

Grant-in-Aid for Scientific Research on Innovative Areas  
(#4903-17H06382/17H06383)

Grant-in-Aid for Scientific Research(S)(16H06319)  
U Horizon 2020 - MSCA-RIZE「CybSPEED」

International Symposium on

# Cutting Edge Technology for EEG Data Analysis

Keiichi Kitajo

(RIKEN Center for Brain Science)

Hiroaki Wagatsuma

(Kyushu Institute of Technology)

Varghese Peter

(Macquarie University)

Anna Lekova

(BAS, Institute of Robotics)

Host Reiko Mazuka

(RIKEN Center for Brain Science)

## 23rd Jun. 2018

12:30 - 17:30



Language: English  
Admission: Free

The University of Tokyo  
Komaba 1 Campus

Collaboration Room 3, 4F, Building 18

## **International Symposium on Cutting Edge Technology for EEG Data Analysis**

Date: 23rd June 2018 Sat. 12 : 30-17 : 30

Venue: Collaboration Room 3, 4th Floor, Building 18, Komaba Campus,  
The University of Tokyo

Co-sponsored by:

- Grant-in-Aid for Scientific Research on Innovative Areas  
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### **Time Table**

12:30	Opening Remark (Reiko Mazuka, RIKEN Center for Brain Science)
12:35-13:35	Talk 1: Keiichi Kitajo (RIKEN Center for Brain Science)
13:35-14:35	Talk 2: Hiroaki Wagatsuma (Kyushu Institute of Technology)
14:35-14:50	Coffee Break
14:50-15:50	Talk 3: Varghese Peter (Macquarie University)
15:50-16:50	Talk 4: Anna Lekova (BAS, Institute of Robotics)
16:50-17:30	General discussion & Closing Remark

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### **Talk 1: Novel approaches to individual differences in intrinsic neural dynamics and human behavior**

Speaker: **Keiichi Kitajo**

CBS-TOYOTA Collaboration Center, RIKEN Center for Brain Science,  
Saitama, Japan

**Abstract:** A growing body of evidence shows that the brain is a nonlinear dynamical system, which exhibits a variety of interesting nonlinear dynamical phenomena, such as oscillations, synchronization, and noise-induced dynamics. It is still unclear if these nonlinear dynamical phenomena causally constrain or mediate brain functions and human behavior. To investigate such functional roles of nonlinear neural dynamics, novel experimental and theoretical approaches are required. Specifically, in this talk, I show how newly emerging experimental and analytic techniques in human neuroscience contribute to the understanding of individual differences in brain functions from a variety of intrinsic neural dynamics. I report our empirical evidence that resting-state human neural dynamics assessed by our new analytic methods are associated with individual-level variations in brain functions and behavior in healthy and disease populations. I also show that noninvasive stimulation methods such as TMS (transcranial magnetic stimulation) and tES (transcranial electric current stimulation) combined with scalp

EEG recordings are useful for dissecting individual-level differences in behavior by analyzing the spatiotemporal patterns of stimulation-induced EEG dynamics. We speculate that individual-level variations in intrinsic nonlinear neural dynamics causally constrain information processing associated with human functions and behavior.

**Short Bio:** Dr. Keiichi Kitajo is Unit Leader (Laboratory head) at Rhythm-based Brain Information Processing Unit, RIKEN CBS – TOYOTA collaboration center, Center for Brain Science, RIKEN where he has been Unit Leader since 2011. Dr. Kitajo completed his undergraduate and Ph. D. studies at the University of Tokyo. He was a postdoc researcher at National Rehabilitation Center for the Disabled. He moved to the University of Tokyo as a research associate. He also worked at the Department of Psychology, University of British Columbia, Canada. Then he joined RIKEN in 2005. His research interest includes functional roles of nonlinear neural dynamics in the human brain. He takes manipulative approaches such as TMS-EEG concurrent recordings to investigate functional roles of nonlinear dynamics.

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## **Talk 2: Integrative methods in Neuroinformatics and Brain-Inspired Robotics focusing on Neural Dynamics**

Speaker: **Hiroaki Wagatsuma**

Graduate School of Life Science and Systems Engineering,  
Kyushu Institute of Technology (Kyutech), Kitakyushu, Japan  
Artificial Intelligence Research Center, AIST, Tokyo, Japan

**Abstract:** With respect to enormous efforts in data sharing and standardization of neuroscience experiments that have been enhanced by the International Neuroinformatics Coordinating Facility (INCF) such as Neuroimaging Data Sharing Task Force, the standard data format for EEG time series with metadata descriptions is a hot topic. Semantic Web techniques such as RDF metadata and analysis techniques accelerate an effective data analysis for verifying possible hypotheses and may provide further possibilities of multidimensional aspects beyond expectations before executing of the experiment. We discuss with the integrative method and possible implementation to our simultaneous measurement of EEGs with eye-tracking and motion capture data.

**Short Bio :** Dr. Hiroaki Wagatsuma received his M.S., and Ph.D. degrees from Tokyo Denki University, Japan, in 1997 and 2005, respectively and he is an Associate Professor in the Graduate School of Life Science and Systems Engineering, Kyushu Institute of Technology from 2009. He is also a Cross-Appointment Fellow, Artificial Intelligence Research Center, National Institute of Advanced Industrial Science and Technology. His areas of specialization are

nonlinear dynamics, brain-based intelligence focusing on episodic memory accompanied with emotions, robotic and application system contributed in society, covering fields of computational neuroscience, neuroinformatics, sport biomechanics, rehabilitation support and social infrastructure. His current research areas are extended to biomedical signal processing based on sparse coding schemes and artificial intelligence with knowledge representation and reasoning. He has published two books and more than hundred papers in the international journals and proceedings as original research and review articles.

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### **Talk 3: Measuring language-related event related potentials (ERP) and neural entrainment in infants, children and adults**

Speaker: **Varghese Peter**

Macquarie University, Sydney, Australia

**Abstract:** This talk will cover three different studies on ERP and neural entrainment in infants, children and adults. The first study is on the discrimination related ERPs recorded to infant directed speech (IDS) and adult directed speech (ADS) in 4- and 8-month-old infants. The second study is on the neural entrainment to speech rhythm in adult listeners of three rhythmically different languages. The third study is on measuring neural entrainment to natural speech stimuli. The discussion will include the methods to analyse neural entrainment and infant ERP data as well as on robust statistical methods.

**Short Bio:** Varghese Peter is a researcher and lab manager at the Department of Linguistics at Macquarie University, Sydney, Australia. Prior to this appointment he was a postdoctoral research fellow at MARCS Institute, Western Sydney University, Australia. His research focuses on neural basis of language development in typically developing infants and children as well as children with language and/or reading impairment.

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### **Talk 4: An Emotive-based Brain Computer Interface for Children with Disabilities Focusing on Emotional Interactions by Using a Humanoid Robot**

Speaker: **Anna Lekova**

Institute of Systems Engineering and Robotics,  
Bulgarian Academy of Sciences, Sofia, Bulgaria

**Abstract:** This study aims to improve the therapy based on play-like activities of children with Special Educational Needs (SEN) by neurofeedback assessment. The designed EEG-based mobile Brain-Computer Interface (BCI) enables and facilitates emotions capture and analysis to provide assistance for special educators. Objectives for the proposed integration of BCI with

programmable robots are (1) storing emotions experienced by the child and eye blinking rate, (2) providing assistive information based on performance metrics in time, (3) the possibility of creating an engaging environment for the child. The concept of added BCI into the play-like activities also evolve into technology to enhance the play of children with SEN by replacement of their lost functionality. By innovative algorithms based on data from Emotiv brain-listening headset, the current child emotional and social brainwave activity over time are scanned, featured, translated in robot commands and wirelessly transmitted to robot sensors, modules and controllers.

**Short Bio:** Dr. Anna Lekova is currently Professor, Head of "Interactive Robotics and Control Systems" Department, Institute of Robotics (IR), Bulgarian Academy of Sciences (BAS), Sofia, Bulgaria. As the academic record, she was awarded PhD in 1995 in the field of Computing from Technical University - Sofia, Visiting Assistant Professor, Faculty of Computing, Technical University in 1990-1992, and Erasmus teacher in "Wireless mobile networks, intelligent routing protocols and security" - University of Portsmouth, UK, 2008-2013. Through the experience of Assoc. Prof. the Institute of System Engineering and Robotics (ISER), BAS, she was selected as the full Professor in IR-BAS. She contributed and organized more than 11 EU and national projects, such as RONNI: Increasing the wellbeing of the population by RObotic and ICT based iNNovative education. Project DSPF, Interreg, EU Strategy for the Danube Region (2018-2019) and European Project (FP5) "Tools for sustainability: Development and application of an integrated framework", EESD Program (2003-2005). Most recent publications are as follows:

- Lekova, A., Mo Adda (2015): "Hand Gesture Recognition Based On Signals Cross-Correlation," Recent Trends in Hand Gesture Recognition, Editor: A. Chaudhary, Science Gate Publishing, Vol. 3, 2015, 43-74.
- Lekova A. (2011): Data-Driven Fuzzy Modeling for Wireless Ad-hoc Networks, ISBN:978-3-8443-2391-7, LAMBERT Academic Publishing GmbH&Co. KG, Saarbrücken, Germany, 96 pages.