
Proceedings of the 9th Graz Brain-Computer Interface Conference 2024

Join Forces - Increase Performance

September 9-12, 2024
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Edited by
Gernot R. Müller-Putz, Kyriaki Kostoglou, Markus E. Oberndorfer, Selina C. Wriessnegger



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Welcome Note

Join Forces – Increase Performance

We chose this year's conference title to concisely reflect the current state of the BCI research field. Researchers from both, the invasive and non-invasive communities, have increasingly worked together, forming a unified community. Techniques from the non-invasive field are now being applied in invasive research and vice versa. Additionally, we are at a point where the definition of a BCI is being questioned and needs to be reformulated. These questions and many more are crucial and need to be addressed achieving progress in BCI research.

The 9th Graz Brain-Computer Interface Conference (GBCIC2024) provides a platform for extensive discussions and exchanges among BCI experts from over 22 countries. We have received nearly 100 scientific contributions from approximately 476 authors, all peer-reviewed by at least two different reviewers. Accepted papers will be openly accessible and published by Verlag der TU Graz. The present conference proceedings are the result of this rigorous review process.

As a partnered event of the BCI Society, we have assembled a diverse and multifaceted program. We have organized several workshops as Satellite Events before the conference. During the conference, researchers will present their work either as talks or posters. We are fortunate that renowned experts in the field such as Dr. Andrea Kübler, Dr. Jennifer Collinger, Dr. Camille Jeunet-Kelway, Dr. Nick Ramsey, and Dr. Henri Lorach accepted our invitation to present keynote addresses at the conference. After a break of several years, GBCIC2024 will conclude with a tour to the South Styrian Vine Yards.

The BCI conferences held in Graz, Austria, are considered an international initiative that fosters stronger scientific cooperation in the BCI field.

We wish all participants an exciting and stimulating Graz BCI Conference 2024.



Gernot R. Müller-Putz
Conference Chair

Editorial Board

Prof. Dr. **Gernot Rudolf 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 Technology 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 24 years. He has also managed several national projects (State of Styria) and international projects (Wings for Life, EU Projects) and he recently coordinated the EU Horizon 2020 project MoreGrasp. Furthermore, he organized and hosted seven international Brain-Computer Interface Conferences over the last 17 years in Graz and chairing the 9th Conference in Sept. 2024. Since August 2019 he is Speciality Chief Editor of *Frontiers in Human Neuroscience: Brain-Computer Interfaces*. He has authored more than 200 peer reviewed publications which were cited more than 16000 times (h-index 77). 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). In May 2018 he was elected into the Board of Directors of the International Brain-Computer Interface Society. In May 2019 he received the Science Award from the State of Styria.

Selina Christin Wriessnegger is Associate 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 in Munich, Germany. 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, neural correlates of covert actions, novel applications of BCIs for healthy users, passive BCIs, VR-based neuroadaptive systems and mental state detection.

Kyriaki Kostoglou received her diploma degree in Electrical and Computer Engineering from Aristotle University of Thessaloniki (AUTH), Greece and her M.Sc. degree in Computer Engineering from University of Cyprus (UCY), Cyprus. In 2017, she completed her Ph.D. studies and received her Ph.D. degree from the Department of Electrical and Computer Engineering, McGill University, Canada. The topic of her Ph.D. thesis was the identification of multiple-input time-varying systems and binary response systems for biomedical applications. She worked as a postdoc researcher in medical ultrasound imaging at the Institute of Signal Processing, Johannes Kepler University, Linz, Austria. Currently she is a postdoc at the Institute of Neural Engineering, Graz University of Technology, Graz, Austria. Her current research interests include system identification and signal processing for biomedical applications and brain computer interfaces.

Markus Erwin Oberndorfer is university assistant at the Institute of Neural Engineering (BCI-Lab), Graz University of Technology, Austria. He received his M.Sc. in Biomedical Engineering, specializing in Computational Neuroscience, from the Graz University of Technology in 2024. His research primarily addresses the forward and inverse problems in EEG, as well as the study of electric potentials originating from the spinal cord. Currently he is working towards his PhD degree in Biomedical Engineering.

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List of Authors I

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

A

Abdelhafez, Norhan	484
Ahmadi, Sara	337, 343
Aksenova, Tetiana.....	68, 80
Ali, Rushna	507
Amadiou, Franck.....	179
Amaunam, Idorenyin.....	531
Amigó-Vega, Joaquín.....	478
Ammendola, Lidia	331
Annicchiarico, Côme	472
Arpaia, Pasquale.....	47, 331
Ayyoubi, Amir Hossein	425

B

Baker, Matthew R.....	127, 513
Banks, Samantha A.	127
Bannier, Elise.....	254
Barłoga, Aneta	272
Baum, Jonathan.....	443
Baumgarten, Daniel	289
Bellicha, Angelina.....	80
Berezutskaya, Julia.....	58
Berger, Lisa.....	403
Bertoni, Tommaso	319
Besheli, Behrang Fazli	425
Bhattacharyya, Saugat.....	295
Bidgoli, Seyed Javad	92
Biktimirov, Artur	381
Bonaiuto, James J.	236
Bouet, Romain	420
Bougrain, Laurent	92
Branco, Mariana P.....	150, 391, 495
Brock, Anke M.....	212
Brunner, Peter.....	132, 190, 507

List of Authors II

C

Cabestaing, François	249
Cancino-Fuentes, Nathalia.....	489
Cantürk, Atilla.....	41
Carrara, Igor	431
Cebolla Alvarez, Ana Maria	92
Chabardès, Stéphan.....	80
Chang, Su-Youne.....	190
Charvet, Guillaume	68, 80
Chavez, Mario.....	98
Cheron, Guy	92
Christopoulos, Alexandros	224
Ciuffini, Roberta	366
Coenen, Volker	507
Congedo, Marco	236
Corsi, Marie-Constance	98
Coudroy, Elina.....	466
Covelo, Joana.....	489
Crell, Markus.....	139
Cropano, Maria	331
Cueva, Valérie Marissens	92
Cunningham, Andrew.....	63
Cury, Claire	254

D

Daly, Ian.....	525
Darnet, Ludovic.....	236
Dash, Adyasha.....	543
De Blasiis, Paolo.....	331
de Jong, Ivo	86, 156
De Luca, Matteo	331
De Vico Fallani, Fabrizio	174
Debroize, Rene-Paul.....	254
Della Calce, Anna	331
Desain, Peter	337, 343
Desbois, Arthur	174

List of Authors III

Di Matteo, Alessandro	355, 366
Diserens, Karin	319
Dreyer, Pauline	448
Driessens, Léa	278
Dumas, Cassandra	375
Duque-Lopez, Andrea	190
Dussard, Claire	168, 375
Dürschmid, Stefan	207
E	
Eder, Manuel.....	145
Edlinger, Guenter.....	489
Egger, Johanna.....	5
Eidel, Matthias	115
Ekramy, Nora	484
Elsayed, Neven.....	63
Engelhardt, Will.....	190
Esposito, Antonio	47
F	
Farne, Alessandro.....	420
Fernández-Rodríguez, Álvaro	230
Forin, Paolo	360
Fragueiro, Agustina.....	254
Freudenburg, Zachary	58, 391, 460
Fu, Zhichun.....	53
Fugger, Peter	145
G	
Galdieri, Fortuna	47
Gao, Xin.....	53
Gargiulo, Ludovica.....	331
Gasq, David	179
Gattaz, Lucie.....	420
George, Nathalie.....	168, 375
Gherman, Diana E.	307
Grechukhin, Natalia	466
Grevet, Elise	179

List of Authors IV

Grosse-Wentrup, Moritz	145, 272
Guerci, Philippe	92
Guetschel, Pierre	11, 349, 437
Guger, Christoph.....	284, 301, 489
H	
Halder, Sebastian.....	319, 525
Hashemi, Iraj.....	92
Herff, Christian	478
Hermes, Dora	132, 190, 195, 501, 518
Hinrichs, Hermann	207
Hinss, Marcel F.	212
Hons, Manuel.....	266
Hornero, Roberto	230, 409
Huang, Harvey.....	195
Hugueville, Laurent.....	375
I	
Ince, Nuri F.....	132, 190, 195, 425, 507
Izac, Margaux	179, 466
J	
Jalilpour, Shayan.....	23
Jensen, Michael A.....	127, 132, 195, 501, 518
Jeunet-Kelway, Camille.....	168, 179, 375, 466
Juillard, Violaine.....	80
Jöhr, Jane	319
K	
Kamada, Kyosuke.....	284
Kanoh, Shin'Ichiro.....	29, 35
Kapeller, Christoph.....	284
Karakas, Serpil	80
Kasprzak, Hubert	201
Keller, Dirk	495
Kerezoudis, Panagiotis	195
Kim, Inyong.....	190, 507
Kim, Jiwon	190, 507
Klassen, Bryan T.....	127, 195, 513

List of Authors V

Klein, Guido	437
Klug, Marius.....	218, 243
Kober, Silvia Erika.....	185, 266, 403
Kojima, Simon.....	29, 35
Komendziński, Tomasz	201
Korostenskaja, Milena.....	284
Kostoglou, Kyriaki	5, 17, 74
Kremen, Vaclav.....	190, 507
Krol, Laurens R.....	372
Kromm, Maria	150
Kubben, Pieter L.....	478
Kübler, Andrea	115, 162, 260
L	
Lafaye de Micheaux, Hugo	68
Lampert, Frederik.....	190, 507
Lau, Brian	375
Le Jeune, François	278, 397
Lebedev, Mikhail	381
Lecuyer, Anatole	249
Leeb, Robert.....	531
Lekhnitskaya, Polina.....	1
Lopes da Silva, Marina	319
Lorach, Henri	68, 80
Lotte, Fabien.....	92, 385, 443, 448, 472
Lozzi, Daniele	355, 366
Lus, Giacomo.....	331
Lécuyer, Anatole	313, 397
M	
Maby, Emmanuel	420
Macé, Marc J-M.	278, 313, 397
Maffei, Luigi	331
Malangone, Daniela.....	331
Manes, Costanzo.....	355
Manivannan, Prithviraj	86
Mannino, Camilla	98

List of Authors VI

Marcos-Martínez, Diego.....	409
Marrelli, Alfonso	366
Martel, Félix	68, 80
Martinez, Jesus Casal.....	443
Martín-Fernández, Ana	230
Martínez-Cagigal, Víctor	230, 409
Masson, Eva.....	260
Matran-Fernandez, Ana	319, 525
Matsoukis, Stratis.....	489
Mattei, Enrico.....	355, 366
Mattout, Jérémie	236, 420, 472
Maurel, Pierre	397
Maurer, Magdalena.....	289
Mehrkanoon, Siamak.....	495
Meistelman, Claude	92
Menegatti, Emanuele	360
Mignosi, Filippo.....	355
Mihic Zidar, Lucija	272
Miller, Kai J.	127, 132, 190, 195, 425, 501, 507, 513, 518
Mirehkoohi, Mehdi Javani	460
Mivalt, Filip.....	190, 507
Mizukami, Naoki.....	35
Moccaldi, Nicola.....	331
Mohammadian, Farhad	272
Mohammadpour, Mostafa	284
Moreau, Thomas.....	11
Muñoz-Montes de Oca, Jenny Noemí	414
Müller-Putz, Gernot R.	5, 17, 23, 63, 74, 104, 121, 139, 537
N	
N'Kaoua, Bernard	385, 466
Narayanan, Shekhar.....	343
Natalizio, Angela	47
Nawaz, Rab	319
Neumann, Amira	460
Niewińska, Nina	201

List of Authors VII

Noel, Jean-Paul	319
Nour-Eldin, Mohammed	484
O	
Oberndorfer, Markus	104
Offenberg, Elena Charlotte.....	58
Ojeda Valencia, Gabriela	127, 513
Ojemann, Jeffrey.....	195
Okkabaz, Jhan L.....	425, 507
Ornello, Raffaele	366
Otake-Matsuura, Mihoko.....	201
Ottenhoff, Maarten C.....	478
P	
Palatella, Alessio.....	360
Pan, Yanzhao.....	218, 243
Papadopoulo, Theodore.....	431
Papadopoulos, Sotirios	236
Parvis, Marco.....	47
Pascual-Roa, Beatriz	409
Pepicelli, Alex.....	63
Perdikis, Serafeim.....	319, 531
Permezel, Fiona.....	518
Petieau, Mathieu.....	92
Petit, Jimmy	115
Pfeiffer, Maria.....	260
Pierrieau, Emeline.....	168, 466
Piliugin, Nikita	381
Pillette, Léa.....	168, 278, 313, 375, 397, 466
Placidi, Giuseppe	355, 366
Pollastro, Andrea.....	47
Polsinelli, Matteo.....	355, 366
Polyanskaya, Arina	109
Popa, Alexia-Theodora	145
Porubcová, Natália.....	109
Prasad, Girijesh	295
Pretl, Harald.....	301

List of Authors VIII

Pulferer, Hannah	74
Py, Jacques	179
Pérez-Velasco, Sergio	409
Q	
Quach, Michael	425
Querry, Ambre	420
R	
Rabe, Lea	218, 243
Raemaekers, Mathijs	150
Raggam, Philipp	145, 272
Raimo, Simona	331
Ramsey, Nick F.	58, 150, 391, 460
Raslan, Ahmed	501
Redmond, Erin	443
Reichert, Christoph	207
Reintsema, Lars H.	207
Rimbert, Sébastien	92
Rizzo, Lorianna	420
Roc, Aline	448
Rockhill, Alex	501
Rodrigues, Johannes	260
Rodriguez-Herreros, Borja	531
Romero-Morales, Héctor	414
Rosignoli, Chiara	366
Rosipal, Roman	109
Rosignol, Eléa	466
Rouillard, José	115
Roy, Raphaëlle N.	212, 448
Rošt'Áková, Zuzana	109
Rutkowski, Tomasz M.	201
S	
Sacco, Simona	366
Samanta, Kaniska	295
Sanchez-Vives, Maria V.	489
Santamaría-Vázquez, Eduardo	230, 409

List of Authors IX

Sauter-Starace, Fabien	68, 80
Savalle, Emile	278, 397
Sayed, Abdelrahman.....	484
Sburlea, Andreea I.	86, 156, 224, 301
Schalk, Gerwin.....	132, 190, 507
Scharinger, Josef	284, 489
Schellander, Sophia	150
Scheppink, Hanneke.....	337
Scherer, Reinhold	319
Schmartz, Denis.....	92
Schomaker, Pauline	301
Schreiner, Leonhard.....	301
Schwarzgruber, Michael.....	284, 301
Seguin, Perrine Rose.....	420
Serino, Andrea	319
Settgast, Tomko	162
Shevtsova, Yulia G.....	454
Shishkin, Sergei L.	454
Si-Mohammed, Hakim	249
Sieghartsleitner, Sebastian	301
Signoriello, Elisabetta	331
Silvestri, Gianluigi	437
Sintsov, Mikhail	381
Sobolová, Gabriela	109
Soghoyan, Gurgen.....	381
Sorrentino, Pierpaolo	98
Sosulski, Jan.....	325
Srisrisawang, Nitikorn	74, 121
Struber, Lucas.....	80
Sultana, Mushfika	531
Suwandjieff, Patrick	537
Swamy, Chandra Prakash.....	425
Swann, Nicole	501
Sweeney-Reed, Catherine M.	207
Szul, Maciej J.....	236

List of Authors X

T

Tadi, Tej	531
Tangemann, Michael.....	11, 325, 337, 349, 437
Tantawy, Manal	484
Tates, Alberto	525
Thielen, Jordy	325, 337, 343
Thomas, Bruce H.....	63
Tonin, Luca	360
Torres-García, Alejandro Antonio	414
Tortora, Stefano	360
Trocellier, David	385, 448

V

Valdenegro-Toro, Matias	86, 156, 224
van den Boom, Max A.....	190, 507
van den Wittenboer, Lüke	156
Van Der Lee, Gael	249
Vansteensel, Mariska	495
Vasilyev, Anatoly N.....	454
Veas, Eduardo E.....	63
Venot, Tristan.....	174
Verwoert, Maxime	478
Villaseñor-Pineda, Luis	414
Vitale, Vincenzo Maria	212
Vitkova, Viktoriya	92
Volmer, Ben	63
Volosyak, Ivan.....	41
Vorwerk, Johannes	289

W

Ward, Tomas.....	443
Wassenaar, Peter	349
Welter, Marc.....	443, 448
Wimmer, Michael	63
Won, Kyungho	313
Wong-Lin, Kongfatt	295
Wood, Guilherme.....	185, 266, 403

List of Authors XI

Worrell, Gregory A.	190, 425, 507
Wriessnegger, Selina Christin	266, 543
Wu, Xiaolong	53
Y	
Yashin, Artem S.	454
Z	
Zander, Thorsten O.	307, 372
Zhang, Dingguo	53
Zhong, Walker.....	391

Table of Contents I

1. WORD PREDICTION DURING NATURALISTIC SPEECH PERCEPTION	1
Polina Lekhnitskaya	
DOI: 10.3217/978-3-99161-014-4-001	
2. INVESTIGATING TEMPORAL VARIATIONS IN MRCPS AND THEIR INFLUENCE ON CLASSIFICATION: A 10-HOUR EEG STUDY.....	5
Johanna Egger, Kyriaki Kostoglou, Gernot R. Müller-Putz	
DOI: 10.3217/978-3-99161-014-4-002	
3. S-JEPA: TOWARDS SEAMLESS CROSS-DATASET TRANSFER THROUGH DYNAMIC SPATIAL ATTENTION	11
Pierre Guetschel, Thomas Moreau, Michael Tangermann	
DOI: 10.3217/978-3-99161-014-4-003	
4. OPTIMIZING TIME-VARYING AUTOREGRESSIVE MODELS FOR BCI APPLICATIONS	17
Kyriaki Kostoglou, Gernot R. Müller-Putz	
DOI: 10.3217/978-3-99161-014-4-004	
5. RECOGNITION OF PERTURBATION EVOKED POTENTIAL BY USING MIXED-DEPTHWISE CONVOLUTIONS	23
Shayan Jalilpour, Gernot R. Müller-Putz	
DOI: 10.3217/978-3-99161-014-4-005	
6. INTRODUCING THE ASME-SPELLER, AUDITORY BCI SPELLER UTILIZING STREAM SEGREGATION: A PILOT STUDY	29
Simon Kojima, Shin'Ichiro Kanoh	
DOI: 10.3217/978-3-99161-014-4-006	
7. A NEW AUDITORY BRAIN-COMPUTER INTERFACE BASED ON STREAM SEGREGATION UTILIZING ASSR	35
Shin'Ichiro Kanoh, Naoki Mizukami, Simon Kojima	
DOI: 10.3217/978-3-99161-014-4-007	
8. A NOVEL CHATGPT-DRIVEN COMMUNICATION AID BASED ON CODE-MODULATED VISUAL EVOKED POTENTIALS (CVEP)	41
Atilla Cantürk, Ivan Volosyak	
DOI: 10.3217/978-3-99161-014-4-008	
9. A STUDY OF PERFORMANCE VARIABILITY IN DEEP NEURAL NETWORKS FOR MOTOR IMAGERY CLASSIFICATION: TOWARDS A ZERO-CALIBRATION APPROACH.....	47
Pasquale Arpaia, Antonio Esposito, Fortuna Galdieri, Angela Natalizio, Marco Parvis, Andrea Pollastro	
DOI: 10.3217/978-3-99161-014-4-009	

Table of Contents II

10. DEEP LEARNING FOR MOTOR IMAGERY-BASED BCIS USING SEEG SIGNALS.....	53
Zhichun Fu, Xiaolong Wu, Xin Gao, Dingguo Zhang	
DOI: 10.3217/978-3-99161-014-4-010	
11. HIGH-PERFORMANCE NEURAL DECODING OF 14 DUTCH KEYWORDS	58
Elena Charlotte Offenberg, Julia Berezutskaya, Zachary Freudenburg, Nick F. Ramsey	
DOI: 10.3217/978-3-99161-014-4-011	
12. PROCESSING OF INCONGRUENT INFORMATION CAN BE DECODED FROM SINGLE- TRIAL EEG: AN AR-STUDY	63
Michael Wimmer, Alex Pepicelli, Ben Volmer, Neven Elsayed, Andrew Cunningham, Bruce H. Thomas, Eduardo E. Veas, Gernot R. Müller-Putz	
DOI: 10.3217/978-3-99161-014-4-012	
13. AUTO-ADAPTATION OF ECOG-BASED MOTOR BCI USING NEURAL RESPONSE DE- CODER: A CROSS-PATIENT STUDY	68
Hugo Lafaye de Micheaux, Félix Martel, Fabien Sauter-Starace, Guillaume Charvet, Henri Lorach, Tetiana Aksenova	
DOI: 10.3217/978-3-99161-014-4-013	
14. CORRECTING TRAJECTORY-DECODING ERRORS VIA CORTICAL SUBSTRATES OF CONTINUOUS ERRONEOUS FEEDBACK PROCESSING	74
Hannah Pulferer, Kyriaki Kostoglou, Nitikorn Srisrisawang, Gernot R. Müller-Putz	
DOI: 10.3217/978-3-99161-014-4-014	
15. PREDICTORS OF ECOG-BCI PERFORMANCES ACROSS SUBJECTS AND SESSIONS DE- RIVED FROM IDLE STATE CHARACTERISTICS	80
Lucas Struber, Félix Martel, Serpil Karakas, Violaine Juillard, Angelina Bellicha, Fabien Sauter-Starace, Stéphan Chabardès, Henri Lorach, Guillaume Charvet, Tetiana Aksenova	
DOI: 10.3217/978-3-99161-014-4-015	
16. UNCERTAINTY QUANTIFICATION FOR CROSS-SUBJECT MOTOR IMAGERY CLASSIFI- CATION	86
Prithviraj Manivannan, Ivo de Jong, Matias Valdenegro-Toro, Andreea I. Sburlea	
DOI: 10.3217/978-3-99161-014-4-016	
17. TOWARDS RIEMANNIAN EEG CLASSIFIERS TO DETECT AWAKE AND ANESTHETIZED STATES USING MEDIAN NERVE STIMULATION	92
Valérie Marissens Cueva, Sébastien Rimbart, Ana Maria Cebolla Alvarez, Mathieu Petieau, Viktoriya Vitkova, Iraj Hashemi, Guy Cheron, Claude Meistelman, Philippe Guerci, Denis Schmartz, Seyed Javad Bidgoli, Laurent Bougrain, Fabien Lotte	
DOI: 10.3217/978-3-99161-014-4-017	

Table of Contents III

18. NEURONAL AVALANCHES FOR EEG-BASED MOTOR IMAGERY BCI	98
Camilla Mannino, Marie-Constance Corsi, Pierpaolo Sorrentino, Mario Chavez	
DOI: 10.3217/978-3-99161-014-4-018	
19. LOCALIZING NEURAL SOURCES IN THE CERVICAL SPINAL CORD	104
Markus Oberndorfer, Gernot R. Müller-Putz	
DOI: 10.3217/978-3-99161-014-4-019	
20. A SMALL STEP TOWARDS THE DETECTION OF MENTAL FATIGUE INDUCED BY BCI- HMD TRAINING	109
Arina Polyanskaya, Roman Rosipal, Gabriela Sobolová, Zuzana Rošt'Áková, Natália Po- rubcová	
DOI: 10.3217/978-3-99161-014-4-020	
21. RECORDING THE SSSEP WITH THE CEEGRID	115
Jimmy Petit, Matthias Eidel, José Rouillard, Andrea Kübler	
DOI: 10.3217/978-3-99161-014-4-021	
22. INVESTIGATING COORDINATES REPRESENTATION DURING REACHING VIA LOW-FRE- QUENCY EEG: A PRELIMINARY STUDY	121
Nitikorn Srisrisawang, Gernot R. Müller-Putz	
DOI: 10.3217/978-3-99161-014-4-022	
23. IDENTIFYING NEW FEATURES FOR BCI CONTROL: SPECTRAL CHANGES IN THE MO- TOR THALAMUS REVEAL HAND REPRESENTATION DURING OVERT AND IMAGINED MOVEMENT	127
Matthew R. Baker, Bryan T. Klassen, Michael A. Jensen, Gabriela Ojeda Valencia, Samantha A. Banks, Kai J. Miller	
DOI: 10.3217/978-3-99161-014-4-023	
24. FEASIBILITY OF STEREO EEG BASED BRAIN COMPUTER INTERFACING IN AN ADULT AND PEDIATRIC COHORT	132
Michael A. Jensen, Gerwin Schalk, Nuri F. Ince, Dora Hermes, Peter Brunner, Kai J. Miller	
DOI: 10.3217/978-3-99161-014-4-024	
25. DETECTION OF MOTION TERMINATION FROM EEG DURING THE EXECUTION OF CON- TINUOUS HAND MOVEMENT	139
Markus Crell, Gernot R. Müller-Putz	
DOI: 10.3217/978-3-99161-014-4-025	
26. AN EMG-BASED BRAIN-COMPUTER INTERFACE FOR COMMUNICATION-IMPAIRED PA- TIENTS: A CASE STUDY	145
Philipp Raggam, Manuel Eder, Alexia-Theodora Popa, Peter Fugger, Moritz Grosse-Wentrup	

Table of Contents IV

DOI: 10.3217/978-3-99161-014-4-026

27. FINDING THE OPTIMAL SIX: DECODING FROM A LARGE SET OF HAND GESTURES WITH 7T FMRI FOR IMPROVED BCI CONTROL..... 150
Maria Kromm, Sophia Schellander, Mariana P. Branco, Mathijs Raemaekers, Nick F. Ramsey
DOI: 10.3217/978-3-99161-014-4-027
28. TRANSFERRING BCI MODELS FROM CALIBRATION TO CONTROL: OBSERVING SHIFTS IN EEG FEATURES..... 156
Ivo de Jong, Lüke van den Wittenboer, Matias Valdenegro-Toro, Andreea I. Sburlea
DOI: 10.3217/978-3-99161-014-4-028
29. RESTING-STATE BRAIN CRITICALITY AND PERFORMANCE WITH P300-BASED BCIS.. 162
Tomko Settgast, Andrea Kübler
DOI: 10.3217/978-3-99161-014-4-029
30. BIDIRECTIONAL NEUROFEEDBACK: A CONTROL CONDITION COMPLEMENTARY TO SHAM? 168
Emeline Pierrieau, Léa Pillette, Claire Dussard, Nathalie George, Camille Jeunet-Kelway
DOI: 10.3217/978-3-99161-014-4-030
31. DYNAMIC BRAIN NETWORKS IN MOTOR IMAGERY-BASED BCI 174
Tristan Venot, Arthur Desbois, Fabrizio De Vico Fallani
DOI: 10.3217/978-3-99161-014-4-031
32. WHICH FACTORS AFFECT THE ACCEPTABILITY OF BCIS FOR FUNCTIONAL REHABILITATION AFTER STROKE AMONG PATIENTS? A QUESTIONNAIRE STUDY AMONG 140 PATIENTS AND A COMPARISON WITH THE GENERAL PUBLIC. 179
Elise Grevet, Margaux Izac, Franck Amadiou, Jacques Py, David Gasq, Camille Jeunet-Kelway
DOI: 10.3217/978-3-99161-014-4-032
33. BREAKING OUT OF THE FEEDBACK LOOP: TRANSFERRING MASTERY OF SELF-REGULATION DURING NEUROFEEDBACK TO OTHER CONTEXTS..... 185
Silvia Erika Kober, Guilherme Wood
DOI: 10.3217/978-3-99161-014-4-033
34. INTEGRATING CORTEC BRAININTERCHANGE DEVICE AND BCI2000 WITH A CLOUD INTERFACE 190
Filip Mivalt, Frederik Lampert, Max A. van den Boom, Jiwon Kim, Andrea Duque-Lopez, Will Engelhardt, Inyong Kim, Su-Youne Chang, Dora Hermes, Peter Brunner, Vaclav Kremen, Nuri F. Ince, Gerwin Schalk, Gregory A. Worrell, Kai J. Miller
DOI: 10.3217/978-3-99161-014-4-034

Table of Contents V

35. SPATIAL AND SPECTRAL CHANGES IN CORTICAL POTENTIALS DURING PINCHING VERSUS THUMB AND INDEX FINGER FLEXION 195
Panagiotis Kerezoudis, Michael A. Jensen, Harvey Huang, Jeffrey Ojemann, Bryan T. Klassen, Nuri F. Ince, Dora Hermes, Kai J. Miller
DOI: 10.3217/978-3-99161-014-4-035
36. PASSIVE OLFACTORY BRAIN-COMPUTER INTERFACE PARADIGM FOR AWARENESS LEVEL PREDICTION 201
Tomasz M. Rutkowski, Hubert Kasprzak, Nina Niewińska, Mihoko Otake-Matsuura, Tomasz Komendziński
DOI: 10.3217/978-3-99161-014-4-036
37. SSVEP-BASED COVERT COMMUNICATION USING HYPERSCANNING 207
Lars H. Reintsema, Catherine M. Sweeney-Reed, Stefan Dürschmid, Hermann Hinrichs, Christoph Reichert
DOI: 10.3217/978-3-99161-014-4-037
38. EEG-BASED PERFORMANCE ESTIMATION DURING A REALISTIC DRONE PILOTING TASK 212
Marcel F. Hinss, Vincenzo Maria Vitale, Anke M. Brock, Raphaëlle N. Roy
DOI: 10.3217/978-3-99161-014-4-038
39. LESS IS MORE: ADVANCING EEG-BASED ONLINE CONTINUOUS MACHINE ERROR DETECTION WITH THE LIGHTWEIGHT MAX-MIN AMPLITUDE NOISE FILTERING TECHNIQUE 218
Yanzhao Pan, Lea Rabe, Marius Klug
DOI: 10.3217/978-3-99161-014-4-039
40. ANA-E: A NOVEL APPROACH FOR PRE-TRAINED ERROR DETECTION MODELS IN BRAIN-COMPUTER INTERFACES 224
Alexandros Christopoulos, Matias Valdenegro-Toro, Andreea I. Sburlea
DOI: 10.3217/978-3-99161-014-4-040
41. ASSESSING CALIBRATION DURATIONS FOR C-VEP-BASED BCIS: INSIGHTS FROM NON-BINARY PATTERNS AND SPATIAL FREQUENCY VARIATIONS 230
Víctor Martínez-Cagigal, Álvaro Fernández-Rodríguez, Eduardo Santamaría-Vázquez, Ana Martín-Fernández, Roberto Hornero
DOI: 10.3217/978-3-99161-014-4-041
42. IMPROVED MOTOR IMAGERY DECODING WITH SPATIOTEMPORAL FILTERING BASED ON BETA BURST KERNELS 236
Sotirios Papadopoulos, Ludovic Darnet, Maciej J. Szul, Marco Congedo, James J. Bonaiuto, Jérémie Mattout

Table of Contents VI

DOI: 10.3217/978-3-99161-014-4-042	
43. EEG-BASED STIMULUS CLASSIFICATION IN A FULL-BODY MOVEMENT, VIRTUAL REALITY PARADIGM	243
Lea Rabe, Yanzhao Pan, Marius Klug	
DOI: 10.3217/978-3-99161-014-4-043	
44. EEG MARKERS OF ACCELERATION PERCEPTION IN VIRTUAL REALITY	249
Gael Van Der Lee, Anatole Lecuyer, François Cabestaing, Hakim Si-Mohammed	
DOI: 10.3217/978-3-99161-014-4-044	
45. EYE-TRACKING AND SKIN CONDUCTANCE TO MONITOR TASK ENGAGEMENT DURING NEUROFEEDBACK SESSIONS	254
Agustina Fragueiro, Rene-Paul Debroize, Elise Bannier, Claire Cury	
DOI: 10.3217/978-3-99161-014-4-045	
46. RELIABILITY OF INDIVIDUAL TASK-RELATED FRONTAL-MIDLINE-THETA FREQUENCY FOR NEUROFEEDBACK TRAINING.....	260
Maria Pfeiffer, Eva Masson, Andrea Kübler, Johannes Rodrigues	
DOI: 10.3217/978-3-99161-014-4-046	
47. MOTOR IMAGERY VIVIDNESS AND NATURALISTIC INNER SPEECH HABITS IN SPEECH IMAGERY CLASSIFICATION	266
Manuel Hons, Silvia Erika Kober, Selina Christin Wriessnegger, Guilherme Wood	
DOI: 10.3217/978-3-99161-014-4-047	
48. REVIRE: A VIRTUAL REALITY PLATFORM FOR BCI-BASED MOTOR REHABILITATION..	272
.....	
Lucija Mihić Zidar, Philipp Raggam, Farhad Mohammadian, Aneta Barłoga, Moritz Grosse-Wentrup	
DOI: 10.3217/978-3-99161-014-4-048	
49. WHICH IMAGINED SENSATIONS MOSTLY IMPACT ELECTROPHYSIOLOGICAL ACTIVITY ?.....	278
Emile Savalle, François Le Jeune, Léa Driessens, Marc J-M. Macé, Léa Pilette	
DOI: 10.3217/978-3-99161-014-4-049	
50. ONLINE DETECTION OF EPILEPTIC SPIKES FOR USE IN EPILEPSY MONITORING	284
Mostafa Mohammadpour, Christoph Kapeller, Kyosuke Kamada, Josef Scharinger, Michael Schwarzgruber, Milena Korostenskaja, Christoph Guger	
DOI: 10.3217/978-3-99161-014-4-050	
51. COMPARISON OF CNN-BASED EEG CLASSIFICATION IN SENSOR AND SOURCE SPACE	289

Table of Contents VII

Magdalena Maurer, Daniel Baumgarten, Johannes Vorwerk
DOI: 10.3217/978-3-99161-014-4-051

52. IMPACT OF MENTAL FATIGUE ON REGAINING MOTOR FUNCTIONALITY: A PRELIMINARY EEG STUDY ON STROKE SURVIVORS 295
Kaniska Samanta, Kongfatt Wong-Lin, Girijesh Prasad, Saugat Bhattacharyya
DOI: 10.3217/978-3-99161-014-4-052
53. MAPPING NEUROMUSCULAR REPRESENTATION OF GRASPING MOVEMENTS USING ULTRA-HIGH-DENSITY EEG AND EMG 301
Leonhard Schreiner, Pauline Schomaker, Sebastian Sieghartsleitner, Michael Schwarzgruber, Harald Pretl, Andreea I. Sburlea, Christoph Guger
DOI: 10.3217/978-3-99161-014-4-053
54. DECODING MORAL JUDGEMENT FROM TEXT: A PILOT STUDY 307
Diana E. Gherman, Thorsten O. Zander
DOI: 10.3217/978-3-99161-014-4-054
55. REAL-TIME NEUROFEEDBACK ON INTER-BRAIN SYNCHRONY: CURRENT STATES AND PERSPECTIVES..... 313
Kyungho Won, Léa Pillette, Marc J-M. Macé, Anatole Lécuyer
DOI: 10.3217/978-3-99161-014-4-055
56. TO REPEAT OR NOT TO REPEAT? ERP-BASED ASSESSMENT OF THE LEVEL OF CONSCIOUSNESS - A CASE STUDY 319
Sebastian Halder, Ana Matran-Fernandez, Rab Nawaz, Marina Lopes da Silva, Tommaso Bertoni, Jean-Paul Noel, Jane Jöhr, Andrea Serino, Karin Diserens, Reinhold Scherer, Serafeim Perdakis
DOI: 10.3217/978-3-99161-014-4-056
57. EXPLORING NEW TERRITORY: CALIBRATION-FREE DECODING FOR C-VEP BCI 325
Jordy Thielen, Jan Sosulski, Michael Tangermann
DOI: 10.3217/978-3-99161-014-4-057
58. MACHINE LEARNING-BASED IDENTIFICATION OF TES-TREATMENT NEUROCORRELATES 331
Pasquale Arpaia, Lidia Ammendola, Maria Cropano, Matteo De Luca, Anna Della Calce, Ludovica Gargiulo, Giacomo Lus, Luigi Maffei, Daniela Malangone, Nicola Moccaldi, Simona Raimo, Elisabetta Signoriello, Paolo De Blasiis
DOI: 10.3217/978-3-99161-014-4-058
59. TOWARDS AUDITORY ATTENTION DECODING WITH NOISE-TAGGING: A PILOT STUDY 337
Hanneke Scheppink, Sara Ahmadi, Peter Desain, Michael Tangermann, Jordy Thielen

Table of Contents VIII

DOI: 10.3217/978-3-99161-014-4-059

60. TOWARDS GAZE-INDEPENDENT C-VEP BCI: A PILOT STUDY..... 343
Shekhar Narayanan, Sara Ahmadi, Peter Desain, Jordy Thielen
DOI: 10.3217/978-3-99161-014-4-060
61. APPROXIMATE UMAP ALLOWS FOR HIGH-RATE ONLINE VISUALIZATION OF HIGH-DI-
MENSIONAL DATA STREAMS 349
Peter Wassenaar, Pierre Guetschel, Michael Tangermann
DOI: 10.3217/978-3-99161-014-4-061
62. ANALYSIS OF THE EEG RESTING-STATE SIGNALS FOR BCI 355
Enrico Mattei, Daniele Lozzi, Alessandro Di Matteo, Costanzo Manes, Filippo Mignosi, Matteo
Polsinelli, Giuseppe Placidi
DOI: 10.3217/978-3-99161-014-4-062
63. AN ALTERNATIVE TRAINING PROTOCOL FOR A MOTOR IMAGERY BMI BASED ON A
COLLABORATIVE APPROACH 360
Alessio Palatella, Paolo Forin, Stefano Tortora, Emanuele Menegatti, Luca Tonin
DOI: 10.3217/978-3-99161-014-4-063
64. THE CHALLENGE OF DRIVING BCI WITH EMOTIONAL SIGNALS COLLECTED BY EEG
.....366
Daniele Lozzi, Enrico Mattei, Roberta Ciuffini, Alessandro Di Matteo, Alfonso Marrelli, Raffaele
Ornello, Matteo Polsinelli, Chiara Rosignoli, Simona Sacco, Giuseppe Placidi
DOI: 10.3217/978-3-99161-014-4-064
65. PROJECT NAFAS: ANNOUNCEMENT AND BRIEF OVERVIEW..... 372
Laurens R. Krol, Thorsten O. Zander
DOI: 10.3217/978-3-99161-014-4-065
66. NEUROFEEDBACK PERFORMANCE UNDER CHALLENGING CONDITIONS: THE THETA-
AGENCY INTERPLAY 375
Claire Dussard, Léa Pillette, Cassandra Dumas, Laurent Hugueville, Brian Lau, Camille
Jeunet-Kelway, Nathalie George
DOI: 10.3217/978-3-99161-014-4-066
67. PERIPHERAL NERVE STIMULATION AND AUDITORY SIMULATION CLOSED LOOP SYS-
TEM FOR SENSORY DECISION MAKING IN TRANSHUMERAL AMPUTEES..... 381
Gurgen Soghoyan, Artur Biktimirov, Nikita Piliugin, Mikhail Sintsov, Mikhail Lebedev
DOI: 10.3217/978-3-99161-014-4-067
68. VALIDATING NEUROPHYSIOLOGICAL PREDICTORS OF BCI PERFORMANCE ON A
LARGE OPEN SOURCE DATASET 385
-

Table of Contents IX

David Trocellier, Bernard N'Kaoua, Fabien Lotte DOI: 10.3217/978-3-99161-014-4-068	
69. THE GOOD, THE BAD, AND THE UGLY OF IEEG SIGNALS: IDENTIFYING ARTIFACTUAL CHANNELS USING CONVOLUTIONAL NEURAL NETWORKS 391 Zachary Freudenburg, Walker Zhong, Mariana P. Branco, Nick F. Ramsey DOI: 10.3217/978-3-99161-014-4-069	
70. INTRODUCING THE USE OF THERMAL NEUROFEEDBACK 397 François Le Jeune, Emile Savalle, Anatole Lécuyer, Marc J-M Macé, Pierre Maurel, Léa Pillette DOI: 10.3217/978-3-99161-014-4-070	
71. DOUBLE-BLIND AND SHAM-CONTROLLED AUGMENTED REALITY EEG-NEUROFEEDBACK STUDY 403 Lisa Berger, Guilherme Wood, Silvia Erika Kober DOI: 10.3217/978-3-99161-014-4-071	
72. INTER-TASK TRANSFER LEARNING BETWEEN UPPER-LIMB MOTOR EXECUTION AND MOTOR IMAGERY 409 Sergio Pérez-Velasco, Diego Marcos-Martínez, Eduardo Santamaría-Vázquez, Víctor Martínez-Cagigal, Beatriz Pascual-Roa, Roberto Hornero DOI: 10.3217/978-3-99161-014-4-072	
73. PURSUING THE IMPLEMENTATION OF A NEUROTUTOR: AN EEG-BASED CLASSIFICATION OF READING TYPES 414 Héctor Romero-Morales, Jenny Noemí Muñoz-Montes de Oca, Alejandro Antonio Torres-García, Luis Villaseñor-Pineda DOI: 10.3217/978-3-99161-014-4-073	
74. ASSESSMENT OF SEVERAL EEG ACTIVE PARADIGMS IN LOCKED-IN SYNDROME ... 420 Perrine Rose Seguin, Emmanuel Maby, Romain Bouet, Lucie Gattaz, Ambre Querry, Lorianne Rizzo, Alessandro Farne, Jérémie Mattout DOI: 10.3217/978-3-99161-014-4-074	
75. AN ONLINE SPIKE DETECTION AND MONITORING FRAMEWORK IN IEEG RECORDED USING BRAIN INTERCHANGE DEVICE 425 Behrang Fazli Besheli, Amir Hossein Ayyoubi, Jhan L. Okkabaz, Chandra Prakash Swamy, Michael Quach, Kai J. Miller, Gregory Worrell, Nuri F. Ince DOI: 10.3217/978-3-99161-014-4-075	
76. ENHANCING MOTOR IMAGERY BCI CLASSIFICATION WITH BLOCK-TOEPLITZ AUGMENTED COVARIANCE MATRICES AND SIEGEL METRIC 431 Igor Carrara, Theodore Papadopoulos	

Table of Contents X

DOI: 10.3217/978-3-99161-014-4-076

77. SYNTHESIZING EEG SIGNALS FROM EVENT-RELATED POTENTIAL PARADIGMS WITH
CONDITIONAL DIFFUSION MODELS..... 437
Guido Klein, Pierre Guetschel, Gianluigi Silvestri, Michael Tangermann
DOI: 10.3217/978-3-99161-014-4-077
78. EEG SINGLE-TRIAL DECODING OF VISUAL ART PREFERENCE..... 443
Marc Welter, Jesus Casal Martinez, Erin Redmond, Jonathan Baum, Tomas Ward, Fabien
Lotte
DOI: 10.3217/978-3-99161-014-4-078
79. EXPLORING EOG MARKERS OF FATIGUE DURING MOTOR IMAGERY BCI USE 448
Pauline Dreyer, Aline Roc, David Trocellier, Marc Welter, Raphaëlle N. Roy, Fabien Lotte
DOI: 10.3217/978-3-99161-014-4-079
80. SHOULD ATTEMPTED MOVEMENTS REPLACE MOTOR IMAGERY IN BCI? THE ISSUE OF
COMPATIBILITY WITH GAZE USE 454
Sergei L. Shishkin, Artem S. Yashin, Yulia G. Shevtsova, Anatoly N. Vasilyev
DOI: 10.3217/978-3-99161-014-4-080
81. USING A CNN-LSTM ARCHITECTURE WITH DATA AUGMENTATION TO IMPROVE HD-
ECOG SPOKEN SYLLABLE CLASSIFICATION 460
Mehdi Javani Mirehkoohi, Zachary Freudenburg, Amira Neumann, Nick F. Ramsey
DOI: 10.3217/978-3-99161-014-4-081
82. NEURAL CORRELATES OF EXPERTISE DURING KINESTHETIC MOTOR IMAGERY:
SHOULD WE REWARD MAXIMUM SMR-ERD? 466
Margaux Izac, Eléa Rossignol, Emeline Pierrieau, Natalia Grechukhin, Elina Coudroy, Bernard
N'Kaoua, Léa Pillette, Camille Jeunet-Kelway
DOI: 10.3217/978-3-99161-014-4-082
83. BAYESIAN MODEL OF INDIVIDUAL LEARNING TO CONTROL A MOTOR IMAGERY BCI
.....472
Côme Annicchiarico, Jérémie Mattout, Fabien Lotte
DOI: 10.3217/978-3-99161-014-4-083
84. USING TRANSFORMER NETWORKS FOR STREAMING SPEECH SYNTHESIS FROM IN-
TRACRANIAL EEG 478
Joaquín Amigó-Vega, Maxime Verwoert, Maarten C. Ottenhoff, Pieter L. Kubben, Christian
Herff
DOI: 10.3217/978-3-99161-014-4-084

Table of Contents XI

85. NEUROPHONE: REAL-TIME BRAIN-MOBILE PHONE INTERFACE	484
Norhan Abdelhafez, Manal Tantawy, Abdelrahman Sayed, Nora Ekramy, Mohammed Nour-Eldin	
DOI: 10.3217/978-3-99161-014-4-085	
86. NOVEL MATERIALS FOR BRAIN COMPUTER INTERFACES: PERSPECTIVES AND ASPECTS OF COMBINATION OF A MAGNETOELECTRIC STIMULATOR AND A GRAPHENE MICROTRANSISTOR ARRAY RECORDING SYSTEM	489
Stratis Matsoukis, Josef Scharinger, Joana Covelo, Nathalia Cancino-Fuentes, Maria V. Sanchez-Vives, Guenter Edlinger, Christoph Guger	
DOI: 10.3217/978-3-99161-014-4-086	
87. COMPARING FINGERS AND GESTURES FOR BCI CONTROL USING AN OPTIMIZED CLASSICAL MACHINE LEARNING DECODER	495
Dirk Keller, Mariska Vansteensel, Siamak Mehrkanoon, Mariana P. Branco	
DOI: 10.3217/978-3-99161-014-4-087	
88. REFERENCING SCHEMES AND THEIR EFFECT ON OSCILLATIONS AND BROADBAND POWER SPECTRAL SHIFTS IN STEREOELECTROENCEPHALOGRAPHY	501
Alex Rockhill, Michael A. Jensen, Nicole Swann, Ahmed Raslan, Dora Hermes, Kai J. Miller	
DOI: 10.3217/978-3-99161-014-4-088	
89. FUNCTIONAL REPRESENTATION OF SOMATOSENSORY, VISUAL, AND REINFORCEMENT PROCESSING ON THE CANINE BRAIN SURFACE	507
Frederik Lampert, Filip Mivalt, Inyong Kim, Nuri F. Ince, Jiwon Kim, Jhan L. Okkabaz, Max A. van den Boom, Vaclav Kremen, Rushna Ali, Volker Coenen, Gerwin Schalk, Peter Brunner, Gregory A. Worrell, Kai J. Miller	
DOI: 10.3217/978-3-99161-014-4-089	
90. MOVEMENT ASSOCIATED INCREASE IN THALAMIC BROADBAND SPECTRAL POWER IS A POTENTIAL FEATURE FOR BCI CONTROL.....	513
Bryan T. Klassen, Matthew R. Baker, Gabriela Ojeda Valencia, Kai J. Miller	
DOI: 10.3217/978-3-99161-014-4-090	
91. DYNAMIC SUPPRESSION OF THE CORTEX THROUGH SYNCHRONISATION DURING BRAIN COMPUTER INTERFACING	518
Fiona Permezel, Michael A. Jensen, Dora Hermes, Kai J. Miller	
DOI: 10.3217/978-3-99161-014-4-091	
92. WAVELET PACKET DECOMPOSITION TO EXTRACT FREQUENCY FEATURES FROM SPEECH IMAGERY	525
Alberto Tates, Ana Matran-Fernandez, Sebastian Halder, Ian Daly	
DOI: 10.3217/978-3-99161-014-4-092	

Table of Contents XII

93. EEG CORRELATES OF ERROR-RELATED ACTIVITY DURING BALLISTIC COMPUTER
MOUSE MOVEMENTS 531
Idorenyin Amaunam, Mushfika Sultana, Borja Rodriguez-Herreros, Tej Tadi, Robert Leeb, Ser-
afeim Perdikis
DOI: 10.3217/978-3-99161-014-4-093
94. FROM CUE-BASED TO SELF-PACED MOVEMENT DETECTION: INFLUENCE OF THE CUE
ON TRAINING DATA 537
Patrick Suwandjieff, Gernot R. Müller-Putz
DOI: 10.3217/978-3-99161-014-4-094
95. TOWARDS A MODEL-BASED PERSONALIZATION APPROACH FOR DRIVING A BCI ... 543
Adyasha Dash, Selina Christin Wriessnegger
DOI: 10.3217/978-3-99161-014-4-095