***

Philipp Raggam[1], Philipp Raggam[1], Christoph Zrenner[2], Eric McDermott[3], Ulf Ziemann[3], Moritz Grosse-Wentrup[1]

[1]University of Vienna, [2]University of Toronto, [3]University of Tübingen

1-E-44 ***Inner speech decoding from EEG and MEG***

Richard Csaky[1], Mats W. J. van Es[1], Oiwi Parker Jones[1], Mark Woolrich[1]

[1]University of Oxford

1-E-45 ***Automatic tagging of BCI artefacts using computer vision***

Peter Redmond[1], Ahsan Awais[1], Tomas Ward[1]

[1]Dublin City University

1-F-46 ***Using autoencoders to denoise cross-session non-stationarity in EEG-based motor-imagery brain-computer interfaces***

Oren Shriki[1], Oren Shriki[1], Oren Shriki[1], Ofer Avin[1], Roman Rosipal[2]

[1]Ben-Gurion University, [2]Slovak Academy of Sciences

1-F-47 ***Longitudinal intervention of VR-based BCI training: a case study of chronic stroke patients***

Athanasios Vourvopoulos[1], Diego Blanco-Mora, Audrey Aldridge[2], Carolina Jorge, Jean-Claude Fernades, Patricia Figueiredo[1], Sergi Bermudez i Badia[3]

[1]Instituto Superior Técnico, [2]Mississippi State University, [3]University of Madeira

1-F-48 ***EEG-based motor imagery classification using machine and deep learning***

Pauline Jonassen[1], Helene Lønvik[1]

[1]NTNU

1-F-49 ***Towards user-centric BCI design: Markov chain-based user assessment for mental imagery EEG-BCIs***

Nicolas Ivanov[1], Nicolas Ivanov[1], Tom Chau[1]

[1]University of Toronto

1-F-50 ***Riemannian transfer learning for pediatric brain-computer interfaces (BCI)***

Brian Irvine[1], Joanna Keough[2], Eli Kinney-Lang[1], Hatem Abou-Zeid[2], Adam Kirton[1]

[1]Alberta Children's Hospital & University of Calgary, [2]University of Calgary

1-F-51 ***Pseudo online framework***

Igor Carrara[1], Théodore Papadopoulo[2]

[1]INRIA, [2]Université Côte d'Azur

1-F-52 ***Neural tracking of acoustic onsets: towards understanding the brain beyond the lab***

Thorge Haupt[1], Thorge Haupt[1], Martin Bleichner[1]

[1]Carl von Ossietzky Universität Oldenburg

1-F-53 ***Contrastive self-supervised learning for motor imagery: impact of the embedding size***

Valerie Marissens Cueva[1], Valerie Marissens Cueva[1], Laurent Bougrain[2]

[1]Université de Lorraine, CNRS, Loria, Neurorhythms team, [2]Université de Lorraine

1-F-54 ***Denoising acoustic-induced vibration artifact in intracranial EEG recordings via a phase-coupling decomposition method***

Victoria Peterson[1], Victoria Peterson[1], Matteo Vissani[2], Shiyu Luo[3], Qinwan Rabbani[3], Nathan Crone[3], Alan Bush[2], Robert Richardson[2]

[1]Consejo Nacional de Investigaciones Científicas y Técnicas, [2]Massachusetts General Hospital, Harvard Medical School, [3]The Johns Hopkins University School of Medicine

1-F-55 ***Optimizing feature selection for word decoding with high-density ECoG***

Julia Berezutskaya[1]

[1]Brain Center, University Medical Center Utrecht

1-F-56 ***Using general-purpose meta-learning algorithms to train a BCI classifier on less data***

Daniil Berdyshev[1], Daniil Berdyshev[1], Artem Grachev, Sergey Shishkin[2], Bogdan Kozyrskiy[3]

[1]Moscow Institute of Physics and Technology, [2]Moscow State University of Psychology and Education (MSUPE), [3]EURECOM

1-F-57 ***A model-based dynamic stopping method for c-VEP BCI***

Sara Ahmadi[1], Peter Desain[2]

[1]Radboud university, Donders Center for Cognition, [2]Radboud University

1-F-58 ***Effectiveness of cross-frequency phase-amplitude covariance as additional features for Riemannian BCIs***

Maria Sayu Yamamoto[1], Sylvain Chevallier[2], Fabien Lotte[3]

[1]LISN, Université Paris-Saclay, [2]Université Paris-Saclay, [3]University of Bordeaux

1-F-59 ***Modeling local neural population responses to intracortical microstimulation.***

Joel Ye[1]

[1]Carnegie Mellon University

1-F-60 ***Offline prediction of prolonged acute pain by means of convolutional neural network model applied to electroencephalographic oscillatory connectivity***

Yiyuan Han[1], Elia Valentini[1], Sebastian Halder[1]

[1]University of Essex

1-G-61 ***Randomized pilot study: BCI with FES motor priming to enhance the effect of physical therapy***

Aleksandra Vuckovic[1], Radha Kumari[1], Mariel Purcell[2], Aleksandra Dybus[1]

[1]University of Glasgow, [2]Queen Elizabeth University Hospital

1-G-62 ***Tackling motor imagery based BCI illiteracy through a novel augmented reality paradigm***

Elena Fenoglio[1]

[1]Italian Institute of Technology

1-G-63 ***Introducing design ideas for an interactive BCI online forum with a mixed-method qualitative and quantitative approach***

Philipp Ziebell[1], Philipp Ziebell[1], Aurélie Modde[1], Ellen Roland[1], Matthias Eidel[1], Mariska Vansteensel[2], Natalie Mrachacz-Kersting[3], Theresa Vaughan[4], Andrea Kübler[1]

[1]University of Würzburg, [2]UMC Utrecht Brain Center, [3]Aalborg University Hospital, [4]Samuel Stratton VA Medical Center

1-G-64 ***EEG oscillatory correlates of aesthetic experience ? A review***

Marc Welter[1], Marc Welter[1], Fabien Lotte[2]

[1]Inria Bordeaux, [2]University of Bordeaux

1-G-65 ***Cybersickness in virtual reality neurofeedback trainings***

Lisa Berger[1], Guilherme Wood[1], Silvia Kober[1]

[1]University of Graz

1-G-66 ***What can we learn from user interviews in BCI sessions?***

Aline Roc[1], Aline Roc[1], Fabien Lotte[1]

[1]University of Bordeaux

1-G-67 ***Care professionals' perspectives on BCI needs in children and adolescents with severe cerebral palsy***

Malinda Verberne[1], Mariana Branco[1], Marjolijn Ketelaar[2], Joke Geytenbeek[3], Marieke van Driel-Boerrigter[4], Marike Willems[4], Kim Rabbie-Baauw[5], Mariska Vansteensel[1]

[1]UMC Utrecht Brain Center, [2]UMC Utrecht Brain Center, De Hoogstraat Rehabilitation, [3]UMC Amsterdam, [4]Patient Association CP Nederland, [5]Baauwopmij

1-G-68 ***The role of agency in neurofeedback performance***

Claire Dussard[1], Léa Pillette[2], Laurent Hugueville[3], Camille Jeunet[4], Nathalie George[5]

[1]Sorbonne Université, [2]University of Rennes, [3]Paris Brain Institute, [4]University of Bordeaux, [5]Sorbonne University

1-G-69 ***Using a pre-trained neural language model to make character predictions for brain-computer interfaces***

Dylan Gaines[1], Keith Vertanen[1], Consortium for Accessible Multimodal Brain-Body Interfaces

[1]Michigan Technological University

1-G-70 ***The effect of gamified calibration environments on P300 and MI BCI performance in children***

Dion Kelly[1], Brian Irvine[2], Eli Kinney-Lang[2], Daniel Comadurán Márquez[1], Adam Kirton[2]

[1]University of Calgary / Hotchkiss Brain Institute, [2]Alberta Children's Hospital & University of Calgary

SESSION 2

Thursday, June 8 15:45-17:15

2-A-1 ***Continuous speech synthesis and articulatory kinematics decoding from intracortical neural activity***

Maitreyee Wairagkar[1], Maitreyee Wairagkar[1], Leigh Hochberg[2], David Brandman[1], Sergey Stavisky[1]

[1]University of California - Davis, [2]Massachusetts General Hostpital

2-A-2 ***Decoding hand kinematics from brain-wide distributed neural recordings***

Maarten Ottenhoff[1], Maxime Verwoert[1], Sophocles Goulis[1], Albert Colon[2], Pieter Kubben[3], Maryam Shanechi[4], Omid Sani[4], Christian Herff[5]

[1]Maastricht University, [2]Kempenhaeghe, [3]Maastrich University, [4]University of Southern California, [5]University of Maastricht

2-A-3 ***Using transient, modality-specific neural responses to enhance decoding***

Brian Dekleva[1], Gary Blumenthal[1], Jennifer Collinger[1]

[1]University of Pittsburgh

2-A-4 ***Decoding attempted movements from human motor cortical activity recorded with a stentrode***

Nikole Chetty[1], Nikole Chetty[1], Kriti Kacker[1], James Bennet[2], Peter Yoo[2], Abbey Sawyer[3], Ashley Dalrymple[1], Devapratim Sarma[1], Dailyn Despradel[1], Noam Harel[3], David Lacomis[4], Shahram Majidi[3], Raul Nogueira[4], Katharine Hill[4], Jennifer Collinger[4], Adam Fry[2], Nicholas Opie[2], Thomas Oxley[2], David Putrino[3], Douglas Weber[1]

[1]Carnegie Mellon University, [2]Synchron Inc, [3]Mount Sinai Hospital, [4]University of Pittsburgh

2-B-10 ***Actively multiplexed μECoG array based on thin-film electronics for high-resolution brain mapping - from the lab to the industry***

Paoline Coulson[1], Horacio Londoño Ramirez[1], Xiaohua Huang[1], Sofie Luijten[2], Marco Ballini[3], Carolina Mora Lopez[4], Kris Myny[5], Jan Genoe[1], Sebastian Haesler[1]

[1]Katholieke Universiteit Leuven, [2]Imec, Nerf, [3]TDK InvenSense, [4]Imec, [5]KU Leuven, Imec

2-B-11 ***Single unit recordings reveal high level role of precentral gyrus in speech production***

Benyamin Meschede-Krasa[1], Erin Kunz[1], Frank Willett[1], Foram Kamdar[1], Leigh Hochberg[2], Krishna Shenoy[1], Shaul Druckmann[1], Jaimie Henderson[1]

[1]Stanford University, [2]Massachusetts General Hostpital

2-B-12 ***Decoding speech intent from non-frontal cortical areas***

Prashanth Prakash[1], Prashanth Prakash[1], Jason Hsieh[1], Robert Flint[1], Joshua Rosenow[1], Matthew Tate[1], Marc Slutzky[1]

[1]Northwestern University

2-B-13 ***Biomimetic multi-channel ICMS conveys precise force feedback for bionic hands***

Charles Greenspon[1], Giacomo Valle[1], Taylor Hobbs[2], Jennifer Collinger[2], Robert Gaunt[2], Sliman Bensmaia[1]

[1]University of Chicago, [2]University of Pittsburgh

2-B-14 ***Biomimetic intracortical microstimulation improves percept naturalness in humans***

Taylor Hobbs[1], Taylor Hobbs[1], Charles Greenspon[1], Michael Boninger[1], Jennifer Collinger[1], Sliman Bensmaia[2], Robert Gaunt[1]

[1]University of Pittsburgh, [2]University of Chicago

2-B-15 ***Development of an iBCI system for control of a soft robotic glove***

Jake Gusman[1], Jacob Gusman[1], Diogo de Lucena[2], Tommy Hosman[3], Anastasia Kapitonava[4], Claire Nicolas[4], Diana Wagner[2], John Simeral[5], Carlos Vargas-Irwin[3], Conor Walsh[2], Leigh Hochberg[6]

[1]Brown University, [2]Harvard University, [3]Brown Univ./Brown Univ./Dept. of VA Med. Ctr., [4]Massachusetts General Hospital, [5]Dept. of VA Med. Ctr./Brown Univ./Brown Univ., [6]Massachusetts General Hostpital

2-B-5 ***Subdural ECoG recordings of high-frequency activity from a wireless implantable BMI device***

Tianfang Yan[1], Katsuyoshi Suzuki, Seiji Kameda[1], Masashi Mihara, Makoto Maeda, Masayuki Hirata

[1]Osaka University

2-B-6 ***Identification of tic onset biomarker from chronic recordings in centromedian thalamus and Globus Pallidus Interna for closed loop deep brain stimulation in Tourette syndrome***

Julieth Gómez[1], Aysegul Gunduz[1]

[1]University of Florida

2-B-7 ***Decoding articulatory trajectories during speech production from intracranial EEG***

Joaquín Amigó-Vega[1], Joaquín Amigó-Vega[1], Maxime Verwoert[2], Maarten Ottenhoff[2], Pieter Kubben[3], Christian Herff[4]

[1]Gran Sasso Science Institute, [2]Maastricht University, [3]Maastrich University, [4]University of Maastricht

2-B-8 ***Adaptive task designer for optimized training of a motor ECoG-based brain-computer interface: toward unassisted closed loop BCI training.***

Félix Martel[1], Félix Martel[1], Charlotte Quellec[2], Romain Guy[2], Guillaume Charvet[1], Stephan Chabardes[1], Tetiana Aksenova[3]

[1]Université Grenoble Alpes, [2]CEA, [3]Swiss Federal Institute of Technology Lausanne

2-B-9 ***Differentiable learning of image encodings for cortical visual neuroprosthetics through bio/phenomenologically-aware phosphene modeling***

Antonio Lozano[1], Maureen van der Grinten[2], Jaap de Ruyter van Steveninck[2], Antonio Lozano[1], Laura Pijnacker[2], Bodo Rückauer[2], Pieter Roelfsema[1], Marcel van Gerven[2], Richard van Wezel[2], Umut Güçlü[2], Yağmur Güçlütürk[2]

[1]Netherlands Institute for Neuroscience, [2]Donders Institute for Brain, Cognition and Behaviour

2-C-16 ***An experimental study to compare feature extraction approaches CSP, TSM and CSP-TSM for MI-BCI under distraction***

Mustapha Moufassih[1], Mustapha Moufassih[1], Ousama Tarahi[1], Soukaina Hamou[1], Said Agounad[1]

[1]Ibn Zohr University

2-C-17 ***Investigating the proper time to perform the motor imagery task in a multimodal BCI***

Tristan Venot[1], Arthur Desbois[1], Marie Constance Corsi[1], Laurent Hugueville[2], Ludovic Saint-Bauzel[3], Fabrizio De Vico Fallani[4]

[1]INRIA, [2]Paris Brain Institute, [3]ISIR, [4]Inria Paris - Paris Brain Institute

2-C-18 ***Predicting user goals based on simulated brain-computer interface inputs and robot sensor data***

Kirill Kokorin[1], Kirill Kokorin[1], Jing Mu[1], Sam John[1], David Grayden[1]

[1]University of Melbourne

2-C-19 ***Exploring wearable high density diffuse optical tomography (HD DOT) as a real-time BCI***

Akshat Sharma[1], Akshat Sharma[1], Fumiya Iida[1], Gemma Bale[1]

[1]Department of Engineering, Cambridge University

2-C-20 ***Riemannian vs. Linear P300 classification for a tactile Brain-Computer-Interface in an end-user single-case study***

Maria Pfeiffer[1], Maria Pfeiffer[1], Matthias Eidel[1], Wolfgang Tröger, Thomas Giesler, Andrea Kübler[1]

[1]University of Würzburg

2-C-21 ***Transcutaneous electrical spinal stimulation fosters motor imagery skill acquisition***

Hussein Alawieh[1], Deland Liu[1], Jonathon Madera[1], Satyam Kumar[2], Frigyes Samuel Racz[1], Ann Majewicz Fey[1], Jose del R Millán[2]

[1]University of Texas at Austin, [2]The University of Texas at Austin

2-C-22 ***Co-adaptive BCI based on supervised domain adaptation: results in motor imagery simulated data***

Valeria Spagnolo[1], Valeria Spagnolo[1], Catalina Galvan[1], Nicolás Nieto[2], Diego Milone[3], Ruben Spies[1], Victoria Peterson[4]

[1]Instituto de Matemática Aplicada del Litoral, [2]UNL-CONICET, [3]Instituto de Investigación en Señales, [4]Consejo Nacional de Investigaciones Científicas y Técnicas

2-C-23 ***Neurofeedback for increasing sense of presence in virtual reality***

Loic Botrel[1], Loic Botrel[1], Andrea Kübler[1]

[1]University of Würzburg

2-C-24 ***Transitional gestures for enhancing ITR and accuracy in movement-based BCIs***

Tan Gemicioglu[1], Yuhui Zhao[1], Melody Jackson[1], Thad Starner[1]

[1]Georgia Institute of Technology

2-D-25 ***EEG channel selection based on feature importance for epileptic seizure classification***

Marie Øverby[1], Marie Øverby[1], Luis Moctezuma[2], Marta Molinas[1]

[1]Norwegian University of Science and Technology, [2]University of Tsukuba

2-D-26 ***Source analysis of directed brain connectivity during opposite neurofeedback tasks***

Ioana Susnoschi-Luca[1], Ioana Susnoschi-Luca[1], Aleksandra Vuckovic[1]

[1]University of Glasgow

2-D-27 ***Virtual physical model-based brain switch via periodic SSVEP modulation for asynchronous brain-computer interfacing***

Songwei Li[1], Songwei Li[1], Jianjun Meng[1]

[1]Shanghai Jiao Tong University

2-D-28 ***Brain-computer interface for treatment of focal dystonia***

Stefan Ehrlich[1], Garrett Tougas[1], Kristina Simonyan[1]
[1]Mass Eye and Ear, Harvard Medical School

2-D-29 ***Improving motor imagery detection with a BCI based on somesthetic non invasive stimulations***

Sébastien Rimbert[1]
[1]University of Bordeaux

2-D-30 ***EEG and EMG graph CNN for upper limb movement classification***

Stefano Tortora[1], Alessio Palatella[1], Stefano Tortora[1], Luca Tonin[1], Manfredo Atzori[1]
[1]University of Padova

2-D-31 ***Detecting focus states in office environment with neurable EEG headset***

Alicia Howell-Munson[1], Alicia Howell-Munson[1], Walter Piper[2], Theresa Guarrera, David Stanley[3], Davide Valeriani, Michelle Lim[2], Ramses Alcaide[2]
[1]Worcester Polytechnic Institute, [2]Neurable Inc., [3]Neurable Inc

2-D-32 ***Assessing the impact of transcranial direct current stimulation (tDCS) on the enhancement of race driving skills***

Mushfika Sultana[1], Mushfika Sultana[1], LUCIAN GHEORGHE[2], Serafeim Perdikis[1]
[1]University of Essex, [2]Advanced Materials and Processing Laboratory, Nissan Research Center, Nissan Motors Co. Ltd,

2-D-33 ***EMG modulation evoked by classical BCI tasks as a potential control signal for movement augmentation***

Patrick Ofner[1], Patrick Ofner[1], Meng-Jung Lee[1], Dario Farina[2], Carsten Mehring[1]
[1]University of Freiburg, [2]Imperial College London

2-D-34 ***Changes in the movement-related cortical potential when exposed to a pure motoric dual task***

Jan Karsten[1], Jan Karsten[1], Andres Gonzalez[1], Natalie Mrachacz-Kersting[2]
[1]University of Freiburg, [2]Aalborg University Hospital

2-D-35 ***Let's move: case studies in learning basic power mobility skills using BCI***

Danette Rowley[1], Corinne Tuck[2], Erica Floreani[3], Leah Hammond[2], Joanna Keough[1], Eli Kinney-Lang[3], John Andersen[2], Adam Kirton[3]
[1]University of Calgary, [2]Glenrose Rehabilitation Hospital, [3]Alberta Children's Hospital & University of Calgary

2-D-36 ***Cross-task transfer learning in emotion estimating BCI***

Nazmun Nahar Khan[1], Nazmun Nahar Khan[1], David E. Thompson[1]
[1]Kansas State University

2-D-37 ***Joie: an affective brain-computer interface (BCI) for learning mental strategies for positive affect***

Angela Vujic[1], Angela Vujic[1], Shreyas Nisal[1], Ashley Martin[1], Pattie Maes[1]
[1]MIT

2-E-38 ***Decoding single and paired phonemes using 7 T functional MRI***

Maria de Araújo Vitória[1], Francisco Guerreiro Fernandes[2], Max van den Boom[3], Nick Ramsey[4], Mathijs Raemaekers[2]
[1]Maastricht University, [2]University Medical Center Utrecht, [3]Mayo Clinic, [4]UMC Utrecht Brain Center

2-E-39 ***Actively multiplexed μECoG array based on thin-film electronics for high-resolution brain mapping***

Horacio Londoño Ramírez[1], Horacio Londoño Ramírez[1], Xiaohua Huang[1], Jordi Cools[2], Anna Chrzanowska[3], Paoline Coulson[1], Clément Brunner[3], Marco Ballini[4], Nick Van Helleputte[5], Carolina Mora Lopez[5], Jan Genoe[1], Sebastian Haesler[1]
[1]Katholieke Universiteit Leuven, [2]Imec, Nerf, [3]KU Leuven, Nerf, [4]TDK InvenSense, [5]Imec

2-F-40 ***Empirical evaluation on multiple BCI datasets of the functional connectivity ensemble (FUCONE) method***

Marie-Constance Corsi[1], Sylvain Chevallier[2], Fabrizio De Vico Fallani[1], Florian Yger[3]
[1]Inria Paris - Paris Brain Institute, [2]Université Paris-Saclay, [3]PSL, Université Paris Dauphine - Greyc, ENSICAEN

2-F-41 ***Inter-stimulus latency jitter in RSVP keyboard: effects on attentional event-related potentials***

Daniel Klee[1], Daniel Klee[1], Tab Memmott[1], Barry Oken[1], Consortium for Accessible Multimodal Brain-Body Interfaces (CAMBI)[1]
[1]Oregon Health & Science University

2-F-42 ***Classifier-based latency estimation for covert attention ERP decoding***

Arne Van Den Kerchove[1], Hakim Si-Mohammed[2], Marc Van Hulle[3], François Cabestaing[4]
[1]KU Leuven, Université de Lille, [2]University of Lille, [3]KU Leuven, [4]Université de Lille

2-F-43 ***Validation of an automated EEG artifact removal tool for eye movement and muscle artifacts***

Daniel Comadurán Márquez[1], Daniel Comadurán Márquez[1], Brian Irvine[2], Adam Kirton[2], Eli Kinney-Lang[2]

[1]University of Calgary / Hotchkiss Brain Institute, [2]Alberta Children's Hospital & University of Calgary

2-F-44 ***PIEEG: Performance evaluation of a motor imagery based BCI on a low-cost, Raspberry Pi 4***

Oluwagbenga Paul Idowu[1], Oluwagbenga Idowu[1], Eli Kinney-Lang[2], Adam Gulamhusein[3], Brian Irvine[2], Adam Kirton[2], Hatem Abou-Zeid[3]

[1]University of Calgary/ Alberta Children's Hospital, [2]Alberta Children's Hospital & University of Calgary, [3]University of Calgary

2-F-45 ***Ultra-high-density electrocorticography recordings of the human sensorimotor cortex***

Simon Geukes[1], Simon Geukes[1], Mariana Branco[1], Giovanni Piantoni[1], Erik Aarnoutse[1], Nick Ramsey[1]

[1]UMC Utrecht Brain Center

2-F-46 ***Shared brain activity during the creative process and dance performance of LiveWire***

Derek Huber[1], Derek Huber[1], Maxine Pacheco-Ramírez[2], Mauricio Ramírez-Moreno[2], Anthony Brandt[3], Andy Noble[4], Dionne Noble[4], Jose Contreras-Vidal[1]

[1]University of Houston, [2]Tecnologico de Monterrey, [3]Rice University, [4]NobleMotion Dance Company

2-F-47 ***Detection of movement preparation-related slow cortical potentials using Riemannian geometry and template matching***

Frigyes Racz[1], Satyam Kumar[1], Rawan Fakhreddine[2], José del R Millán[1]

[1]The University of Texas at Austin, [2]Carnegie Mellon University

2-F-48 ***Neural network transfer learning with fast calibration for mental imagery decoding***

Pierre Guetschel[1], Pierre Guetschel[1], Théodore Papadopoulo[2], Michael Tangermann[1]

[1]Donders Institute for Brain, Cognition and Behaviour, [2]Université Côte d'Azur

2-F-49 ***Neural correlates of continuous feedback processing during the execution of a 2D driving task***

Hannah Pulferer[1], Cuntai Guan[2], Gernot Müller-Putz[1]

[1]Graz University of Technology, [2]Nanyang Technological University

2-F-50 ***N2pc-based decoding of covert visual spatial attention is independent of stimulus predictability***

Christoph Reichert[1], Christoph Reichert[1], Stefan Dürschmid[1], Franziska Tittel[2], Hermann Hinrichs[2]

[1]Leibniz Institute for Neurobiology, [2]Otto-von-Guericke University

2-F-51 ***Robust representation learning from corrupted EEG with contrastive learning***

Farzaneh Taleb[1], Farzaneh Taleb[2], Miguel Vasco[3], Nona Rajabi[2], Danica Kragic[2]

[1]Robotics, Perception and Learning Division, EECS, KTH Royal Institute of Technology, Stockholm, Sweden, [2]Robotics, Perception and Learning Division, EECS, KTH Royal Institute of Technology, Stockholm, Swed, [3]INESC-ID & Instituto Superior Técnico, University of Lisbon, Portugal

2-F-52 ***Development of an EEG-EMG processing pipeline and Graphical User Interface for analysis, recognition, and peak-negativity detection of movement-related cortical potentials***

Jose Jesus Hernandez Gloria[1], Jose Jesus Hernandez Gloria[1], Andres Jaramillo Gonzalez[1], Natalie Mrachacz-Kersting[2]

[1]Institut für Sport und Sportwissenschaft Albert-Ludwigs-Universität Freiburg, [2]Aalborg University Hospital

2-F-53 ***Towards including covariates in EEG classification - a preliminary study on simulated data***

David Trocellier[1], Fabien Lotte[2], Bernard N'Kaoua[2]

[1]Bordeaux University, [2]University of Bordeaux

2-F-54 ***Electrovascular phase-amplitude coupling during an auditory task***

John McLinden[1], Chetan Kumar[2], Neela Rahimi[2], Ming Shao[2], Kevin Spencer[3], Yalda Shahriari[1]

[1]University of Rhode Island, [2]University of Massachusetts, Dartmouth, [3]Boston VA Medical Center

2-F-55 ***EEG indices of responsiveness in minimally conscious state***

Valentina Galiotta[1], Valentina Galiotta[1], Ilaria Quattrociocchi[2], Valentina Caracci[1], Jlenia Toppi[2], Mariagrazia D'Ippolito[1], Pietro Aricò[2], Donatella Mattia[1], Febo Cincotti[2], Rita Formisano[1], Angela Riccio[1]

[1]Fondazione Santa Lucia, [2]Sapienza University of Rome

2-F-56 ***The theta-to-alpha ratio represents a convenient task independent measure of brain workload***

Romain Cardis[1], Claire Lugrin[2], Skander Mensi[1], Robert Leeb[1]

[1]MindMaze, [2]University of Zurich

2-F-57 ***Advancing artifact handling in BCI research: from filtering to non-neuronal artifacts***

Tab Memmott[1], Tab Memmott[1], Daniel Klee[1], Basak Celik[2], Betts Peters[1], Niklas Smedemark-Margulies[2], Melanie Fried-Oken[1], Barry Oken[1], Consortium of Accessible Multimodal Brain-Body Interfaces[1]

[1]Oregon Health & Science University, [2]Northeastern University

2-F-58 ***Assessing the potential of VASO-fMRI to determine which cortical layer offers the best motor decodability for ECoG BCI***

Maria Kromm[1], Maria Kromm[1], Mathijs Raemaekers[1], Nick Ramsey[2]

[1]University Medical Center Utrecht, [2]UMC Utrecht Brain Center

2-F-59 ***Decoding visual scenes from visual cortex spikes using deep learning***

Alex McClanahan[1], Alexander McClanahan[1], Matthew Moench[2], Brian Kim[3]

[1]University of Arkansas for Medical Sciences, [2]College of Medicine, University of Central Florida, [3]Bioelectronics Lab, University of Central Florida

2-F-60 ***Continuous mental state estimation using EEG band power time series predictions.***

José Moedano-Atristain[1], José Moedano-Atristain[1], Óscar Yáñez-Suárez[1], Erik Bojorges-Valdez[2]

[1]Universidad Autónoma Metrolopitana, [2]Universidad Iberoamericana Ciudad de México

2-G-61 ***EEG biomarkers of working memory, attention, and fatigue***

Ángel Blanco[1], Karan Chugani[1], Aureli Soria-Frisch[1]

[1]Starlab Barcelona S.L.

2-G-62 ***Individuals with neurodegenerative disease discuss values about the speed-accuracy trade-off in communication BCIs***

Melanie Fried-Oken[1], Michelle Kinsella[1], Ian Stevens[1], Eran Klein[1]

[1]Oregon Health & Science University

2-G-63 ***Does gender matter in motor imagery BCIs?***

Maryam Alimardani[1], Valentina Gamboa von Groll[1], Nikki Leeuwis[1], Sébastien Rimbert[2], Aline Roc[2], Léa Pillette[3], Fabien Lotte[2]

[1]Tilburg University, [2]University of Bordeaux, [3]University of Rennes

2-G-64 ***A large-scale study on the general public to assess and model the acceptability of BCIs dedicated to motor rehabilitation after stroke***

Elise Grevet[1], Elise Grevet[1], Kylliam Forge[2], Sébastien Tadiello, Margaux Izac[3], Franck Amadieu[4], Lionel Brunel[5], Léa Pillette[6], Jacques Py[7], David Gasq[8], Camille Jeunet[3]

[1]Université de Bordeaux, [2]CNRS, CLLE laboratory, [3]University of Bordeaux, [4]The French National Centre for Scientific Research, [5]Université Paul Valéry Montpellier 3, [6]University of Rennes, [7]University of Toulouse, [8]Centre Hospitalier Universitaire de Toulouse

2-G-65 ***Pediatric brain-computer interface (BCI) participant predictors and experiences: learnings from year 1 of a registry project***

Leah Hammond[1], Leah Hammond[1], Corinne Tuck[1], John Andersen[1]

[1]Glenrose Rehabilitation Hospital

2-G-66 ***A case study in BCI learning: preliminary results from a longitudinal BCI power mobility study***

Erica Floreani[1], Danette Rowley[2], Vella Kim[2], Eli Kinney-Lang[1], Adam Kirton[1]

[1]Alberta Children's Hospital & University of Calgary, [2]University of Calgary

2-G-67 ***Design and evaluation of a tangible and haptic BCI for upper limb rehabilitation after stroke***

Laurent Bougrain[1]

[1]Université de Lorraine

2-G-68 ***You've got mail: using telehealth to improve dissemination of brain-computer interfaces (BCIs) for communication and control***

Theresa Vaughan[1], Edward Hitchcock[2], Debra Zeitlin[3], Charles Carmack[1], Susan Heckman[1], Hadi Habibzadeh[1], Prerana Keerthi[1], James Norton[1], Colin Franz[2], Jonathan Wolpaw[1]

[1]Samuel Stratton VA Medical Center, [2]Shirley Ryan AbilityLab, [3]Bridging Voice

SESSION 3

Friday, June 9 15:45-17:15

3-A-1 *A shared-control framework for BCI control of various effectors: towards home-used BCIs*

Lucas Struber[1], Serpil Karakas[2], Angelina Bellicha[2], Louise Devigne[3], François Pasteau[3], Félix Martel[4], Violaine Juillard[2], Armand Castillejo[5], Stephan Chabardes[4], Tetiana Aksenova[6], Guillaume Charvet[4], Marie Babel[3]

[1]French Alternative Energies and Atomic Energy Commission, [2]CEA, [3]INRIA, [4]Université Grenoble Alpes, [5]STMicroelectronics, [6]Swiss Federal Institute of Technology Lausanne

3-A-2 *Distinct patterns of whole-body representation in human motor cortex and posterior parietal cortex*

Kelly Kadlec[1], Tyson Aflalo[1], Jorge Gamez[1], Charles Guan[1], Emily Rosario[2], Nader Pouratian[3], Richard Andersen[4]

[1]Caltech, [2]Casa Colina, [3]University of California, [4]California Institute of Technology

3-A-3 *Platform for closed-loop deep brain stimulation research: DAREPLANE*

Matthias Dold[1], Matthias Dold[1], Joana Pereira[2], Bastian Sajonz[2], Volker Coenen[3], Mark Janssen[4], Michael Tangermann[5]

[1]Radboud University, [2]University Medical Center of Freiburg University, [3]University of Freiburg, [4]Maastricht University Medical Center, [5]Radboud University Nijmegen

3-A-4 *Automated online optimal features selection for an ECoG-based motor brain-computer interface*

Tetiana Aksenova[1], Alexandre Moly[2], Alexandre Aksenov, Félix Martel[3], Guillaume Charvet[3], Stephan Chabardes[3]

[1]Swiss Federal Institute of Technology Lausanne, [2]Univ. Grenoble Alpes, CEA, LETI, CLINATEC, [3]Université Grenoble Alpes

3-A-5 *Tracking variability in subject state and iBCI performance over time*

William Hockeimer[1], William Hockeimer[1], Nicolas Kunigk[1], Brian Dekleva[1], Steven Chase[2], Michael Boninger[1], Jennifer Collinger[1]

[1]University of Pittsburgh, [2]Carnegie Mellon University

3-A-6 *BRAND: A platform for real-time deep network inference in closed-loop BCIs*

Yahia Ali[1], Kevin Bodkin[2], Mattia Rigotti-Thompson[3], Kushant Patel[4], Bareesh Bhaduri[5], Samuel Nason-Tomaszewski[6], Domenick Mifsud[6], Xianda Hou[4], Claire Nicolas[7], Shane Allcroft[8], Leigh Hochberg[9], Nicholas Au Yong[6], Sergey Stavisky[10], Lee Miller[2], David Brandman[10], Chethan Pandarinath[11]

[1]Georgia Tech & Emory University, [2]Northwestern University, [3]Emory University and Georgia Tech, [4]University of California, [5]Georgia Institute of Technology, [6]Emory University, [7]Massachusetts General Hospital, [8]Brown University, [9]Massachusetts General Hostpital, [10]University of California - Davis, [11]Georgia Institute of Technology & Emory University

3-A-7 *ECoG-based high-dimensional robotic control with shared autonomy*

Sarah Seko[1], Sarah Seko[1], Nikhilesh Natraj[1], Edward Chang[1], Karunesh Ganguly[1]

[1]University of California - San Francisco

3-B-8 *Decoding invasive brain signals using deep learning*

Mousa Mustafa[1], Timon Merk[2], Richard Köhler[2], Meera Chikermane[2], Jonathan Vanhoecke[2], Katharina Faust[2], Gerd-Helge Schneider[2], Andrea Kühn[2], Benjamin Blankertz[1], Wolf-Julian Neumann[2]

[1]TU Berlin, [2]Charite

3-B-9 *Scanning electron microscopy data of 980 intracortical microelectrodes, implanted in three humans for recording and stimulation of cortical networks*

David Bjånes[1], Loren Rieth[2], Spencer Kellis[3], Robert Nickl[4], Matthew Fifier[4], Brian Baker[5], Tyson Aflalo[6], Luke Bashford[1], Srinivas Chivukula[6], Luke Osborn[7], Breanne Christie[7], Brock Wester[7], Pablo Celnik[7], Nathan Crone[8], William Anderson[6], Kelsie Pejsa[1], Nader Pouratian[9], Brian Lee[3], Charles Liu[3], Francesco Tenore[7], Richard Andersen[1]

[1]California Institute of Technology, [2]West Virginia University, [3]Keck School of Medicine of USC, [4]APL, Johns Hopkins University, [5]University of Utah, [6]Caltech, [7]APL Johns Hopkins University, [8]The Johns Hopkins University School of Medicine, [9]University of California

3-C-10 *Real-time mobile robot obstacles detection and avoidance through EEG signals*

Karameldeen Omer[1]

[1]Università Politecnica delle Marche

3-C-11 *Recruiting neural field theory for motor imagery data augmentation*

Daniel Polyakov[1], Daniel Polyakov[1], Oren Shriki[1]

[1]Ben-Gurion University

3-C-12 ***Should robotic limb control mimic the human body? Effect of control strategies on bionic hand skill learning***

Hunter Schone[1], Malcolm Udeozor, Mae Moninghoff, Beth Rispoli, James Vandersea, Levi Hargrove, Blair Lock, Grace Edwards, Shruti Japee, Tamar Makin[2], Chris Baker

[1]National Institutes of Health, [2]University of Cambridge

3-C-13 ***A non-invasive EEG-based brain-machine interface for the control of myoelectric prostheses***

Corentin Piozin[1], Lisa Bouarroudj, Jean-Yves Audran[2], Brice Lavrard[3], Catherine Simon[3], Florian Waszak[1], Selim Eskiizmirliler[1]

[1]Integrative Neuroscience and Cognition Center, [2]Otto Bock France, [3]Institut Robert Merle d'Aubigné

3-C-14 ***A feasibility study on the development of a movement related cortical potential based brain-computer interface for communication in patients with amyotrophic lateral sclerosis***

Hatim Barioudi[1], Hatim Barioudi[1], Thomas Felderhoff[1], Andres Jaramillo-Gonzalez[2], Natalie Mrachacz-Kersting[3]

[1]University Dortmund of Applied Sciences and Arts, [2]University of Freiburg, [3]Aalborg University Hospital

3-C-15 ***Combining EEG and switch input in RSVP keyboard***

Betts Peters[1], Betts Peters[1], Basak Celik[2], Deirdre Galvin-McLaughlin[1], Tales Imbiriba[2], Michelle Kinsella[1], Dan Klee[1], Matt Lawhead[1], Shijia Liu[2], Tab Memmott[1], Niklas Smedemark-Margulies[2], Deniz Erdogmus[2], Barry Oken[1], Melanie Fried-Oken[1]

[1]Oregon Health & Science University, [2]Northeastern University

3-C-16 ***Decoding primary color responses in EEG signals with deep learning in the source space***

Simen Fløtaker[1], Simen Fløtaker[1], Andres Soler[2], Marta Molinas[1]

[1]Norwegian University of Science and Technology, [2]NTNU

3-C-17 ***Exploring recognition methods for asynchronous(un-cued) SSVEP-based BCI speller system***

Heegyu Kim[1], Kyungho Won[1], Minkyu Ahn[2], Sung Jun[1]

[1]GIST, [2]Handong Global University

3-C-18 ***Transfer learning promotes acquisition of individual BCI skills***

Satyam Kumar[1], Hussein Alawieh[2], Frigyes Racz[1], Rawan Fakhreddine[3], José Millán[1]

[1]The University of Texas at Austin, [2]University of Texas at Austin, [3]Carnegie Mellon University

3-C-19 ***ROS-Neuro: a common middleware for neural interfaces and robotic applications***

Luca Tonin[1], Stefano Tortora[1], Gloria Beraldo[2], Emanuele Menegatti[1]

[1]University of Padova, [2]National Research Council

3-C-20 ***Generalization across participants in continuous hand trajectory decoding***

Nitikorn Srisrisawang[1], Gernot Müller-Putz[1]

[1]Graz University of Technology

3-C-21 ***Mini-batch sampling strategies for data augmentation in MI-BCI decoding based on deep learning***

Catalina Galván[1], Catalina Galván[1], Ruben Spies[1], Diego Milone[2], Victoria Peterson[3]

[1]Instituto de Matemática Aplicada del Litoral, [2]Instituto de Investigación en Señales, [3]Consejo Nacional de Investigaciones Científicas y Técnicas

3-C-22 ***A comparison of stimulus sequences for code-modulated visual evoked potential (c-VEP) based BCI***

Jordy Thielen[1], Jordy Thielen[1], Gijs Cornielje[1], Floris van der Werff[1], Peter Desain[1]

[1]Radboud University

3-C-23 ***Early stopping strategies for P300 speller with Bayesian accumulation of Riemannian probabilities***

Sylvain Chevallier[1], Quentin Barthelemy[2], Raphaelle Bertrand-Lalo[3], Pierre Clisson[3]

[1]Université Paris-Saclay, [2]Foxstream, [3]Independent researcher

3-C-24 ***Enriched sensorimotor feedback modalities may increase upper extremity motor recovery in stroke survivors in a brain-computer interface mediated functional electrical stimulation***

Alexander Remsik[1], Peter L.E. van Kan[1], Veena Nair[1], Vivek Prabhakaran[1]

[1]University of Wisconsin- Madison

3-C-25 ***Predicting performance of a P300 speller using classifier-based latency estimation***

Taylor Sweet[1], Nazmun Khan[1], Chase Harvey[1], Seth Warschausky[2], Jane Huggins[2], David Thompson[1]

[1]Kansas State University, [2]University of Michigan

3-C-26 ***Do automatic artifact removal algorithms reduce accuracy by removing dependence on post-stimulus blinks***

Chase Harvey[1], Chase Harvey[1], David Chan[2], Taylor Sweet[1], Jane Huggins[3], David Thompson[1]

[1]Kansas State University, [2]KSU, [3]University of Michigan

3-D-27 ***Virtual mirror therapy with brain-computer interface and motor imagery***

Kup-Sze Choi[1], Shuang Liang[2]

[1]Hong Kong Polytechnic University, [2]Nanjing University of Posts and Telecommunications

3-D-28 ***Auditory high entropy response (A-HER): a new paradigm with high amplitude for potential auditory-BCI application***

Gan Huang[1], Xiaoqi Liang[1], Zhenxing Hu[1], Qianyun Zhu[1], Li Zhang[1], Zhen Liang[1], Linling Li[1], Zhiguo Zhang[2]

[1]Shenzhen University, [2]Harbin Institute of Technology

3-D-29 ***BCI-STAR Project: Associative brain computer interface for upper limb rehabilitation following stroke***

Benjamin Svejgaard[1], Benjamin Svejgaard[1], Andrew Stevensen[2], Helle Jørgensen[3], Boris Modrau[1], Strahinja Dosen[2], Natalie Mrachacz-Kersting[1]

[1]Aalborg University Hospital, [2]Aalborg University, [3]North Denmark Regional Hospital

3-D-30 ***EEG-based decoding of auditory attention using a deep attention network: revealing neural commonalities of selective attention across individuals***

Gabriel Ivucic[1], Saurav Pahuja[2], Siqi Cai[3], Haizhou Li[3], Tanja Schultz[4]

[1]Cognitive Systems Lab (CSL), University of Bremen, Germany, [2]Machine Listening Lab, University of Bremen, Germany, [3]Department of Electrical Engineering, National University of Singapore, Singapore, [4]University of Bremen

3-D-31 ***Distinct brain potential of balance perturbation and error processing***

Shayan Jalilpour[1], Shayan Jalilpour[1], Gernot Müller-Putz[2]

[1]Technical University of Graz, [2]Graz University of Technology

3-D-32 ***Design and evaluation of vibrotactile stimulus to support KMI-based neurofeedback***

Gabriela Herrera Altamira[1], Gabriela Herrera Altamira[1], Stéphanie Fleck[2], Anatole Lécuyer[3], Laurent Bougrain[1]

[1]Université de Lorraine, [2]Université de Lorraine, PErSEUs, [3]Université de Rennes

3-D-33 ***EEG potentials evoked by deep brain stimulation in patients with treatment-resistant depression***

Joana Pereira[1], Matthias Dold[2], Bastian Sajonz[1], Michael Tangermann[2], Volker Coenen[3]

[1]University Medical Center of Freiburg University, [2]Radboud University, [3]University of Freiburg

3-D-34 ***Re-Configuration of Resting state brain networks after BCI training in stroke patients***

Andrea Ranieri[1], Andrea Ranieri[1], Floriana Pichiorri[2], Jlenia Toppi[1], Emma Colamarino[1], Elena Mongiardini[1], Febo Cincotti[1], Donatella Mattia[2]

[1]Sapienza University of Rome, [2]Fondazione Santa Lucia

3-D-35 ***Long-term effect on EEG sensorimotor responsiveness to motor imagery after a BCI training for stroke rehabilitation***

Elena Mongiardini[1], Elena Mongiardini[1], Floriana Pichiorri[2], Emma Colamarino[1], Andrea Ranieri[1], Jlenia Toppi[1], Donatella Mattia[2], Febo Cincotti[1]

[1]Sapienza University of Rome, [2]Fondazione Santa Lucia

3-D-36 ***Effect of auditory stimuli on electroencephalography-based authentication***

Nibras Abo Alzahab[1], Angelo Di Iorio[1], Marco Baldi[1], Lorenso Scalise[1]

[1]Università Politecnica delle Marche

3-D-37 ***EEG for the stratification of brain stimulation response***

Aureli Soria-Frisch[1], Paulina Dagnino[2], Maike Splittgerber[3], Vera Moliadze[3], Claire Braboszcz[2], Eleni Kroupi[2]

[1]Starlab Barcelona S.L., [2]Starlab Barcelona SL, [3]Kiel University

3-D-38 ***A study on detection of frustration threshold using EEG-based brain-machine interface***

Milena Korostenskaja[1], Svetlana Blashchuk[2]

[1]The Institute of Neuroapproaches, [2]Vilnius University

3-D-39 ***Does my child know I'm here? EEG signatures of parental comfort for disorders of consciousness in critically ill children***

Araz Minhas[1], Eli Kinney-Lang[1], Kristine Woodward[2], Michael Esser[1], Adam Kirton[2]

[1]University of Calgary, [2]Alberta Children's Hospital & University of Calgary

3-E-40 ***Movement-related cortical potentials associated with single and multiple joint movements using a gel-free cap and a custom build amplifier***

Imran Khan Niazi[1], Usman Ghani[1], Mona Bruun Gyldenvang[2], Mads Jochumsen[2]

[1]New Zealand College Of Chiropractic, [2]Aalborg University

3-E-41*DUPE MIBCI: database with user's profile and EEG signals for motor imagery brain computer interface research*

Pauline Dreyer[1], Pauline Dreyer[1], Aline Roc[2], Sébastien Rimbert[2], Léa Pillette[3], Fabien Lotte[2]

[1]Inria, [2]University of Bordeaux, [3]University of Rennes

3-E-42 ***Investigating the impact of ecologically valid interactions on rapid serial visual presentation-based brain-computer interface performance***

Muhammad Ahsan Awais[1], Muhammad Ahsan Awais[1], Tomas Ward[1], Graham Healy[1]

[1]Dublin City University

3-E-43 ***Increased spatial resolution reveals separated EEG activation of individual finger movements***

Christoph Kapeller[1], Leonhard Schreiner[1], Sebastian Sieghartsleitner[1], Christoph Guger[1]

[1]g.tec medical engineering GmbH

3-F-44 ***An EEG source imaging BCI for movement decoding in youth with brain lesions***

Jason Leung[1], Masuma Akter[1], Tom Chau[2]

[1]Holland Bloorview Kids Rehabilitation Hospital, [2]University of Toronto

3-F-45 ***Deep learning-based diagnosis of tinnitus using EEG signals***

Byoung-Kyong Min[1], Byoung-Kyong Min[1], Eul-Seok Hong[1], Hyun-Seok Kim[2], Sung Kwang Hong[3], Dimitrios Pantazis[4]

[1]Korea University, [2]Asan Medical Center, [3]Hallym University College of Medicine, [4]Massachusetts Institute of Technology

3-F-46 ***Evaluating implant locations for a minimally invasive speech BCI***

Maxime Verwoert[1], Maxime Verwoert[1], Maarten Ottenhoff[1], Joaquín Amigó-Vega[2], Sophocles Goulis[1], Louis Wagner, Pieter Kubben[3], Christian Herff[4]

[1]Maastricht University, [2]Gran Sasso Science Institute, [3]Maastrich University, [4]University of Maastricht

3-F-47 ***What is the exact relationship between beta band activity and hand motor imagery?***

Sotirios Papadopoulos[1], Sotirios Papadopoulos[1], Maciej Szul[1], Marco Congedo[2], James Bonaiuto[3], Jérémie Mattout[4]

[1]University Lyon 1, [2]University Grenoble Alpes, [3]Institut de Sciences Cognitives Marc Jeannerod, CNRS, UMR5229, [4]Lyon Neuroscience Research Center, CRNL, INSERM U1028, CNRS, UMR5292

3-F-48 ***High-gamma band event detection improves stability of finger trajectories decoded from ECoG-LMP activity***

Eva Calvo Merino[1], Eva Calvo Merino[1], Axel Faes[1], Marc Van Hulle[1]

[1]KULeuven

3-F-49 ***Identifying sEEG contacts with auditory perception and speech production information: a pilot study***

Dean Krusienski[1], Christian Herff[2], Jerry Shih[3], Tanja Schultz[4], Pedram Zanganeh Soroush[1]

[1]Virginia Commonwealth University, [2]University of Maastricht, [3]UCSD Health, [4]University of Bremen

3-F-50 ***Characterizing neural representation and sleep architecture in early motor sequence learning using a chronic neural interface in patients with Parkinson's disease***

Kara Presbrey[1], Kara Presbrey[1], John Bernabei[2], Sravani Kondapavulur[1], Kenneth Louie[1], Alexis Giff[1], Philip Starr[3], Doris Wang[1]

[1]University of California San Francisco, [2]University of Pennsylvania, [3]University of California - San Francisco

3-F-51 ***Exploring the impacts of longitudinal BCI training for power mobility in children with physical disabilities***

Vella Shin-Hyung Kim[1], Daniel Comadurán Márquez[2], Danette Rowley[1], Erica Floreani[3], Joanna Keough[1], Eli Kinney-Lang[3], Adam Kirton[3]

[1]University of Calgary, [2]University of Calgary / Hotchkiss Brain Institute, [3]Alberta Children's Hospital & University of Calgary

3-F-52 ***Measuring presence in a virtual environment using electroencephalography: a study of breaks in presence using an oddball paradigm***

Emile Savalle[1], Léa Pillette[2], Ferran Argelaguet[1], Anatole Lécuyer[3], Marc Macé[4]

[1]Inria Rennes/IRISA, [2]University of Rennes, [3]Université de Rennes, [4]CNRS

3-F-53 ***Speech perception in the sensorimotor cortex: A potential source for false positives during speech-BCI control?***

Anouck Schippers[1], Anouck Schippers[1], Zac Freudenburg[1], Mariska Vansteensel[1], Nick Ramsey[1]

[1]UMC Utrecht Brain Center

3-F-54 ***TSMNet for BCI: online, unsupervised adaptation***

Reinmar Kobler[1], Motoaki Kawanabe[1]

[1]Advanced Telecommunications Research Institute International (ATR)

3-F-55 ***Stabilizing brain-computer interfaces through alignment of latent dynamics***

Brianna Karpowicz[1], Brianna Karpowicz[1], Yahia Ali[1], Lahiru Wimalasena[2], Andrew Sedler[2], Mohammad Reza Keshtkaran[1], Kevin Bodkin[3], Xuan Ma[3], Lee Miller[3], Chethan Pandarinath[4]

[1]Georgia Tech & Emory University, [2]Georgia Institute of Technology, [3]Northwestern University, [4]Georgia Institute of Technology & Emory University

3-F-56 ***Pole tracking of EEG signals for BCI applications***

Kyriaki Kostoglou[1], Kyriaki Kostoglou[1], Gernot Mueller-Putz[1]

[1]Graz University of Technology

3-F-57 ***UMM: Unsupervised classification of ERPs with confidence***

Michael Tangermann[1], Michael Tangermann[1], Jan Sosulski[2]

[1]Radboud University, [2]University of Freiburg

3-F-58 ***Testing of the designed protocol to investigate motor imagery in different mediums: a pilot study***

Sonal Santosh Baberwal[1], Sonal Santosh Baberwal[1], Tomas Ward[1], Shirley Coyle[1]

[1]Dublin City University

3-F-59 ***Cross-dataset few-shot learning for motor imagery BCI classification***

Yassine EL OUAHIDI[1], Nicolas Farrugia[1], Bastien Pasdeloup[1], Vincent Gripon[1], Giulia Lioi[1]

[1]IMT Atlantique

3-F-60 ***Network features for motor imagery-based brain-computer interfaces***

Juliana Gonzalez Astudillo[1], Juliana Gonzalez Astudillo[1], Fabrizio De Vico Fallani[2]

[1]Inria, [2]Inria Paris - Paris Brain Institute

3-F-61 ***Graph-based modeling of EEG: insights on neural data analytics for BCI applications***

Sarah Hosni[1], Sarah Hosni[1], John McLinden[1], Seyyed Bahram Borgheai[1], Shaotong Zhu[2], Sarah Ostaddabbas[2], Yalda Shahriari[1]

[1]University of Rhode Island, [2]Northeastern University

3-F-62 ***Towards BCI-based assessment of individual differences in color vision***

James Norton[1], Darren Gemoets[2], Theresa Vaughan[1]

[1]Samuel Stratton VA Medical Center, [2]United States Department of Veterans Affairs

3-F-63 ***Novel EEG network neuroscience features for dementia and awareness level estimation in passive BCI framework***

Tomasz Rutkowski[1], Tomasz Komendzinski[2], Mihokio Otake-Matsura[1]

[1]Riken, [2]Nicolaus Copernicus University

3-G-64 ***How do ethical concerns differ in active and passive brain-computer interfaces?***

Ronja Ronnback[1], Fenna Blom[1], Maryam Alimardani[1]

[1]Tilburg University

3-G-65 ***Mechanisms and impacts of brain-computer interface fatigue in children***

Joanna Keough[1], Joanna Keough[1], Brian Irvine[2], James Wrightson[3], Daniel Comadurán Márquez[4], Adam Kirton[2], Eli Kinney-Lang[2]

[1]University of Calgary, [2]Alberta Children's Hospital & University of Calgary, [3]University of British Columbia, [4]University of Calgary / Hotchkiss Brain Institute

3-G-66 ***Improving user experience and performance through gamification of MI-BCI training***

Fred Atilla[1], Fred Atilla[1], Maryam Alimardani[1], Marie Postma[1]

[1]Tilburg University

3-G-67 ***A writing aid for synchronous binary access methods (like some BCIs)***

Jeremy Hill[1]

[1]Stratton VA Medical Center

3-G-68 ***Why BCI-fi?***

Brendan Allison[1]

[1]UCSD

Thank you to our Sponsors

Blackrock Neurotech

Caltech Tianqiao and Chrissy Chen Institute for Neuroscience

Cyborg and Bionic Systems
A SCIENCE PARTNER JOURNAL

CHEN TIANQIAO & CHRISSY INSTITUTE

NEURO ABILITIES

G3ict

NCAN
National Center for Adaptive Neurotechnologies

NSF

NIH National Institutes of Health
Turning Discovery Into Health

OpenBCI

Science Robotics
AAAS

fwo Research Foundation Flanders
Opening new horizons

synchron

Wyss Center