Workshop: From BCI to Human Robot Augmentation

Code: WAPM10 | Wednesday, 26th June

Royal Geographical Society

Co-Chairs and Organisers:
Fani Deligianni, The Hamlyn Centre, Imperial College London, UK
Shamas Khan, The Hamlyn Centre, Imperial College London, UK
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08:30-09:00	**Registration and Coffee**
09:00	**Brain-Computer Interfaces: Beyond Decoding** *(Keynote) Jose del R Millan, Swiss Federal, Switzerland*
09:40	**Current Trends in Brain-Computer Interfaces – From Neurogaming to Disorders of Consciousness** *Damian Coyle, Ulster University, UK*
10:10	**Brain-Computer Interface for Mental Workload Assessment** *Fabio Babiloni, Rome Sapienza, Italy (Work realized with the contribution of the Italian Minister of University and Research, project BrainSafeDrive between Italy and Sweden)*
10:40-11:15	**Coffee Break**
11:15	**Hybrid Collaborative Brain–Computer Interfaces for Augmenting Cognitive Processes** *Ricardo Poli, Essex University, UK*
11:45	**Challenges of Translating BCI Research Concepts into Real-World Products** *Claude Clement, Wyss Centre, Switzerland*
12:15	**Poster Teaser Session**
13:00-14:00	**Lunch Break**

14:00	**Brain-Computer Interfaces for Neurorehabilitation** *Natalie Mrachacz-Kersting, Aalborg University, Denmark*
14:30	**Precision Manipulation for Neuro-prosthetics Based on EMG-Brain-Computer Interface** *Dario Farina, Imperial College London, UK*
15:00	**Next-Generation Brain/Neural-Machine Interfaces for Restoration of Brain Function** *Surjo Soekadar, Charité - University Medicine Berlin, Germany*
15:30-15:45	**Coffee Break**
15:45	**Neuro-stimulation for Spine to Machine Interface Technology** *Joel Burdick, Caltech University, USA*
16:15	**Gaze as a Cognition-machine Interface for Human-robot Interaction** *Ali Shafti, Imperial College, UK*
16:45	**Poster Award**
17:00	**Closing Remarks**

Keynote Speaker :

José Del R Millán, Swiss Federal Institute of Technology, Switzerland

Title:

Brain-Computer Interfaces: Beyond Decoding

Abstract:

Biography:

Dr. José del R. Millán holds the Defitech Foundation Chair and directs the Brain-Machine Interface Laboratory. He received a PhD in computer science from the Technical University of Catalonia, Barcelona, in 1992. Previously, he was a research scientist at the Joint Research Centre of the European Commission in Ispra (Italy) and a senior researcher at the Idiap Research Institute in Martigny (Switzerland). He has also been a visiting scholar at the Universities of Berkeley and Stanford as well as at the International Computer Science Institute in Berkeley.

Dr. Millán has made several seminal contributions to the field of brain-machine interfaces (BMI), especially based on electroencephalogram (EEG) signals. Most of his achievements revolve around the design of brain-controlled robots. He has received several recognitions for these seminal and pioneering achievements, notably the IEEE-SMC Nobert Wiener Award in 2011 and elevation to IEEE Fellow in 2017. During the last years Dr. Millán is prioritizing the translation of BMI to end-users suffering from motor disabilities. As an example of this endeavor, his team won the first Cybathlon BMI race in October 2016. Together with his team, he is also designing BMI technology to offer new interaction modalities for able-bodied people.

Speaker:

Fabio Babiloni, Sapianza University of Roma, Italy (Work realized with the contribution of the Italian Minister of University and Research, project BrainSafeDrive between Italy and Sweden)

Talk Title:

Brain-Computer Interface for Mental Workload Assessment

Abstract:

Biography:

Prof. Babiloni got the master degree in Electronic Engineering at the University of Rome “La Sapienza“and the PhD in Computational Engineering at the Helsinki University of Technology, Helsinki. He is currently Professor of Physiology at the Faculty of Medicine of the University of Rome “La Sapienza”, Rome, Italy. He is also full professor of Biomedical Engineering. Currents interests are in the field of cortical connectivity estimation, estimation of cognitive workload in pilots, neuromarketing and neuroaestethic. He is author of more that 250 papers on bioengineering and neurophysiological topics on international peer-reviewed scientific journals, and more than 250 contributions to conferences and books chapter. His total impact factor is more than 450 and his H-index is 63. Professor Babiloni is in the list of the top Italian scientists in all the fields of knowledge.

Prof. Babiloni is currently grant reviewer for the internationals agencies as well as European Union through the FP7 and Horizon2020 research programs. He was president of the International Society of Functional Source Imaging (2009-2011), the International Society of Bioelectromagnetism (2007-2009), member of the Italian Society of Physiology. He is an Associate Editor of 4 scientific Journals "IEEE Trans. on Biomedical Engineering", "International Journal of Bioelectromagnetism","IEEE Trans. On Neural System and Rehabilitation Engineering", and "IEEE Reviews on Biomedical Engineering". Prof. Babiloni was Chair of the IEEE Technical Committee for Biomedical Signal Processing from 2009 to 2015.Since 2013 to now is in the IEEE EMBS Advisory committee.

Speaker:
Joel Burdick, Caltec University, USA

Title:
Neuro-stimulation for Spine to Machine Interface Technology

Abstract:

Biography:
Prof. Burdick did his B.S. at Duke University, 1981, his M.S. and Ph.D. at Stanford University, 1982-1988. He was appointed as Assistant Professor at Caltech at 1988 and he became full Professor at 2000. Currently, he is a Jet Propulsion Laboratory Research Scientist. Professor Burdick focuses on robotics, kinematics, mechanical systems and control. Active research areas include robotic locomotion, sensor-based motion planning algorithms, multi-fingered robotic manipulation, applied nonlinear control theory, neural prosthetics, and medical applications of robotics. Currently, his research time is divided between traditional robotics research, and collaborations with neuroscientists to develop technology for paralyzed nervous systems. His group has received several awards, such as the Henry Ford II Scholar award and Amazon Fellows.

Speaker:
Claude Clement, Wyss Centre for Bio and Neuroimaging, Switzerland

Title:
Challenges of Translating BCI Research Concepts into Real-World Products

Abstract:

Biography:
Claude Clément joined the Wyss Center as CTO in early 2015. He has been founder, chairman or board member of several start-ups and small businesses. He holds a Master's in Electrical and Electronic Engineering from the Swiss Federal Institute of Technology (EPFL) in Lausanne and an MBA from HEC at the University of Lausanne (Switzerland).

Claude started in R&D for the watch industry (Swatch Group) as head of the transducers and actuators development group. He entered the world of medical technologies by heading the diversification activities of Swatch in the field of wearable programmable drug delivery pumps.
He then spent 23 years in the field of active implantable medical devices, as Director of Manufacturing Engineering at Intermedics (now Boston Scientific), as Plant Manager of the Swiss operations of Medtronic and later as a consultant for major companies, mainly in the field of pacemakers and for various innovative start-ups.

Starting in 1996, he put in place and ramped-up the highly automated factory of Medtronic in the Lake Geneva area. This plant is the world's largest site for the assembly of active implantable medical devices, producing more than 2,000 pacemakers, defibrillators and neuro-stimulators per day. Until 2014, he was CEO of MyoPowers, a start-up company developing an electromechanical implant to treat severe incontinence.

Speaker:

Damian Coyle, Ulster University, UK

Title:

Current Trends in Brain-Computer Interfaces – From neurogaming to Disorders of Consciousness

Abstract:

Biography:

Professor Damien Coyle, a Professor of Neurotechnology, is currently Director of the Intelligent Systems Research Centre and Research Director in the School of Computing, Engineering and Intelligent Systems at Ulster University.
He has published over 130 research papers in areas such as computational intelligence/AI, bio-signal processing, computational neuroscience, neuroimaging, neurotechnology and brain-computer interface (BCI) applications and has won a number of prestigious international awards for his research including the 2008 IEEE Computational Intelligence Society (CIS) Outstanding Doctoral Dissertation Award and the 2011 International Neural Network Society (INNS) Young Investigator of the Year Award. He was an Ulster University Distinguished Research Fellow in 2011, a Royal Academy of Engineering/The Leverhulme Trust Senior Research Fellow in 2013 and a Royal Academy of Engineering Enterprise Fellow in 2016-2017. He is a founding member of the International Brain-Computer Interface Society, a Senior member of the IEEE and chairs the IEEE Computational Intelligence Society (CIS) UK-Ireland chapter.

Professor Coyle is also CEO of NeuroCONCISE Ltd, the Ulster University spinout company he founded in 2016 to build wearable neurotechnology that non-invasively measures and translates brainwaves into control signals using advanced algorithms to enable people to interact with technology and communicate without moving which has applications in rehabilitation, diagnostics, augmentative and assistive communication devices and entertainment.

Speaker:
Dario Farina, Imperial College London, UK

Title:
Precision Manipulation for Neuro-prosthetics Based on EMG-Brain-Computer Interface

Abstract:

Biography:
Professor Farina has been Full Professor at Aalborg University, Aalborg, Denmark, (until 2010) and at the University Medical Center Göttingen, Georg-August University, Germany, where he founded and directed the Institute of Neurorehabilitation Systems (2010-2016) until he moved to Imperial College London as Chair in Neurorehabilitation Engineering. His research focuses on biomedical signal processing, neurorehabilitation technology, and neural control of movement. Within these areas, he has (co)-authored approximately 400 papers in peer-reviewed Journals and >500 conference abstract and papers. He has been the President of the International Society of Electrophysiology and Kinesiology (ISEK) (2012-2014) and is currently the Editor-in-Chief of the official Journal of this Society, the Journal of Electromyography and Kinesiology. He is also currently an Editor for IEEE Transactions on Biomedical Engineering and the Journal of Physiology, and previously covered editorial roles in several other Journals. Prof Farina is also the recipient of several prestigious awards, such as the Royal Society Wolfson Research Merit Award (2016).

Speaker:
Natalie Mrachacz-Kersting, Aalborg University, Denmark

Title:
Brain-Computer Interfaces for Neurorehabilitation

Abstract:

Biography:
Natalie Mrachacz-Kersting received her PhD in Biomedical Engineering from The University of Aalborg, Denmark in 2005 and held several post-doc positions at the University of Auckland, New Zealand and Aalborg University, Denmark. Since 2007 she is an Associate Professor at the Center for Sensory-Motor Interaction, Aalborg University, Denmark. Her research focus involves the integration of neurophysiological and clinical research to evaluate neuromuscular control during walking in people with stroke. It is within this area that she commenced Brain-Computer-Interface research. Her research interests also include motor skill learning and training for musculoskeletal disorders. She has published over 54 papers in peer-reviewed Journals, more than 100 conference papers/abstracts and 8 book chapters. In 2016 she was one of the recipients of the prestigious

Innovation Grant in Denmark to pursue her research on BCI technology and its application in the real world.

Speaker:
Riccardo Poli, University of Essex, UK

Title:
Hybrid Collaborative Brain–Computer Interfaces for Augmenting Cognitive Processes

Abstract:

Biography:
Professor Riccardo Poli is a full professor in School of Computer Science and Electronic Engineering of the University of Essex where he is coordinator of the BCI-NE Lab. Prof Poli is a biomedical engineer (by first degree, PhD and subsequent research) as well as an expert in genetic and evolutionary computation, and more generally machine learning and computational intelligence.
He has co-authored the books Foundations of Genetic Programming, Springer, 2002 and A Field Guide to Genetic Programing, Lulu, 2008. He has been chairing numerous international conferences. He is an advisory board member of the Evolutionary Computation journal and was an associate editor of the Genetic Programming and Evolvable Machines journal and a member of the editorial board of Swarm Intelligence. He has over 300 refereed publications (and two books). According to Google Scholar he has approximately 19,000 citations and an H-index of 59.

Speaker:
Dr. Ali Shafti, Imperial College London, UK

Title:
Gaze as a cognition-machine interface for human-robot interaction

Abstract:

Biography:
Ali Shafti is a post-doctoral fellow with the Brain and Behaviour Lab, Imperial College London. Dr. Shafti studies the interaction and collaboration between humans and robots and how to make these more intuitive and natural for increased synergy, and augmented capabilities on both sides. He is curious about achieving machine intelligence, while conserving the role of human intelligence as an essential part of the action/perception loop and the overall interaction. To this aim, his research involves human-robot interaction/collaboration through machine learning and human behaviour analytics.

He received his PhD in Robotics from King's College London in 2017, where he focused on intuitive human-robot interaction methods based on human behavioural analysis; with particular focus on optimisation of human-robot collaborative tasks, to reduce physiological stress. In his post-doc role at Imperial, he leads research on gaze-contingent human-robot interfaces, with focus on human assistance and augmentation through shared autonomy. This has been implemented in the form of a robotic system for assisted reaching and grasping, for patients with disabilities, enabling them to use their arms and hands again, simply by looking at the objects they want to interact with.