 DOI: 10.3217/978-3-85125-533-1-00

Verlag der Technischen Universität Graz

http://ub.tugraz.at/Verlag

ISSN 2311-0422

ISBN 978-3-85125-533-1

DOI 10.3217/978-3-85125-533-1

Published by Verlag der TU Graz
Graz University of Technology

 DOI: 10.3217/978-3-85125-533-1-00

Welcome Note

From Vision to Reality

We have chosen our this year's conference title to summarize the current situation of BCI research in a very brief statement. On the one hand, we see that some of our ideas are still visions, far from any applications. Basic research is the state of those visions and we still need to lay the foundation to transform those visions into working systems. On the other hand, we see that first BCI systems come to patients in clinics and that they are used on regular basis. However, it is important to discuss the needs in the BCI field to bring more of our ideas, our visions into reality. Is it research funding? Do we have too few people in the field? Is it too interdisciplinary? Do we need big industry partners? All these questions are vivid and need to be addressed to achieve progress in the field of BCI research. This 7th Graz Brain-Computer Interface Conference (GBCIC2017) offers the opportunity for extensive discussions and exchange of ideas among BCI experts from more than 30 countries. We received more than 100 scientific contributions from roughly 300 authors. The scientific contributions have been peer-reviewed by at least two reviewers and collected in this present open access ebook.

For the Conference itself, we have been able to setup a colorful and multifaceted program. We are very happy that the GBCIC2017 has been officially endorsed by the BCI Society and that we will have an official Meeting of the BCI Society at the Conference. Further, we are lucky that outstanding experts in the field, Dr. A Bolu Ajiboye (Case Western Reserve University, & Louis Stokes Cleveland VA Medical Center, Cleveland, OH, USA), Prof. Benjamin Blankertz (Technische Universität Berlin, Germany), Dr. Fabien Lotte (Inria Bordeaux Sud-Ouest, France), and Dr. Natalie Mrachacz-Kersting (Aalborg University, Denmark), accepted our invitation to present keynote addresses at the Conference. As a special keynote, we present Prof. Fred D. Davis (Texas Tech University, Rawls College of Business, USA). He is a senior researcher in the field of user acceptance of information technology, technology supported decision making, skill acquisition, and NeuroIS. With his talk he will make a link between the BCI field and his research disciplines. Additionally, we have several Satellite Events prior and after the Conference. New in the program: the BCI Science Slam, an event where researchers can present their work in an entertaining way. Finally, we end the GBCIC2017 with a tour to the South Styrian Vineyards, like we did in the past years.

We hope that this conference contributes towards a strong scientific cooperation among our field, and we wish all participants an exciting, stimulating and productive Graz BCI Conference 2017!

Gernot R. Müller-Putz
Conference Chair

Published by Verlag der TU Graz
Graz University of Technology

 DOI: 10.3217/978-3-85125-533-1-00

Editorial Board

Prof. Dr. **Gernot R. Müller-Putz** is head of the Institute of Neural Engineering and its associated Laboratory of Brain-Computer Interfaces. He received his MSc in electrical and biomedical engineering in 2000, his PhD in electrical engineering in 2004 and his habilitation and “venia docendi” in medical informatics from Graz University of Technoloy in 2008. Since 2014 he is full professor for semantic data analysis. He has gained extensive experience in the field of biosignal analysis, brain-computer interface research, EEG-based neuroprosthesis control, communication with BCI in patients with disorders of consciousness, hybrid BCI systems, the human somatosensory system, and BCIs in assistive technology over the past 16 years. He has also managed several national projects (State of Styria) and international projects (Wings for Life, EU Projects) and is currently coordinator of the EU Horizon 2020 project “MoreGrasp”. Furthermore, he organized and hosted six international Brain-Computer Interface Conferences over the last 13 years in Graz. He is review editor of Frontiers in Neuroscience, special section neuroprosthetics, associate editor of IEEE Transactions in Biomedical Engineering and associate editor of the Brain-Computer Interface Journal. In 2014/15 he was guest editor in chief of a special issue of the Proceedings if the IEEE “The Plurality of Human Brain-Computer Interfacing”. He has authored more than 135 peer reviewed publications and more than 100 contributions to conferences which were cited more than 10000 times (h-index 47). Recently he was awarded with an ERC Consolidator Grant “Feel your Reach” from the European Research Council. In May 2017 he received the Ludwig-Guttman Award from the German Medical Spinal Cord Injury Association (DMGP).

David Steyrl is teaching and research assistant at the Institute of Neural Engineering (BCI-Lab), Graz University of Technology, Austria. He received his M.Sc. in electrical engineering with focus on biomedical engineering from Graz University of Technology in 2012. He (co-) authored more than 20 peer-reviewed journal and conference articles. Among others, he is reviewer for Journal of Neural Engineering, IEEE-TBME, IEEE-THMS, and Neuroimage. David Steyrl co-organized two major BCI conferences in Graz and he is founding member of the Graz BCI Racing Team MIRAGE91. His research interests include biosignal processing and machine learning for simultaneous EEG-fMRI and brain-computer interfaces. Currently he is working towards his PhD degree in computer science.

Selina Christin Wriessnegger is assistant professor at the Institute of Neural Engineering (BCI-Lab), Graz University of Technology, Austria. From 2001 to 2005 she was PhD student at the Max-Planck-Institute for Human Cognitive and Brain Sciences and received her PhD from the Ludwig-Maximilians University. During that time, she spent one year in Rome as research assistant at IRCCS (Fondazione Santa Lucia), Laboratory for Human Psychophysiology. From 2005 to 2008 she was university assistant at the Karl-Franzens-University Graz, section neuropsychology. From 2009 until May 2016 she was senior researcher at the Institute of Neural Engineering (BCI-Lab). In 2017 she was visiting professor at SISSA (Scuola Internazionale Superiore di Studi Avanzati), Trieste. Her research interests are subliminal visual information processing, neural correlates of motor imagery, novel applications of BCIs for healthy users, passive BCIs and embodiment of language acquisition.

Reinhold Scherer is associate professor and deputy head of the Institute of Neural Engineering at the Graz University of Technology, Austria. He is member of the Laboratory for Brain-Computer Interfaces (BCI-Lab) at Graz University of Technology and of the Institute for Neurological Rehabilitation and Research at the rehabilitation center Judendorf-Strassengel, Austria. In 2008 he received his PhD in computer science from Graz University of Technology, where, beginning in 2001, he worked on non-invasive electroencephalogram-based (EEG) brain-computer interfacing (BCI). He spend the years from 2008 to 2010 as postdoctoral researcher at the Department for Computer Science & Engineering, University of Washington, Seattle, USA, and was member of the Neural Systems and the Neurobotics Laboratories at the University of Washington.

Published by Verlag der TU Graz
Graz University of Technology

 DOI: 10.3217/978-3-85125-533-1-00

Organizing Committee

Conference Chair

Univ.-Prof. Dipl.-Ing. Dr.techn.
Gernot R. Müller-Putz
Institute of Neural Engineering
Graz University of Technology
Austria
(BCI Society Member)

Papers and Proceedings

Dipl.-Ing.
David Steyrl
Institute of Neural Engineering
Graz University of Technology
Austria

Students Awards

ing. Dr. MSc
Andreea I. Sburlea
Institute of Neural Engineering
Graz University of Technology
Austria

Social Media

MSc
Joana Pereira
Institute of Neural Engineering
Graz University of Technology
Austria
(BCI Society Member)

Advisor

Prof. Dipl.-Biol. Dipl.-Psych. Dr.rer.nat.
Andrea Kübler
Interventionspsychologie am Lehrstuhl für Psychologie I
Universität Würzburg
Germany
(BCI Society Board)

Satellite Events and Sponsoring

Assoc.Prof. Dipl.-Ing. Dr.techn.
Reinhold Scherer
Institute of Neural Engineering
Graz University of Technology
Austria
(BCI Society Member)

Poster Sessions

Ass.Prof. Mag.rer.nat. Dr.phil.
Selina C. Wriessnegger
Institute of Neural Engineering
Graz University of Technology
Austria

Administration

Petra Still
Institute of Neural Engineering
Graz University of Technology
Austria

Advisor

Prof. Dr.
Nicolas F. Ramsey
Brain Center Rudolf Magnus
University Medical Center Utrecht
The Netherlands
(BCI Society President)

Advisor

Assoc.Prof. Dr.
José del R. Millán
Defitech Foundation Chair in Brain-Machine Interface
École polytechnique fédérale de Lausanne EPFL
Switzerland
(BCI Society Board)

Published by Verlag der TU Graz
Graz University of Technology

 DOI: 10.3217/978-3-85125-533-1-00

Additional Local Staff

Local Arrangements

Dipl.-Ing.
Reinmar Kobler
Institute of Neural Engineering
Graz University of Technology
Austria

Program Folder

MSc
Catarina Lopes Dias
Institute of Neural Engineering
Graz University of Technology
Austria

Local Arrangements

Dipl.-Ing.
Patrick Ofner
Institute of Neural Engineering
Graz University of Technology
Austria

Local Arrangements

Dipl.-Ing.
Andreas Pinegger
Institute of Neural Engineering
Graz University of Technology
Austria

Local Arrangements

Dipl.-Ing.
Andreas Schwarz
Institute of Neural Engineering
Graz University of Technology
Austria

Published by Verlag der TU Graz
Graz University of Technology

 DOI: 10.3217/978-3-85125-533-1-00

International Program Committee and Review Board I

We are very grateful to all reviewers for their help, to make this conference a success!

A	
Aarnoutse Erik	University Medical Center Utrecht
Anderson Charles	Colorado State University
B	
Bauernfeind Günther	Medizinische Hochschule Hannover
Bianchi Luigi	University of Rome Tor Vergata
Blankertz Benjamin	Technische Universität Berlin
Brouwer Anne-Marie	TNO Human Factors - Perceptual and Cognitive Systems
Brunner Clemens	University of Graz
C	
Chavarriaga Ricardo	École polytechnique fédérale de Lausanne (EPFL)
Clerc Maureen	INRIA Congedo Marco CNRS
Cohen Ori	Interdisciplinary Center Herzliya
Coyle Damien	University of Ulster
D	
Daly Ian	University of Essex
F	
Faller Josef	Columbia University
Farquhar Jason	Radboud University Nijmegen
Friedman Doron	Interdisciplinary Center Herzliya
G	
Gao Shangkai	Tsinghua University
Grosse-Wentrup Moritz	Max Planck Institute for Intelligent Systems
Guan Cuntai	Nanyang Technological University
Guger Christoph	g.tec Guger Technologies OG
Gutiérrez Dania	Center for Research and Advanced Studies (Cinvestav)
H	
Halder Sebastian	University of Wuerzburg
Hochberg Leigh	Brown University
Huggins Jane	University of Michigan Health System
J	
Jeunet Camille	Inria / École polytechnique fédérale de Lausanne (EPFL)
Jin Jing	East China University of Science and Technology

Published by Verlag der TU Graz
Graz University of Technology

 DOI: 10.3217/978-3-85125-533-1-00

International Program Committee and Review Board II

K

Kanoh Shin'Ichiro	Shibaura Institute of Technology
Kindermans Pieter-Jan	Technische Universität Berlin
Kleih Sonja	University of Würzburg
Kober Silvia	Department of Psychology, University of Graz
Kobler Reinmar	Graz University of Technology
Krusienski Dean	Old Dominion University
Kübler Andrea	Julius Maximilian University of Würzburg

L

Lopes Dias Catarina	Graz University of Technology
Lotte Fabien	INRIA Bordeaux Sud-Ouest

M

Mattia Donatella	Fondazione Santa Lucia, IRCCS
Mattout Jérémie	Lyon Neuroscience Research Center
Milekovic Tomislav	École polytechnique fédérale de Lausanne (EPFL)
Millan José del R.	École polytechnique fédérale de Lausanne (EPFL)
Müller-Putz Gernot R.	Graz University of Technology

N

Nam Chang	North Carolina State University
Nijboer Femke	Leiden University
Nijholt Anton	University of Twente
Noirhomme Quentin	Brain Innovation BV

O

Ofner Patrick	Graz University of Technology

P

Pereira Joana	Graz University of Technology
Pinegger Andreas	Graz University of Technology
Prasad Girijesh	Ulster University

R

Ron-Angevin Ricardo	University of Malaga
Rutkowski Tomasz M.	University of Tokyo

S

Sburlea Andreea I.	Graz University of Technology
Scherer Reinhold	Graz University of Technology
Schwarz Andreas	Graz University of Technology

Published by Verlag der TU Graz
Graz University of Technology

 DOI: 10.3217/978-3-85125-533-1-00

International Program Committee and Review Board III

Silvoni Stefano	Central Institute of Mental Health
Solis-Escalante Teodoro	Delft University of Technology
Sorger Bettina	Dpt. of Cognitive Neuroscience, Maastricht University
Spüler Martin	Eberhard-Karls-University Tübingen
Steyrl David	Graz University of Technology
T	
Tangermann Michael	University of Freiburg
Tonin Luca	Ecole Polytechnique Fédérale de Lausanne (EPFL)
V	
Vansteensel Mariska J	Brain Center Rudolf Magnus, UMC Utrecht
Vidaurre Carmen	Public University of Navarra
Volosyak Ivan	Rhine-Waal University of Applied Sciences
Vuckovic Aleksandra	University of Glasgow
W	
Wriessnegger Selina Christin	Graz University of Technology
Z	
Zander Thorsten	Berlin Institute of Technology
Zhang Yu	East China University of Science and Technology

Published by Verlag der TU Graz
Graz University of Technology

 DOI: 10.3217/978-3-85125-533-1-00

List of Authors I

List of authors in alphabetical order with start pages of their respective contributions.

Published by Verlag der TU Graz
Graz University of Technology

 DOI: 10.3217/978-3-85125-533-1-00

List of Authors II

Published by Verlag der TU Graz
Graz University of Technology

 DOI: 10.3217/978-3-85125-533-1-00

List of Authors III

Published by Verlag der TU Graz
Graz University of Technology

 DOI: 10.3217/978-3-85125-533-1-00

List of Authors IV

Published by Verlag der TU Graz
Graz University of Technology

 DOI: 10.3217/978-3-85125-533-1-00

List of Authors V

Published by Verlag der TU Graz
Graz University of Technology

 DOI: 10.3217/978-3-85125-533-1-00

List of Authors VI

Published by Verlag der TU Graz
Graz University of Technology

 DOI: 10.3217/978-3-85125-533-1-00

List of Authors VII

Published by Verlag der TU Graz
Graz University of Technology

 DOI: 10.3217/978-3-85125-533-1-00

List of Authors VIII

Published by Verlag der TU Graz
Graz University of Technology

 DOI: 10.3217/978-3-85125-533-1-00

List of Authors IX

Published by Verlag der TU Graz
Graz University of Technology

 DOI: 10.3217/978-3-85125-533-1-00

Table of Contents I

All contributions are sorted in alphabetical order based on the name of the first author.

Published by Verlag der TU Graz
Graz University of Technology

Table of Contents II

Published by Verlag der TU Graz
Graz University of Technology

Table of Contents III

Published by Verlag der TU Graz
Graz University of Technology

Table of Contents IV

Published by Verlag der TU Graz
Graz University of Technology

Table of Contents V

Published by Verlag der TU Graz
Graz University of Technology

Table of Contents VI

Published by Verlag der TU Graz
Graz University of Technology

Table of Contents VII

Published by Verlag der TU Graz
Graz University of Technology

Table of Contents VIII

Published by Verlag der TU Graz
Graz University of Technology

Table of Contents IX

Published by Verlag der TU Graz
Graz University of Technology

Table of Contents X

Published by Verlag der TU Graz
Graz University of Technology

 DOI: 10.3217/978-3-85125-533-1-00

Table of Contents XI

Published by Verlag der TU Graz
Graz University of Technology