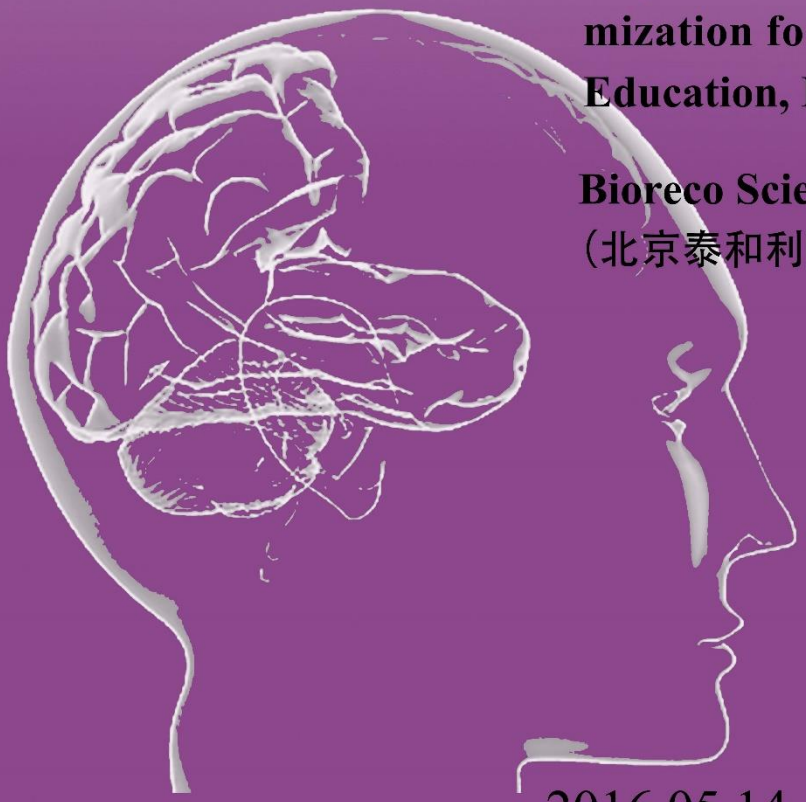
Workshop on Brain Control System and Computational Neuroscience

Date: 14 May 2016 (Saturday)

Venue: Report Hall in Yifu Building, ECUST, Shanghai

Organizers: Key Laboratory of Advanced Control and Optimization for Chemical Processes of Ministry of Education, ECUST;

Bioreco Sciences Limited
（北京泰和利康医药技术开发有限公司）



2016.05.14 Shanghai

Workshop on Brain Control System and Computational Neuroscience

Conference Program

May 14, 2016

Key Laboratory of Advanced Control and Optimization for Chemical Processes of Ministry of Education, School of Information Science and Engineering, East China University of Science and Technology, Shanghai

The 2016 Workshop on "Brain Control System and Computational Neuroscience" will be held in Shanghai on 14th May, 2016. Brain-Computer Interfaces (BCIs) provide the possibility of a new generation of multidisciplinary technologies that allow users to directly control external devices by the nervous system. Successful realization of such approaches encompass several challenges including design of novel paradigms for BCIs, investigation on novel algorithm for computational neuroscience, development of intelligent control system based on BCI, and applications to neural engineering & rehabilitation engineering.

The workshop aims to bring together scientists and researchers to present and discuss the latest progresses on frontier of multidiscipline research fields covering from brain science, biology to computing technology.

Committees

Expert Committee

Feng Qian, Professor, Academician of Chinese Academy of Engineering, Vice President of East China University of Science and Technology, Director of Key Laboratory of Advanced Control and Optimization for Chemical Processes, Shanghai, China

Xingyu Wang, Professor, East China University of Science and Technology, Shanghai, China

Hongbo Shi, Professor, Deputy Director of Key Laboratory of Advanced Control and Optimization for Chemical Processes, East China University of Science and Technology, Shanghai, China

Wenli Du, Professor, Dean of School of Information Science and Engineering, Deputy Director of Key Laboratory of Advanced Control and Optimization for Chemical Processes, East China University of Science and Technology, Shanghai, China

Yugang Niu, Professor, Vice Dean of School of Information Science and Engineering, East China University of Science and Technology, Shanghai, China

Chair

Jing Jin, Professor, East China University of Science and Technology, Shanghai, China

Organizing Committee

Yu Zhang
Bei Wang
Lanlan Chen
Yuanyuan Zou
Xiangyun Qing

Program Committee

Wei Wu, South China University of Technology, Guangdong, China
Yadong Liu, National University of Defense Technology, Hunan, China
Yangsong Zhang, Southwest University of Science and Technology, Sichuan, China
Yunfa Fu, Kunming University of Science and Technology, Yunnan, China
Dan Zhang, Tsinghua University, Beijing, China
Yu Zhang, East China University of Science and Technology, Shanghai, China
Erwei Yin, China Astronaut Research and Training Center, Beijing, China
Xiaogang Chen, Chinese Academy of Medical Sciences, Beijing, China
Minpeng Xu, Tianjin University, Tianjing, China
Qiang Wu, Shandong University, Shandong, China
Dong Wen, Yanshan University, Hebei, China

Conference Program

Friday, May 13, 2016
8:00-24:00 Checking in at Lotel Hotel
(385 Laohumin Rd, Xuhui, Shanghai, China)

Opening Ceremony

Saturday, May 14
Address: Report Hall in Yifu Building
9:00-9:10 Welcome by honored guest
9:10-9:20 Group Photo

Morning Lectures, Saturday, May 14, 2016
9:20-9:50
Title:
Gunther Krausz, CBO, G-tec, Austria

9:50-10:20
Title: Recent Progress in Visual BCIs
Dean Krusienski, Associate Professor, Old Dominion University, USA

10:20-10:40 Tea and Coffee Break

10:40-11:10
Title: Linking Brain Responses to Naturalistic and Continuous Music through Analysis of Ongoing EEG and Stimulus Features
Fengyu Cong, Professor, Dalian University of Technology, Dalian, China

11:40-13:30 Lunch

Afternoon Lectures, Saturday, May 14, 2016
13:30-14:00
Title: Use of A Steady-State Baseline to Address Evoked vs. Oscillation Models of Visual Evoked Potential Origin
Dong Ming, Professor, Tianjin University, Tianjin, China

14:00-14:30
Title: Removal of Ocular Artifacts from EEG Signals without Collecting EOG in BCIs
Banghua Yang, Professor, Shanghai University, Shanghai, China

14:30-14:50 Tea and Coffee Break

14:50-15:20
Title: Group Component Analysis for Multiblock Data: Common and Individual Feature Extraction
Guoxu Zhou, Professor, Guangdong University of Technology, Guangzhou, China

15:20-15:50
Title: High-Speed Brain-Computer Interfaces Based on Visual Evoked Potentials
Yijun Wang, Professor, Academy of Sciences, Beijing, China

15:50-16:20
Title: How to Decrease the Fatigue and Improve the Performance of Visual Stimulus-based BCI
Jing Jin, Professor, East China University of Science and Technology, Shanghai, China

16:40-18:00
BCI Demo Show

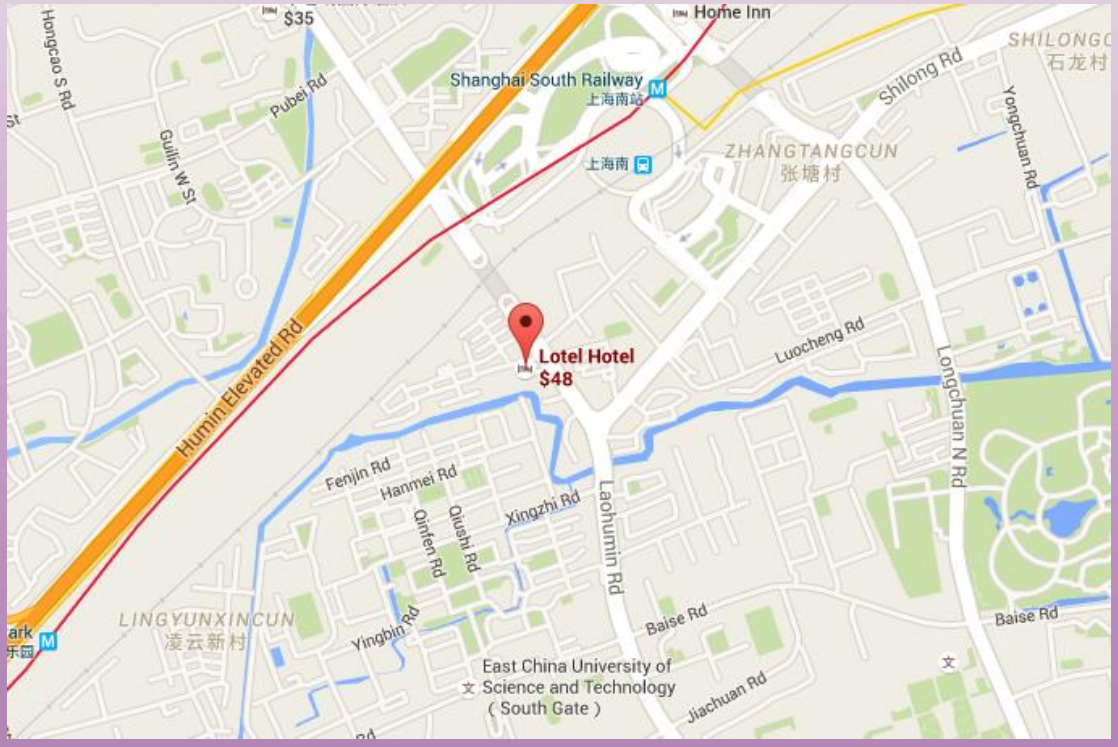
18:00-20:00 Conference Banquet

Breakfast
Breakfast is served between 7:00 and 9:00 in Lotel Hotel.

Internet Access
Internet service is available in your hotel room

Conference Contact
Bei Wang (Cell phone: 13701843508)

Hotel Information
Lotel Hotel
Address: 385 Laohumin Rd, Xuhui, Shanghai, China
Telephone: +86 21 5464 9797
The hotel is about 1.2km from ECUST.



Key Laboratory of Advanced Control and Optimization for Chemical Processes of Ministry of Education

East China University of Science and Technology (ECUST), founded in 1952, is among the first batch of universities to be granted the permission to admit postgraduates in 1956 and one of the 13 national key universities designated by the Central Committee of the Chinese Communist Party in 1960. Its current name was adopted by Ministry of Education in 1993. After 60 year's efforts, the university has developed itself into a national key research university with distinct characteristics of each and every discipline and a coordinated interdisciplinary development.

The Key Laboratory of Advanced Control and Optimization for Chemical Processes (ACOCP) was established at the East China University of Science and Technology by Ministry of Education in 2008. The construction and development of laboratory was confirmed by Ministry of Education in 2009 and 2011, respectively.

The Laboratory was supported by "Control Theory and Control Engineering" of National Leading Academic Discipline Project and Shanghai Leading Academic Discipline Project. Laboratory was orientated to be developed according to the national medium-and-long-term scientific technical development project, national and local area economic requirement, and academic development requirement. It was efficiently investigating on the combination of chemical engineering, automatic control, and computer application areas, contributing in solving the significant scientific and technology problems in the field of engineering processes control and optimization, focusing on the leading academic discipline of "Control Theory and Control Engineering ", regarding the "Chemical Process modeling and advanced control" Process Optimization and System Integration", "Process Monitoring and Healthy Diagnosis" and "Complex Systems Control Theory and Method" as the major directions, developing the advanced control and optimization technique and software having proprietary intellectual property rights for chemical processes, making effort to be developed as the main base for talents cultivation, scientific research and achievement transformation in the field of oil chemical automation to be advanced in domestic and international area.

Expert Committee

Feng Qian, Professor, Academician of Chinese Academy of Engineering, Vice President of ECUST, Director of Key Laboratory of Advanced Control and Optimization for Chemical Processes

Feng Qian, a specialist in the field of process control, is now professor and doctor supervisor in East China University of Science and Technology (ECUST). For many years, he has been dedicated to research in the field of system operation behavior intelligent regulation and real-time integrated optimization theory and technology, in order to utilize the material and energy with high efficiency for chemical process. As chief investigator, he has lead dozens of national and industrial major research projects supported by National Natural Science Foundation of China, State Key Development Program of Fundamental Research of China (973 Project), National High Technology Research and Development Program (General/Major) of China (863 Project), National Key Technology Support Program, National High Technology Industrialization Project, Technology Research and Development Funds from SINOPEC, and etc.

As the inventor of series of patented technology, in the field of system intelligent modeling, control, optimization and performance monitoring based on the fusion of the material transformation principle and production equipment operation information, he has been authorized with thirty computer software copyrights, 20 national invention patents, as well as 10 national patents in publicity. Moreover, he has successfully applied plants, such as ethylene, purified terephthalic acid (PTA), oil refineries, aromatic, polyester, and etc., which created significant economic and social benefit.

His research results have been selected as one of the ten excellent cases of Industry-University-Research Institute Collaboration in China, with the awards including, four Grade 2 Awards for National Science and Technology Progress, twenty Awards for Provincial Science and Technology Progress (including seven Grade 1 Awards), Chinese Excellent Patent Award and two Grade 1 Award for Shanghai Invention Award. He has published 200 papers indexed by SCI/EI in both domestic and foreign academic journals. He has also received the following honors as: Holeungholee Science & Technology Innovation Awards, special term professor of Chang Jiang Scholars Program by Ministry of Education, Winners of National Outstanding Youth Science Foundation, Chief Scientist of State Key Development Program of Fundamental Research of China (973 Project) national level candidates of "Millions of Talents Project for New Century" for first session, member of Discipline Group of Control Science and Engineering in State Council Education Degree Committee, consulting expert for National of Informatics Division in National Natural Science Foundation, National Award of Invention and Entrepreneurship, Cross Century Talents by Ministry of Education, Scientific Elite by Shanghai City, Inventor of Shanghai, Labor Model of Shanghai and Excellent Discipline Leader of Shanghai, and etc.

Currently he is serving as the Vice President of ECUST, member of National Committee of CPPCC, Director of Key Laboratory of Advanced Control and Optimization for Chemical Processes by Ministry of Education, Director of PSE (Process System Engineering) Research Center by Ministry of Education, Vice Chairman of China National Association for Automation in Petroleum and Chemical Industry, Vice Director of PSE Professional Committee in System Engineering Society of China, and etc.

Xingyu Wang, Professor, School of Information Science and Engineering, ECUST

Xingyu Wang（Shienyu Wang） is a professor of control science and engineering at ECUST. He graduated from the Mathematics Department of Fudan University with a bachelor degree in 1967. In 1981 he completed his graduate course in Cybernetics at East China Normal University. He obtained his PhD in Industry Automation from East China Institute of Chemical Technology in 1984. He was served as the president of East China University of Science and Technology from 1994 to 2004.

Xingyu Wang was served as a member of the Control Science and Engineering Discipline Appraisal Group under the Academic Degree Committee of the State Council, a member of the Automation Discipline Appraisal Group of the State Natural Science Foundation Committee, the standing director of Chinese Association of Automation, the vice director of Chinese Association of Intelligent Automation, the vice chairman of Shanghai Association of Automation, the vice chairman of Shanghai Association of Artificial Intelligent, etc.

Xingyu Wang's research interests were mainly in the fields of control science and engineering, information technology and the applications. He had published three books and more than 300 scientific papers on the international and domestic journals and high level conferences. He firstly proposed and established "block pulse operator" theory which has become a new mathematical tool in the research of system and control theory and has been proved quite successful in applications. He firstly proposed "extension control" theory and method, setting up a new research area in intelligent control. In recently decade, He also develops a new research direction of "brain control" by combining brain science and control science. His current research interests include brain control, brain-computer interface, sleep EEG analysis and intelligent robot control, and so on.

Prof. Wang is recipient of the Second Prize (1991，1986), and the Third Prize（1995） of Scientific and Technology Progress by State Education Commission of China, the Second Prize of National Science and Technology Progress（2005，1996）, and the Second Prize of Shanghai Awards in Natural Sciences（2010）, etc. He was awarded the title of Middle-aged and Young Expert with Outstanding Achievements by the State Personnel Ministry of China in 1994.

Hongbo Shi, Professor, Deputy Director of Key Laboratory of Advanced Control and Optimization for Chemical Processes, ECUST

Hongbo Shi is the deputy director of Key Laboratory of Advanced Control and Optimization for Chemical Processes of ministry of education. He is also the member of Process Control Committee and Fault Diagnostic and Security Committee of Chinese Association of Automation, the member of Information Technology Application of Chemical Industry and Engineering Society of China, and the council of Shanghai Instrument and Control society and Shanghai microcomputer Application Society.

Dr. Hongbo Shi has been engaged in process modeling for process industry and advanced control technology, theory analysis of integrated automation system, fault diagnosis for chemical process and condition monitoring technology, process systems engineering. As main participant in the projects, he was awarded second prize of chemical ministerial technology progress, third prize of the National science and technology progress, and second prize of Hebei province technology progress for the National high-tech R&D program of China (863 program). As the project leader, he has completed many programs including the National high-tech R&D program of China (863 program), NSF of China. He was the recipient of Shuguang Scholar (2003). He has published more than 100 papers in International and national journals.

Wenli Du, Professor, Dean of School of Information Science and Engineering, Deputy Director of Key Laboratory of Advanced Control and Optimization for Chemical Processes, ECUST

Wenli Du received her BSc and MSc degrees from Dalian University of technology in 1997 and 2000, respectively, and her PHD degree in East China University of Science and Technology in 2005. Her PHD thesis has been awarded for Shanghai Excellent Doctoral Dissertation. She joined the Automation department ECUST since 2000.

Her research interests focus on the modeling, control, optimization and fault diagnosis of Chemical process. The research results have been applied to ethylene plants and purified terephathalic acid plants, and bring significant economic and social benefits for the SINOPEC. She has been granted by National Natural Science Funds for Excellent Young Scholar project in 2012, the new century excellent person of Ministry of Education in 2010 and the technical Phospherus plan in Shanghai Province in 2005.

Yugang Niu, Professor, Vice Dean of School of Information Science and Engineering, ECUST

Yugang Niu received his BSc degree from Hebei Normal University in 1986, and his MSc and PhD degree from the Nanjing University of Science & Technology in 1992 and 2001, respectively. His postdoctoral research was carried out in the East China University of Science& Technology between 2001 and 2003. In 2003, he joined the School of Information Science & Engineering, East China University of Science & Technology, where he is currently a Professor and Vice Dean.

From 2002 to 2012, as Research Associate or Research Fellow, respectively, he visited the University of Hong Kong, and City University of Hong Kong for many times. From January to March 2008 and July to August 2012, he visited the Brunel University as Visiting Research Fellow supported by the Royal Society of UK. Now, he is an Associate Editor of IET Control Theory and Applications, International Journal of System Sciences, Cogent Engineering, Conference Editorial Board of IEEE Control Systems Society. He is also recipient of "The Best youth paper award" from Beijing Chapter of IEEE Control Systems Society in 2002. His research interests include stochastic systems, sliding mode control, Markovian jump systems, networked control systems, wireless sensor network, smart grid.

Keynote Speakers

Gunther Krausz, CBO,g.tec Austria

Gunther Krausz, Ing. Mag. rer. nat., is an engineer in electronics and telecommunication and a neuropsychologist. He received his academic degree (MSc) at the Karl-Franzens University in Graz/Austria and worked for several years in the field of BCI research and EEG basic research at the University of Technology in Graz. He also gave university lectures in experimental psychology and research methodology before he joined g.tec in 2003. Gunther Krausz is actively involved in several national and international research projects, of which most are related to BCI. The range of these projects covers different fields of application, such as BCIs for communication and control, assessment of patients with disorders of consciousness (DOC), real-time cortical mapping using the ECoG, and BCI-based neurotechnologies for rehabilitation purposes. The company 'g.tec medical engineering GmbH' supplies universities and research labs worldwide with hard- and software for biosignal acquisition, processing and analysis, especially for real-time applications like BCIs.

Talk Title: From Research to Clinical Applications - BCI & Neurotechnology 2.0

Abstract: In the end of the twentieth century, BCI research was strongly focused on communication and control applications for completely paralyzed people. Communication tools such as the P300-spelling device "intendiX" are now available on the market for several years. It has also been shown by different groups that especially invasive BCIs (using ECoG and implanted micro electrode arrays) can control robotic limbs in paralyzed patients with an incredible accuracy. For a long-term use of such applications we still lack in reliable wireless sensors which can be implanted and remain in the brain for a long period of time. During the past decade, several new fields of application for BCI technology arose. The most important approaches deal with BCI-based training methods for stroke patients and with consciousness assessment and simple communication for patients with disorders of consciousness (DOC). Also invasive cortical mapping for brain surgery patients relies on similar techniques. The main methodological approaches of BCI will be briefly introduced and it's potential for the latest applications will be discussed.

Dean Krusienski, Associate Professor, Old Dominion University, USA

Dean Krusienski received his BS, MS, and PhD degrees in Electrical Engineering from The Pennsylvania State University. He conducted his post-doctoral research in the Brain-Computer Interface (BCI) Laboratory at the Wadsworth Center of the New York State Dept. of Health. He is currently a Professor of Electrical and Computer Engineering at Old Dominion University in Norfolk, VA, where he directs the Advanced Signal Processing in Engineering and Neuroscience (ASPEN) Laboratory.

He is also the Graduate Program Director and Director of the Biomedical Engineering Institute at ODU. He has co-authored over 70 peer-reviewed technical publications in the fields of to signal processing, brain-computer interfaces, and neural engineering. He has received funding from the National Science Foundation (NSF), the National Institutes of Health (NIH), and NASA/National Institute of Aerospace (NIA).

Talk Title: Recent Progress in Visual BCIs

Abstract: Brain-computer interfaces (BCIs) based on visual-evoked potentials (VEPs) have shown to achieve among the highest information transfer rates (ITRs) for non-invasive BCIs. However, these systems still have some limitations that create issues for usability, particularly for long durations. This talk will highlight the development of new stimulus paradigms for VEP BCIs that aim to create a balance between performance and ergonomics. These studies include a novel ring-stimulator paradigm and optimal selection of spatial frequencies for checkerboard stimuli.

Fengyu Cong, Professor, Dalian University of Technology, Dalian, China

Fengyu Cong received the B.S. degree in Power and Thermal Dynamic Engineering and the Ph.D. degree in Mechanical Design and Theory from the Shanghai Jiao Tong University, China, in 2002 and 2007, and the Ph.D. degree in Mathematical Information Technology from the University of Jyväskylä, Finland, in 2010. Since March 2007, he has been with the Department of Mathematical Information Technology in the University of Jyväskylä. From March 2007 to August 2008, he was a postdoctoral researcher, from September 2008 to June 2011, he was junior lecturer (faculty position), and from July 2011 to June 2015, he has been holding a tenure-track faculty position. In May 2012, he was conferred the title of Docent (Adjunct Associate Professor) in Signal Processing at the Department of Mathematical Information Technology, University of Jyväskylä. From December 2013, he has taken the professor position in the Department of Biomedical Engineering in the Dalian University of Technology at Dalian in China. He is the visiting scientist of RIKEN Brain Science Institute, Japan (2013.04-2018.03). He was the visiting doctoral student of Dalian Scientific Test & Control Technology Institute (2003.07-08, 2004.07-08) and the visiting doctoral student of Hangzhou Applied Acoustics Research Institute (2005.09-2007.03).

He is a senior member of IEEE (2013.06-), the editorial board member of Journal or Neuroscience Methods (2013.07-), and technical program committee members of LVA/ICA2012&2015, IEEE MLSP2013-2015. His research interests include brain signal processing for cognitive neuroscience, blind source separation/independent component analysis, tensor decomposition, higher-order partial least squares, sequential Monte Carlo, and anomaly detection in machine learning.

He has authored or co-authored over 60 publications in international journals, book chapters and conference proceedings. As the first author, he will publish one monograph book titled by Advanced Signal Processing on Brain Event-related Potentials (ERPs): Filtering ERPs in Time, Frequency and Space Domains Sequentially and Simultaneously' in World Scientific in 2015 (web: http://www.worldscientific.com/worldscibooks/10.1142/9306).

Talk Title: Linking Brain Responses to Naturalistic and Continuous Music through Analysis of Ongoing EEG and Stimulus Features

Abstract: This talk is concerned with the novel approaches for the analysis of brain responses in the modality of ongoing EEG elicited by the naturalistic and continuous music stimulus. The 512-second long ongoing EEG data (recorded with 64 electrodes) were collected when participants listened to a piece of modern tango with the duration of 512 seconds. The ongoing EEG is different from the spontaneous EEG when no stimulus is present or the event-related potentials (ERPs) when the controlled, short and quickly repeated stimulus is present. In order to analyze the ongoing EEG during the real-world experiences, independent component analysis (ICA), tensor decomposition, EEG source localization, clustering, acoustical feature extraction, spectral-temporal analysis, and correlation were applied. This talk will introduce how those methods can be formulated to build a reliable approach for finding reasonable EEG components from the challenging ongoing EEG data.

Dong Ming, Professor, Tianjin University, Tianjin, China

Dong Ming received his B.S. and Ph.D. degrees in biomedical engineering at Tianjin University, Tianjin, China, in 1999 and 2004, respectively. He worked as a Research Associate in the Department of Orthopaedics and Traumatology, Li Ka Shing Faculty of Medicine, University of Hong Kong, from 2002 to 2003 and was a visiting scholar in the Division of Mechanical Engineering and Mechatronics, University of Dundee, U.K., from 2005 to 2006. He joined Tianjin University (TJU) faculty in the College of Precision Instruments and Optoelectronics Engineering in 2006 and was promoted to full professor of biomedical engineering since 2011. Now he is the Chair Professor of the Department of Biomedical Engineering of TJU, the Head of the Neural Engineering and Rehabilitation Laboratory of TJU, and the Chair of IEEE-EMBS Tianjin Chapter.

His major research interests include neural engineering, rehabilitation engineering, sports science, biomedical instrumentation and signal/image processing, especially in functional electrical stimulation, gait analysis, and brain-computer interface. He has also managed over 10 national and international research projects. Furthermore, he has been an International Advisory Board member of the Foot, and the Editorial Committee member of Acta Laser Biology Sinica, and International Journal of Biomedical Engineering in China. Dr. Ming has organized and hosted several international conferences as the Session Chair or Track Chair over the last 10 years and was the General Chair of the 2012 IEEE International Conference on Virtual Environments, Human-Computer Interfaces and Measurement Systems (VECIMS 12).

Talk Title: Use of A Steady-State Baseline to Address Evoked vs. Oscillation Models of Visual Evoked Potential Origin

Abstract: There has been a long debate about the neural mechanism of event-related potentials (ERPs). Previously, no evidence or method was apparent to validate the two competing models, the evoked model and the oscillation model. One argument is whether the pre-stimulus brain oscillation could influence the following ERP. This study carried out an innovative visual oddball task experiment to investigate the dynamic process of visual evoked potentials. A period of stable oscillations of specified dominant frequencies and initial phases, i.e. the steady-state baseline, would be induced before responses to transient stimuli of different contrasts, which could overcome the artifact problem caused by the 'sorting' method. The result first revealed a 'three-period-transition' for the generation of visual evoked potentials by an objective decomposition. The ERP almost retained the preceding oscillation during the first period, provided an unstable negative potential in the second period, and generated the N1 component in the third period. The cross term analysis showed that the evoked model couldn't be the whole explanation for the ERP generation. Furthermore, the component analysis revealed that the N1 latency was sensitive to the initial phase under the low stimulus contrast (supporting the oscillation model) but not under the high stimulus contrast (supporting the evoked model). It demonstrated that the external stimulus contrast is a significant factor deciding the explicit model for ERPs. Our method and preliminary results may help reconcile the previous, seemly contradictory findings on the ERP mechanism.

Banghua Yang, Professor, Department of Automation, Shanghai University, China

Banghua Yang received her Ph.D degree in precision instrument from Shanghai Jiaotong University in 2006, Shanghai, China. She is currently a Professor in the Department of Automation, Shanghai University, Shanghai, China. She completed postdoctoral appointments at Hasselt University, Belgium from March 2011 to March 2012.

Prof. Yang's research interests include brain-computer interface, EEG signal processing, biomedical signal processing, pattern recognition and intelligent system. She has undertaken two National Natural Science Funds as the project leader. He won the talent program of Shanghai Pujiang. Meanwhile, she has also participated many national projects. Prof. Yang has published about 100 articles in peer-reviewed core national and international journals. She is a reviewer of many national and international journal including IEEE Transactions on Biomedical Engineering, Medical Engineering and Physics, Signal Processing, Journal of Biomedical and Health Informatics, Chinese Journal of Scientific Instrument, etc.

Prof. Yang and her students have developed many processing algorithms for EEG signal. Her research group attended the 2th China BCI Competition, which was held by Tsinghua University in Beijing and was supported by National Science Foundation of China. Her research team obtained the third prize in the robot control based on BCI.

Talk Title: Removal of Ocular Artifacts from EEG Signals without Collecting EOG in BCIs

Abstract: Ocular artifacts cause the main interfering signals within electroencephalogram (EEG) signals measurements. An adaptive filter based on reference signals from an electrooculogram (EOG) can reduce ocular interference, but collecting EOG signals during a long-term EEG recording is inconvenient and uncomfortable for the subject. Three methods about removal of ocular artifacts from EEG signals without collecting EOG are introduced. (1) SCICA-RLS: In the first stage, independent component analysis (ICA) is used to decompose multiple EEG channels into an equal number of independent components (ICs). Ocular ICs are identified by an automatic artifact detection method based on kurtosis. In the second stage, SCICA applies exact artifact ICs as a constraint to extract artifact ICs from the given EEG signal. These extracted ICs are called spatially constraint ICs (SC-ICs). Then the adaptive filtering based on RLS uses SC-ICs as reference signals to reduce interference. (2) SAE-RLS: The high order statistical information in the EOG artifact can be learned automatically using only EOG signals during offline stage and so a SAE (sparse autoencoder) model is obtained. In the online stage, the learned SAE model is first used to identify and extract preliminary EOG artifact from a given raw EEG signal. And then an RLS adaptive filter uses the identified EOG artifact as reference signal to remove interference. (3) DN-RLS: During the offline stage, EOG signals are used to train a DN to learn features of EOG signals. During the online stage, the learned DN is used to extract EOG artifacts from electroencephalogram (EEG), then a RLS filter is used to further remove EOG artifacts. These three methods not only avoid the need for parallel EOG recordings but also have the ability of fast computation.

Guoxu Zhou, Professor, Guangdong University of Technology, Guangzhou, China

Guoxu Zhou received the Ph.D. degree in intelligent signal and information processing from South China University of Technology, Guangzhou, China, in 2010. He is currently a full Professor at the School of Automation, Guangdong University of Technology, Guangzhou, China, and a Visting Researcher at the Laboratory for Advanced Brain Signal Processing, RIKEN Brain Science Institute, Japan. His research interests include statistical signal processing, tensor analysis, big data analytics, and machine learning.

He won the 2012 Excellent Doctoral Dissertation of Guangdong Province, the Nomination Award for the 2013 National Excellent Doctoral Dissertation of China, and the Huawei Technology Award in 2015. He has authored or co-authored over 50 papers in journals and international conferences.

Talk Title: Group Component Analysis for Multiblock Data: Common and Individual Feature Extraction

Abstract: Real-world data are often acquired as a collection of matrices rather than as a single matrix. Such multiblock data are naturally linked and typically share some common features while at the same time exhibiting their own individual features, reflecting the underlying data generation mechanisms. To exploit the linked nature of data, we propose a new framework for common and individual feature extraction (CIFE) which identifies and separates the common and individual features from the multiblock data. Two efficient algorithms termed common orthogonal basis extraction (COBE) are proposed to extract common basis is shared by all data, independent on whether the number of common components is known beforehand. Feature extraction is then performed on the common and individual subspaces separately, by incorporating dimensionality reduction and blind source separation techniques. Comprehensive experimental results on both the synthetic and real-world data demonstrate significant advantages of the proposed CIFE method in comparison with the state-of-the-art.

Yijun Wang, Professor, Chinese Academy of Sciences, Beijing, China

Yijun Wang is a Research Fellow at the State Key Laboratory on Integrated Optoelectronics, Institute of Semiconductors, Chinese Academy of Sciences, Beijing, China. He received a B.E. degree and a Ph.D. degree in biomedical engineering from Tsinghua University in 2001 and 2007, respectively. From 2008 to 2015, he was first a postdoctoral researcher and later an Assistant Project Scientist at the Swartz Center for Computational Neuroscience (SCCN), Institute for Neural Computation, University of California San Diego, USA.

Dr. Wang's research interests include brain-computer interface (BCI), biomedical signal processing, and machine learning. He is also interested in applying computational neuroscience approaches to modeling event-related brain dynamics using Electroencephalogram (EEG). Currently, Dr. Wang's research focuses on developing signal processing and machine learning methods to improve the performance of BCI. He also develops new brain monitoring methods such as the mobile EEG/BCI and multi-brain EEG/BCI technologies. Dr. Wang has published more than 70 research papers in peer-reviewed scientific journals and conferences including PNAS, IEEE TBME, IEEE TNSRE, JNE, IJNS. His work has been widely cited by researchers, including over 2000 Google Scholar citations (H-index: 22).

Dr. Wang was the winner of four datasets in the International BCI Competitions. He was presented the First Prize of Outstanding Doctoral Dissertation Award of Tsinghua University in 2007 and the Nominee Award of Best 100 Doctoral Dissertations of China in 2009. Dr. Wang was selected by the Recruitment Program of Young Professionals in 2015.

Talk Title: High-Speed Brain-Computer Interfaces Based on Visual Evoked Potentials

Abstract: Over the past several decades, visual evoked potentials (VEP)-based brain-computer interfaces (BCIs) have attracted increasing attention because of their high information transfer rate (ITR), little user training, and low user variation. In this talk, I will introduce our recent progress in developing high-speed BCIs using VEPs. I will first review the current state of VEP-based BCIs, categorizing them according to stimulus coding methods. The multiple access (MA) methods from telecommunications will be introduced to facilitate the taxonomy. I will then present the design and implementation of a high-speed BCI speller, which achieved a record-breaking ITR of 267 bits/min. The details of stimulus coding and target identification methods will be described. I will conclude with an overview of research directions and implications that my work suggests for developing high-speed BCI technologies.

Jing Jin, Professor, East China University of Science and Technology, Shanghai, China

Jing Jin received a Ph.D. degree in control science and engineering from the School of Information Science and Engineering, East China University of Science and Technology, Shanghai, China, in 2010. From 2008 to 2010, he worked as a joint supervised Ph.D student for two years in the Laboratory of Brain-Computer Interfaces (Graz BCI) at Institute for Knowledge Discovery, Graz, Austria. His supervisors were Prof. Xingyu Wang and Prof. Pfurtscheller. Now, he is working as a Professor at the School of Information Science and Engineering, East China University of Science and Technology, Shanghai, China.

His research focuses on event-related potential-based brain computer interface (BCI), cognitive neuroscience and external skeletal rehabilitation system. He published more than sixty research papers in BCI related journals and conferences including Journal of Neural Engineering, IEEE Transactions on Neural Systems and Rehabilitation Engineering, International Journal of Neural Systems, Acta Automatica Sinica and International BCI Conference and Meeting. His work was cited by researchers from more than twenty countries. In 2014 and 2015, he was selected as Most Cited Chinese Researchers in the field of biomedical engineering. He is Member of Hand Function Rehabilitation Specialized Committee, Senior Member of Chinese Society of Biomedical Engineering, Member of EMBS and Member of BCI Society.

Talk Title: How to Decrease the Fatigue and Improve the Performance of Visual Stimulus-based BCI

Abstract: In recent 10 years, a large amount of research has been done to improve the BCI system by using optimized signal processing and pattern recognition methods to improve the classification accuracy, designing new ERP evoking paradigms (e.g. gaze independent BCIs) to expand the applicability for patients and optimizing the stimuli configuration to increase speed and reliability. Since the direct users of BCI system are human, the fatigue and persistent performance should also be considered. In this study, we focused on decreasing the fatigue and calibration time to improve the practicability of brain computer interface system. We designed optimized stimulus sequence and configuration methods, novel stimulus patterns and training methods of classifiers to solving the fatigue and calibration problems.

Key Laboratory of Advanced Control and Optimization for Chemical Processes of Ministry of Education, ECUST;

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