CONFERENCE ABSTRACT

2019 2nd International Conference on Digital Medicine and Image Processing (DMIP 2019)

Science Building, East China Normal University

Shanghai, China

November 13-15, 2019

Co-Organized by

Supported by

Published and Indexed by

http://www.dmip.org

Conference Venue

Science Building, East China Normal University (上海华东师范大学理科大楼)

http://ditu.ecnu.edu.cn/ECNUzb/ECNU.html

Add.: North Zhongshan Road Campus, 3663 N. Zhongshan Rd., Shanghai 200062

地址：上海市中山北路3663号 200062

Founded in Shanghai in October 1951, East China Normal University (ECNU) is one of the most prestigious universities in China and is sponsored by the national programs “Project 211” and “Project 985”. With a total area of over 207 hectares, ECNU has long been reputed as a Garden University for its beautiful campus scenes.

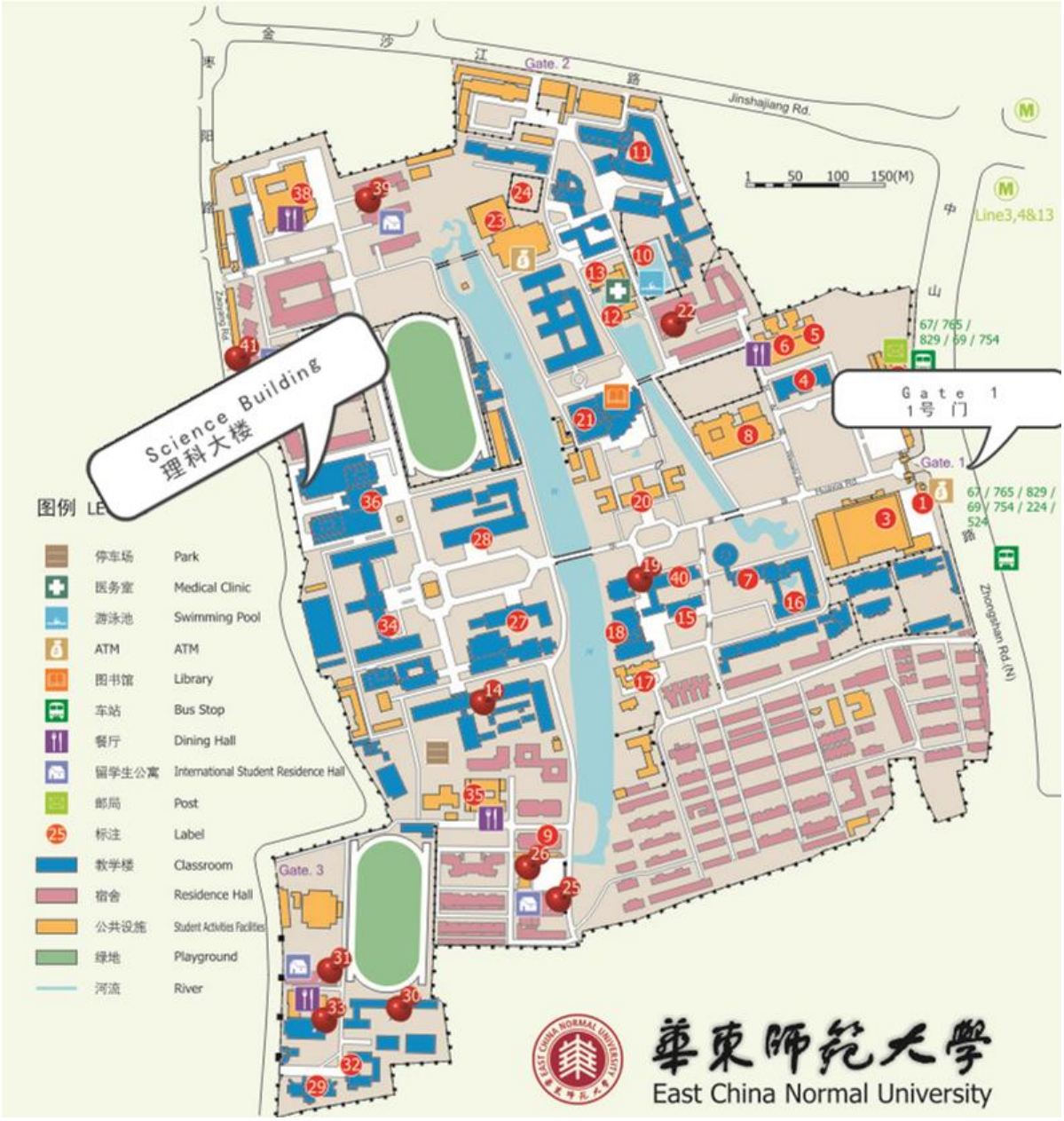
Recommended Hotels:

1. Jinjiang Inn Shanghai East China Normal University （锦江之星上海华师大酒店）
2. Ji Hotel (Shanghai Caoyang Road) （全季上海曹杨路酒店）
3. Vienna International Hotel (Shanghai Jinshajiang Road) （维也纳国际酒店上海金沙江路店）

Note:

The registration fee does not cover the accommodation. It is suggested that you should do an early reservation.

Campus Map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Science Building
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Gate. 3
图例 LE
停车场 Park
医务室 Medical Clinic
游泳池 Swimming Pool
ATM ATM
图书馆 Library
车站 Bus Stop
餐厅 Dining Hall
留学生公寓 International Student Residence Hall
邮局 Post
标注 Label
教学楼 Classroom
宿舍 Residence Hall
公共设施 Student Activities Facilities
绿地 Playground
河流 River
華東師範大學
East China Normal University

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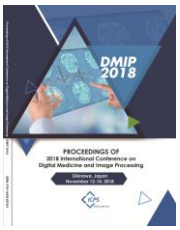
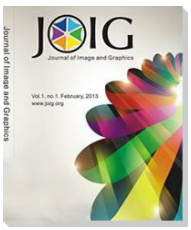
Introduction

Welcome to 2019 2nd International Conference on Digital Medicine and Image Processing (DMIP 2019) which is co-organized by Biology and Bioinformatics Society (BBS) under Hong Kong Chemical, Biological & Environmental Engineering Society (CBEES) and Shanghai Key Laboratory of Multidimensional Information Processing. DMIP 2019 aims to provide a platform for researchers, engineers, academicians as well as industrial professionals from all over the world to present their research results and development activities in Digital Medicine and Image Processing and related fields.

Papers will be published in one of the following conference proceedings or journals:



International Conference Proceedings by ACM (ISBN: 978-1-4503-7698-3), which will be archived in **ACM Digital Library**, indexed by **Ei Compendex** and **Scopus**, and submitted to be reviewed by Thomson Reuters Conference Proceedings Citation Index (ISI Web of Science).



Journal of Image and Graphics (JOIG, ISSN: 2301-3699) which will be included in Ulrich's Periodicals Directory, Google Scholar, Crossref, Engineering & Technology Digital Library and Electronic Journals Digital Library.

Conference website and email: http://www.dmip.org; dmip@cbees.net

Committee

Conference Chairs

Prof. Kiyoshi Hoshino, University of Tsukuba, Japan
Prof. Yen-Wei Chen, Ritsumeikan University, Japan

Conference Program Chairs

Prof. Qingli Li, East China Normal University, China
Assoc. Prof. Zhifu Sun, Mayo Clinic, USA

Conference Technical Committee

Prof. Kathiravan Srinivasan, Vellore Institute of Technology (VIT), India
Prof. Akira Asano, Kansai University, Japan
Prof. Shin-Feng Lin, National Dong Hwa University, Taiwan
Assoc. Prof. Ran Liu, Chongqing University, China
Assoc. Prof. Tomio Goto, Nagoya Institute of Technology, Japan
Assoc. Prof. Xiuxin Wang, Chongqing University of Posts and Telecommunications, China
Dr. Alba Garc á Seco De Herrera, University of Essex, UK
Dr. Wen-Liang Hwang, Academia Sinica, Taiwan
Dr. Tomoko Tateyama, Hiroshima Institute of Technology, Japan
Assist. Prof. Yutaro Iwamoto, Ritsumeikan University, Japan
Dr. Roberto Caldelli, University of Florence, Italy
Dr. Xin Yi, Beijing Institute of Technology, China
Assoc. Prof. CHEN Nanguang, National University of Singapore, Singapore
Assoc. Prof. ShengFu Liang, National Koxinga University, Taiwan
Assoc. Prof. HongXia Deng, Taiyuan University of Technology, China
Assist. Prof. Xu Qiao, Shandong University, China
Dr. Chunhua Dong, Fort Valley State University, USA
Assoc. Prof. Rahul K. Kher, G H Patel College of Engineering & Technology, India
Assoc. Prof. Shinya Zozaki, University of Ryukyus, Japan
Dr. Feichen Shen, Mayo Clinic, USA
Dr. Yan Guo, University of New Mexico, USA
Dr. Sumit Kushwaha, KNIT Sultanpur, India
Assist. Prof. Sofia Cavaco, Universidade NOVA de Lisboa, Portugal
Dr. S. Jafar Ali Ibrahim, Anna University, India
Assist. Prof. Dionysis Goularas, Yeditepe University, Turkey
Assoc. Prof. Dinesh Bhatia, North Eastern Hill University, Shillong, Meghalaya, India
Assoc. Prof. Jinshan Tang, Michigan Technological University, USA
Dr. Ayan Seal, PDPM IIITDM Jabalpur, India
Assoc. Prof. Yu-Lin (Eugene) Song, Asia University, Taiwan

Presentation Instruction

Instruction for Oral Presentation

Devices Provided by the Conference Organizer:

Laptop Computer (MS Windows Operating System with MS PowerPoint and Adobe Acrobat Reader)
Digital Projectors and Screen; Laser Stick

Materials Provided by the Presenters:

PowerPoint or PDF Files (Files should be copied to the Conference laptop at the beginning of each Session.)

Duration of each Presentation (Tentatively):

Keynote Speech: about **35** Minutes of Presentation and **5** Minutes of Question and Answer
Oral Presentation: about **12** Minutes of Presentation and **3** Minutes of Question and Answer

Instruction for Poster Presentation

Materials Provided by the Conference Organizer:

The place to put poster

Materials Provided by the Presenters:

Home-Made Posters: Submit the poster to the staff when signing in; Poster Size: A1 (841*594mm) Load Capacity: Holds up to 0.5 kg

Best Presentation Award

One Best Presentation will be selected from each session, and the Certificate for Best Presentation will be awarded at the end of each session on November 14, 2019.

Dress Code

Please wear formal clothes or national representative of clothing.

Disclaimer

Along with your registration, you will receive your name badge, which must be worn when attending all conference sessions and activities. Participants without a badge will not be allowed to enter the conference venue.
Please do not lend your name badge to the persons who are not involved in the conference and do not bring the irrelevant persons into the conference venue.
The organizers are not liable for damages and/or losses of any kind which may be incurred by the conference delegates or by any other individuals accompanying them, both during the official activities as well as going to/from the conference. Delegates are responsible for their own safety and belongings.

Keynote Speaker Introduction

Keynote Speaker I

Prof. Yen-Wei Chen
Ritsumeikan University, Japan

Yen-Wei Chen received the B.E. degree in 1985 from Kobe Univ., Kobe, Japan, the M.E. degree in 1987, and the D.E. degree in 1990, both from Osaka Univ., Osaka, Japan. He was a research fellow with the Institute for Laser Technology, Osaka, from 1991 to 1994. From Oct. 1994 to Mar. 2004, he was an associate Professor and a professor with the Department of Electrical and Electronic Engineering, Univ. of the Ryukyus, Okinawa, Japan. He is currently a professor with the college of Information Science and Engineering, Ritsumeikan University, Japan. He is also an adjunct professor with the College of Computer Science, Zhejiang University, China and Zhejiang Lab, China. He was a visiting professor with the Oxford University, Oxford, UK in 2003 and a visiting professor with Pennsylvania State University, USA in 2010. His research interests include medical image analysis, computer vision and computational intelligence. He has published more than 300 research papers in a number of leading journals and leading conferences including IEEE Trans. Image Processing, IEEE Trans. SMC, Pattern Recognition. He has received many distinguished awards including ICPR2012 Best Scientific Paper Award, 2014 JAMIT Best Paper Award, Outstanding Chinese Oversea Scholar Fund of Chinese Academy of Science. He is/was a leader of numerous national and industrial research projects.

Topic: *"Tensor Sparse Coding for Multi-Dimensional Medical Image Analysis"*

***Abstract*—**Abstract: Due to the rapid development of imaging technologies, we have obtained a large amount of biomedical images. In addition to 3-dimensional spatial information, the biomedical images have temporal information. Efficient representation of the multi-dimensional biomedical image is an important issue for biomedical image analysis. Sparse coding is one of machine learning methods and is widely used for efficient image representation and image recognition. The limitation of the conventional sparse coding is that a multi-dimensional data (e.g. an image or a video image) should be unfolded into a vector resulting in loss of spatial and spatial-temporal relationship of the data. In this keynote talk, I will talk about anew tensor sparse coding method and its application to multi-dimensional medical image analysis, in which the multi-dimensional data can be treated as a tensor without unfolding.

Keynote Speaker II

Prof. Yue Dai
East China Normal University, China

Yue Dai obtained Ph.D. degree in neurophysiology from University of Manitoba, Winnipeg, Canada in 2001, and then he did post-doctoral research in the Department of Physiology and Biophysics at University of Washington, Seattle, USA. He also received Master of Science in applied mathematics from University of Manitoba in 1996 and Bachelor of Science in computational mathematics from Yunnan University, Kunming, China in 1982. From 2003-2013 he worked as a senior research scientist in the Spinal Cord Research Center at University of Manitoba. In 2014 he was appointed to the Zijiang-scholar professor by the East China Normal University. Using combined approaches of electrophysiology and computer simulation. Dr. Dai has been engaged in interdisciplinary research across neurophysiology and bioinformatics for more than 17 years. His research focuses on the cellular properties and channel mechanisms underlying locomotion and has made some important discoveries in this field.

Topic: *" Motor Control and Simulation: Channel Mechanisms Underlying Locomotion"*

***Abstract*—**Locomotion in vertebrates is generated by spinal networks known as the central pattern generator (CPG). During locomotion spinal motoneurons exhibited dramatic changes in membrane properties including hyperpolarization of voltage threshold for generation of action potential, reduction of input resistance and afterhyperpolarization, voltage-dependent excitation of membrane properties, and alteration of frequency-current (F-I) relationship. Due to the complexity of the CPG, little is known about the mechanism underlying these changes. Furthermore, the functional significance of these changes for generating locomotion remains unclear. Combining electrophysiological and modeling approaches we study the motor control of CPG from ionic channels to neuronal excitability and from neurons to networks, based on the experimental data collected from ion channels and intrinsic membrane properties of spinal neurons. Our study suggest that modulation of ionic channels play an essential role in regulating neuronal excitability and enhancing recruitment of motoneuron pools during locomotion.

Keynote Speaker III

Prof. Kiyoshi Hoshino
University of Tsukuba, Japan

Prof. Kiyoshi Hoshino received two doctor's degrees; one in Medical Science in 1993, and the other in Engineering in 1996, from the University of Tokyo respectively. From 1993 to 1995, he was an assistant professor at Tokyo Medical and Dental University School of Medicine. From 1995 to 2002, he was an associate professor at University of the Ryukyus. From 2002, he was an associate professor at the Biological Cybernetics Lab of University of Tsukuba. He is now a professor. From 1998 to 2001, he was jointly appointed as a senior researcher of the PRESTO "Information and Human Activity" project of the Japan Science and Technology Agency (JST). From 2002 to 2005, he was a project leader of a SORST project of JST. He served as a member of the “cultivation of human resources in the information science field” WG, Special Coordination Funds for the Promotion of Science and Technology, MEXT, a member of “Committee for Comport 3D Fundamental Technology Promotion”, JEITA, and the chairman of the 43rd Annual Meeting of Japanese Society of Biofeedback Research.

Topic: *"Eye Movement Estimation Based on the Intensity Gradients of Blood Vessels in the Eye"*

Abstract**—**The author proposes a method that allows eye movement measurement with high accuracy without using a blue auxiliary light for users between whom blood vessels in the white part of the eye differ considerably in terms of thickness and density on the image. In the proposed system, in order to select a template image that includes a thick, dense blood vessel suitable for tracking in the white part of the eye, feature points are first extracted from the white part of the eye on the acquired image based on the intensity gradients, and the number of feature points in a candidate template image is counted. Next, from among the candidate template images that include a larger number of feature points, those with a reflection of external light source are excluded. Lastly, a candidate template image that includes a blood vessel with a distinct shape is selected as a template image. The results of an evaluation experiment show that the method proposed in this study can, even without a blue auxiliary light, reduce the standard deviation of estimation errors to almost by half, compared with that of the conventional method developed by our group that uses a blue auxiliary light to enhance the contrast of blood vessels.

Keynote Speaker IV

Assoc. Prof. Kuo-Yuan Hwa
National Taipei University of Technology, Taiwan

Kuo-Yuan Hwa is an associate professor and the director of the Center for Biomedical Industries at the National Taipei University of Technology. Dr. Hwagraduated and received her PhD from the School of Medicine, the Johns Hopkins University. She is the president of the Medical Association for Indigenous Peoples of Taiwan (MAIPT). Dr. Hwa's scientific interests are: 1) nanotechnology and biosensor, 2) new drug discovery for human diseases by proteomics and genomics approaches and 3) glycobiology, especially on enzymes kinetics. She has published 85 conference and journal articles and 10 patents. She has served in many national and international committees. Dr. Hwa has been invited as a speaker for many academic research institutes and universities in China, Korea, Japan and USA. She has been invited as a reviewer, a judge and an editor for international meetings and journals. In addition, one of her currently works is on developing culturally inclusive health science educational program, with both indigenous and western science knowledge for indigenous children.

Topic: *" Proteogenomics in Cancer Biology and Therapy: Computational Approaches"*

***Abstract*—**The advancement in technology such as the next-generation genomic sequencing (NGS) and high throughput mass spectrometry (HT-MS) has helped clinical scientists to collect more biological data, in order to explain the biology of cancer and for the potential clinical utilities against the diseases. By combining data from genomics, proteomics and metabolomics, we hope to find new therapeutic approaches. In clinical oncology with the effort from the cancer research communities and the private and public funding agencies such as the US National Cancer Institute, large collaborative projects have emerged. However, many key issues remain to be resolved. One of the major challenges is to interoperate complicate proteomics data from LC-MS/MS, with various genomic variants occurred in cancer patents. How to correlate genomics, including DNA sequencing, expressed sequence tags (ESTs) and transcriptomics, in cluding RNA-Seq with expression and/or modification of oncoproteins requires new algorithms from artificial intelligence computation. Moreover, how to interlinked the phenotypic figures of cancer to molecular signals is still at the early development stage. The new approaches in combining omics and cellular or diseases phenotype, have extended not only the basic research on cancer biology but also on finding new treatments.

Brief Schedule of Conference

Day 1 November 13, 2019 (Wednesday)	10:00-16:00	**Venue: Lobby of Meeting Room A228（A228 会议室） Participant Onsite Registration & Conference Material Collection**
	14:00-17:00	**Academic Visit**
Day 2 November 14, 2019 (Thursday)	**Venue: Meeting Room A228（A228 会议室）**	
	09:00-09:10	**Opening Remarks** Prof. Xing Wu Vice Dean of School of Communication and Electronic Engineering, East China Normal University, China
	09:10-09:50	**Keynote Speech I** Prof. Yen-Wei Chen Ritsumeikan University, Japan Topic: "Tensor Sparse Coding for Multi-Dimensional Medical Image Analysis"
	09:50-10:30	**Keynote Speech II** Prof. Yue Dai East China Normal University Topic: "Motor Control and Simulation: Channel Mechanisms Underlying Locomotion"
	10:30-11:00	**Coffee Break & Group Photo**
	11:00-11:40	**Keynote Speech III** Prof. Kiyoshi Hoshino University of Tsukuba, Japan Topic: "Eye Movement Estimation Based on the Intensity Gradients of Blood Vessels in the Eye"
	11:40-12:20	**Keynote Speech IV** Assoc. Prof. Kuo-Yuan Hwa National Taipei University of Technology, Taiwan Topic: "Proteogenomics in Cancer Biology and Therapy: Computational Approaches"

<table>
<tr><td rowspan="5">Day 2
November
14, 2019
(Thursday)</td><td colspan="2">12:20-13:30 Lunch
Qiulin Pavilion (秋林阁)</td></tr>
<tr><td>Session 1: 13:30-16:00
Venue: Meeting Room A228
(A228 会议室)
Topic: “Digital Image Processing and Signal Processing”
10 presentations</td><td>Session 2: 13:30-15:45
Venue: Meeting Room A207
(A207 会议室)
Topic: “Medical Image Processing and Technology”
9 presentations</td></tr>
<tr><td colspan="2">16:00-16:15 Coffee Break</td></tr>
<tr><td>Session 3: 16:15-18:30
Venue: Meeting Room A228
(A228 会议室)
Topic: “Molecular Biology and Bioinformatics”
9 presentations</td><td>Session 4: 16:15-18:30
Venue: Meeting Room A207
(A207 会议室)
Topic: “Clinical Medicine and Rehabilitation Medicine”
9 presentations</td></tr>
<tr><td colspan="2">Poster Session: 13:30-17:00
Venue: Meeting Room A228 (A228 会议室)</td></tr>
<tr><td colspan="2">18:30-20:00 Dinner Banquet
Qiulin Pavilion (秋林阁)</td></tr>
</table>

Tips: Please arrive at the Conference Room 10 minutes before the session begins to upload PPT into the laptop; submit the poster to the staff when signing in.

Session 1

Tips: The schedule for each presentation is for reference only. In order not to miss your presentation, we strongly suggest that you attend the whole session.

Afternoon, November 14, 2019 (Thursday)
Time: 13:30-16:00
Venue: Meeting Room A228 (A228会议室)
Topic: "Digital Image Processing and Signal Processing"
Session Chair: Assoc. Prof. Kuo-Yuan Hwa

S1017 Session 1 Presentation 1 (13:30-13:45)	A World Camera for Recording the Game Tactics in Martial Arts using Bamboo Swords Kiyoshi Hoshino, **Maki Nakamura**, Yuya Nakai, Yoshimasa Ozone, Satoshi Shimanoe and Yuki Noguchi University of Tsukuba, Japan *Abstract*—The proposed system was designed for tankendo, kendo, or Japanese fencing using bamboo swords that also use a mask. First, a lightweight, miniaturized world-camera that is 3mm square, or smaller than the width of the vertical bar in the mask, is attached to the center of the vertical bar. This keeps the world-camera out of the field of vision of the competitor and protects the camera from damage. Second, a lengthened signal cable is connected to the control computer and compact power supply attached to the competitor's waist. This minimizes any discomfort a competitor might feel when using the system.
S0029 Session 1 Presentation 2 (13:45-14:00)	A Model-based Method for Measuring Autonomic Nerve Activity and Sensitivity **Xiang'ao Meng**, Zhipei Huang and Jiankang Wu University of Chinese Academy of Sciences, China *Abstract*—The measurement of autonomic nerve activity plays an important role in the diagnosis and treatment of various cardiovascular diseases. This paper presents a model-based method for measuring autonomic nerve activity and sensitivity. By non-invasively recording heart rate and blood pressure data of the subjects during the sit-to-stand experiment, we modeled the blood pressure-heart rate regulation system and solved personalized parameters. These personalized parameters were used to obtain the autonomic nerve activity and sensitivity of the subjects. We conducted experiments on 9 patients with refractory hypertension and 20 healthy people, and the results showed that there were significant differences in the sensitivity and activity of autonomic nerves.

S1016 Session 1 Presentation 3 (14:00-14:15)	Predicting the Types of Striking and Thrusting Motions by using Deep Learning Kiyoshi Hoshino, Yuki Noguchi, **Yuya Nakai**, **Yoshimasa Ozone** and Maki Nakamura University of Tsukuba, Japan *Abstract*—The final goal is to make a "tankendo machine" that is easy to use, safe, fun, and can provide a mechanical competitor for humans. First, deep learning technology was used to install an image processing system that could detect the start (initial motion) of striking and thrusting motions by humans and quickly predict the type of technique used.
S3003 Session 1 Presentation 4 (14:15-14:30)	On the Radon Transform and Linear Transformations of Images **Fawaz Hjouj** and Mohamed Soufiane Jouini Khalifa University, UAE *Abstract*—We present a novel original method for estimating and recovering a general geometric transformation which is applied to an image. Our main tool is the Radon Transform; we develop analysis to address the behavior of this transform under a Linear Transformation in terms of the singular value decomposition of the Transformation's matrix. We derive a mathematical exact solution to this problem. We then implement our analysis and validate the work on synthetic images as well as real images. In so doing, we developed efficient numerical tools for carrying out such analysis.
S1014 Session 1 Presentation 5 (14:30-14:45)	Scenario-based Customer Service VR Training System with Honorific Exercise **Soichiro Iida**, Takehito Utsuro, Hiromitsu Nisizaki and Junichi Hoshino University of Tsukuba, Japan *Abstract*—Customer service plays an important role in increasing customer satisfaction in service industries. In this paper, we propose a scenario-based customer service VR training system with an honorific exercise. First, the concept and general requirements of the service training system using voice conversation with a 3D customer agent is described. Trainees can participate in virtual customer service situations with various types of customers in restaurants, shops, and airports. We then focus on an honorific exercise during customer service. Japanese society places great importance on courtesy and, accordingly, honorifics are a frequent theme when training new employees. With this system, users receive training on how to use honorifics in speech, and a diagnostics report is automatically generated to aid improvement. Initial evaluation results of the accuracy of honorific misuse judgment are also described.
S2009 Session 1	A Lightweight Channel-spatial Attention Network for Real-time Image De-raining **Yirui Zeng** and Zhengming Ma Sun Yat-sen University, China

Presentation 6 (14:45-15:00)	*Abstract*—Image de-raining aims to eliminate rain streaks captured by outdoor equipment such as video surveillance, remote sensor and automatic pilot. Recently, a de-raining method called non-locally enhanced encoder-decoder network (NLEDN) has achieved reliability performance. Nevertheless, it is very time consuming (2.2571s per image) and takes up memory so that it cannot be applied to mobile devices to process image in real-time. To solve this problem, we design a lightweight channel-spatial attention network that is 55 times faster (41ms per image) and memory saving. The most advanced performances are achieved in most de-raining data sets. More specifically, we design a channel-spatial attention dense block (CSADB). The channel attention operation will be carried out together with the spatial attention. Our experiments demonstrate that the network can learn more effective features by this way. In order to make our proposed method more lightweight, the depthwise convolutions are adapted in each block to reduce parameters. We conduct experiments on four public synthetic datasets to demonstrate the effectiveness of our proposed method, which achieve excellent performance. And the real-world de-raining results are also tacked into comparison. Moreover, an additional experiment demonstrates that our method also works well on face hallucination task. The relevant code and trained models will be available in GitHub soon.
S3008 Session 1 Presentation 7 (15:00-15:15)	Improvement of Robustness Blind Image Restoration Method using Failing Detection Process **Ryohei Teranishi**, **Tomio Goto** and Takahiro Nagata Nagoya Institute of Technology, Japan *Abstract*—Blurring is one of the representative image degradation, and much research has been done on its restoration -. In these studies, the degradation process of the image is modeled by a point spread function (PSF: Point Spread Function) of blurring, and it is possible to recover from one input image by estimating its PSF. However, when noise is mixed into the image due to factors such as the characteristics of the camera, there is still a failure of the image due to PSF estimation error. In this paper, we introduce a ringing removal method using L0 regularization. We propose a high-performance restoration method that can estimate clear images, and confirm its effectiveness by experiments.
S3006 Session 1 Presentation 8 (15:15-15:30)	Towards Tomography with Random Orientation **Fawaz Hjouj** Khalifa University, UAE *Abstract*—We consider the two-dimensional parallel beam Tomography problem in which both the object being imaged and the projection directions are unknown. Specifically: Given unsorted set of Radon projections that correspond to angles $\varphi_j = 0°, 1°, \ldots, 179°$. Our main goal is to determine

	(align) the projections with their angles. We introduce a type of Local Radon Transform from which we propose a distance formula between any two Radon projections. We solve the problem by combining the second order Geometric Moments of these projections together with this measure of distance. We validate our framework on synthetic images and real images.
S1013 Session 1 Presentation 9 (15:30-15:45)	Complaint Handling Training VR System using Customer Agent **Satoru Fujita**, Donghao Wang, Kazuki Okawara and Junichi Hoshino University of Tsukuba, Japan *Abstract*—In many customer service industries, a hospitable reception is important to increasing customer satisfaction (CS). This is especially the case when handling complaints, due to psychological pressures not usually experienced elsewhere. In conventional training methods, such as on the job training (OJT), it is difficult to cover the variety of situations that may occur rarely. In this paper, we propose a multimodal conversational Virtual Reality (VR) training system that provides complaint handling training in various customer service scenarios. Claims situations are reproduced using a 3D customer agent with an emotional voice and gestures. Complaint handling skills and psychological resistance are compared through interpersonal role play with and without VR training. User study experiments show that psychological resistance can be reduced through repeat VR system training, leading to improvements in complaint handling skills.
S2012 Session 1 Presentation 10 (15:45-16:00)	Comparison of Hand-craft Subtype Features, Deep Learning Features and Their Fused Features for Classification of Alzheimer's Disease **Naohiro Hashizume**, Yutaro Iwamoto, Akihiko Siino and Yen-Wei Chen Ritsumeikan University, Japan *Abstract*—Dementia has become a major issue in an aging society in recent years, and it is important to make an early diagnosis for Alzheimer's disease (AD), which accounts for the largest proportion. In the conventional method, it is effective to use the hippocampus region. However, it is known that AD subtypes exist due to differences in the tendency of atrophy, which may affect AD diagnosis focused on the hippocampus. In this study, we compare the performance of three models to verify the effect of subtype features. We build that (1) SVM Classifier model with hand-craft subtype features (region volumes), (2) ResNet-50 model using MRI slices containing hippocampus, and (3) RseNet50 model with fused hand-craft features and deep features. In addition, we compare each models based on whether or not the data augmentation. We use MRI data with Alzheimer (n = 364) and Normal (n = 365) acquired from ADNI. Region volume features are extracted using FreeSurfer, and MRI is standardized using SPM. We will report detailed comparison results in the conference.

Session 2

Tips: The schedule for each presentation is for reference only. In order not to miss your presentation, we strongly suggest that you attend the whole session.

Afternoon, November 14, 2019 (Thursday)
Time: 13:30-15:45
Venue: Meeting Room A207 (A207会议室)
Topic: "Medical Image Processing and Technology"
Session Chair: Prof. Aleksandr Poliakov

S0001 Session 2 Presentation 1 (13:30-13:45)	Field Map Estimation in MRI using Compressed Sensing Algorithm **Kang Yan** and Huajun She Shanghai Jiao Tong University, China *Abstract*—For non-cartesian magnetic resonance imaging, like spiral imaging, field inhomogeneity could cause image blurring, especially for long readout time. General correction method required field map estimation. However, when images are in low spin density, the estimated field map suffers from noise. A regularized method which utilizes the physical feature that field map is spatial smoothing, is proposed to estimate field map with little noise. The field map estimated by regularized method only have good performance while the images in low noise level. Once image suffers from severe noise, an accurate field map is still hard to obtain. In reality, to shorten scan time in spiral imaging, we would decrease the number of interleaves of sampling. As results of that, Signal-to-noise Ratio (SNR) of image gets lower, and effect of B0 inhomogeneity becomes serious problem. In such situation, a better way to calculate field map is required. In this paper, we propose optimized field map estimation method which employs compressed sensing algorithm. Actually, recovery expected signal of compressed sensing (CS) algorithm is noise reduction process, which could be used to estimate field map when images are in low SNR. The experiments show that using Wavelet transform as regularization term could perform better when images are in low Signal-to-Noise Ratio (SNR). To improve calculated field map further, both Total Variation (TV) term and Waveform term as regularization term are adapted. The method in this paper promises great field map estimation.
S0033 Session 2 Presentation 2	An Inductive Transfer Learning Approach using Cycle-consistent Adversarial Domain Adaptation with Application to Brain Tumor Segmentation **Yuta Tokuoka**, Shuji Suzuki and Yohei Sugawara Keio University, Japan

(13:45-14:00)	*Abstract*—With recent advances in supervised machine learning for medical image analysis applications, the annotated medical image datasets of various domains are being shared extensively. Given that the annotation labelling requires medical expertise, such labels should be applied to as many learning tasks as possible. However, the multi-modal nature of each annotated image renders it difficult to share the annotation label among diverse tasks. In this work, we provide an inductive transfer learning (ITL) approach to adopt the annotation label of the source domain datasets to tasks of the target domain datasets using Cycle-GAN based unsupervised domain adaptation (UDA). To evaluate the applicability of the ITL approach, we adopted the brain tissue annotation label on the source domain dataset of Magnetic Resonance Imaging (MRI) images to the task of brain tumor segmentation on the target domain dataset of MRI. The results confirm that the segmentation accuracy of brain tumor segmentation improved significantly. The proposed ITL approach can make significant contribution to the field of medical image analysis, as we develop a fundamental tool to improve and promote various tasks using medical images.
S0003 Session 2 Presentation 3 (14:00-14:15)	Fast Multislice Chemical Exchange Saturation Transfer (CEST) MRI with Dual-channel RF Irradiation **Yudong Zhong**, Xiaodong Zhou, Yiping Du and Qun Chen Shanghai Jiao Tong University, China *Abstract*—The aim of this study is to develop a technique for rapid multislice chemical exchange saturation transfer (CEST) imaging with dual-channel radiofrequency (RF) irradiation to reduce scan time and enhance CEST contrast. Conventional CEST MRI is implemented with a long RF irradiation module, followed by fast image acqui-sition to obtain a steady state CEST contrast. However, it typically requires a long preparation time while producing relatively small CEST contrast. A dual-channel RF irradiation scheme is proposed including a long dual-channel RF irradiation module that establishes a steady state CEST contrast and repetitive short dual-channel secondary RF irradiation modules to maintain the contrast. The proposed method is designed to reduce the preparation time to reach steady state CEST contrast and efficiently maintain the contrast throughout signal averages and multislice acquisition. The proposed method was validated on a creatine phantom, and exhibited 31.96% higher CEST contrast than the conventional method. The proposed method, a fast multislice CEST MRI sequence with dual-channel RF irradiation module, is a promising technique with significantly improved CEST contrast and reduced scan time.
S3005 Session 2	Low Dose Brain CT, Comparative Study with Brain Post Processing Algorithm **Hamza Arjah**, Mohammad Hjouj and Fawaz Hjouj

Presentation 4 (14:15-14:30)	Al-Quds university, Palestine *Abstract*—CT scanners and CT exams increase continuously. Researchers try to minimize ionizing radiation dose by introducing new CT protocols, and providing diagnostic CT images with lower radiation dose to patient. However, such studies encounter difficulties, when radiation dose is lowered, the quality of images becomes less and sometime not diagnostic. In this study, the researchers try to provide low dose brain CT protocol, and then determine if the images match quality criteria of Brain CT; in addition to exploring radiologists' opinions about the diagnostic appearance of the images. Then, the researchers will compare the result obtained from source Brain CT, and Brain post processing algorithm to determine which one of them provides better diagnostic image, and has a better match for quality criteria of Brain CT. Numerical criterion (1: weak, 2: moderate, 3:perfect) is used by expert medical imaging technologists to determine the quality criteria. On a sample of 35 patients; the first brain CT was conducted by 22 milli-gray (mGy) volume computed tomography dose index ($CTDI_{vol}$); the resulting image was noisy, and has poor match for quality criteria, then $CTDI_{vol}$ was raised to 25 mGy, then to 30 mGy, and finally to 33.8 mGy. At this point, the image was acceptable to complete the study. The researchers have engaged four radiologists to determine if the image provides diagnostic appearance, then six expert medical imaging technologists were involved to determine the quality criteria. These steps were followed for Brain CT before and after applying post processing algorithm. The study published by (Calzado et al. 2000) is used as reference for this present study. In this study, the criteria has a stronger match and better results
S0007 Session 2 Presentation 5 (14:30-14:45)	Reference-free Correction for the Nyquist Ghost in Echo-planar Imaging using Deep Learning **Xudong Chen**, Yufei Zhang, Huajun She and Yiping Du Shanghai Jiao Tong University, China *Abstract*—Echo-planar imaging suffers from Nyquist ghost (i.e., N/2 ghost) because of the imperfection of the gradient system and gradient delays. The phase mismatch between even and odd echoes can be eliminated by an extra reference scan without the phase encoding. However, due to the non-linear and time-varying local magnetic field changes or movement of the patients, the reference-based methods may have incorrect correction results. Other correction methods like parallel imaging reconstruction may suffer from the image noise amplification and signal-to-noise ratio penalty. In this study, a deep learning method is proposed to eliminate the phase error in k-space and correct the mismatch between even and odd echoes without reference scan and SNR penalty. The Fourier transform layer is introduced into the conventional U-Net structure, and the distortion-free images are directly reconstructed from

	the k-space EPI data. Turbo spin echo data and single-shot EPI data are tested using this network. The results show that this method has a good performance in ghost correction, and the ghost-to-signal ratio is effectively reduced compared to other state-of-the-art correction methods. The proposed deep learning method is reference-free and effective to correct Nyquist ghost in EPI, and can also combine with parallel imaging to achieve additional acceleration.
S2011 Session 2 Presentation 6 (14:45-15:00)	Automatic Segmentation of Infant Brain Ventricles with Hydrocephalus in MRI based on 2.5D U-net and Transfer Learning **Kenji Ono**, Yutaro Iwamoto, Yen-Wei Chen and Masahiro Nonaka Ritsumeikan University, Japan *Abstract*—The goal of our study is to segment and quantify brain ventricles in infants with hydrocephalus. The Hydrocephalus is a brain disease in which cerebrospinal fluid accumulates in the ventricles, which expand abnormally. The ventricles then press on other brain tissues, leading to the risk of multiple functional and developmental disorders. Segmenting brain ventricles is necessary for early detection and surgical follow-up. Unfortunately, there are few studies on patients with hydrocephalus and infant ventricles are complex and diverse with limited data. Moreover, using conventional automatic segmentation by atlas and machine learning with handcrafted features is difficult to segment the infant brain ventricles with hydrocephalus because of the above data-specific issues. Here, we propose a deep automatic method based on 2.5D U-Net and transfer learning to segment the infant brain ventricles with hydrocephalus. We apply a network architecture that combines low-level features with high-level features to improve learning efficiency, and to maintain the correlation in the slice direction. The input images of the network are multi-slice images (the target slice image and its neighbor slices). Furthermore, we apply transfer learning using adult datasets to deal with limited data and fine-tuning in the hydrocephalus infant datasets. In our experiments, our proposed method outperforms conventional methods and improves the DICE from 58% to 72%.
S0019 Session 2 Presentation 7 (15:00-15:15)	Acoustic Noise Reduction of Echo Planar Imaging in Diffusion MRI Junwei Zhao, **Zhenliang Lin**, Xiaodong Zhou, Guobin Li and Jie Luo Shanghai Jiao Tong University, China *Abstract*—Acoustic noise during MR scans, generated by the gradient coil vibration, has been compromising for patient comfort and even poses risk for sensitive populations such as fetuses and infants. Although recommended noise level for neonatal MRI with hearing protection such as earplugs is 65 dBA, noise level of an MRI scan could be as high as 125–130 dB(A) at 3T. Further, hearing protection compliance for neonates using earplug could be unreliable. Single-shot echo planar imaging (EPI) has a rapid switching readout gradient waveform that is very efficient for

	data acquisition but also very loud. Given that EPI is widely used diffusion MRI techniques, modifications in the EPI sequence design could offer a solution that is ubiquitous across scanner platforms. In this work, we investigated the acoustic noise reduction effects of gradient waveform adjustments, echo spacing adjustments, in combination with parallel imaging. Through gradient waveform and echo spacing (ESP) adjustment, the acoustic noise was reduced by 7.5 dBA while keeping high image SNR. Besides, we validated the image consistency and ADC value accuracy quantitatively between traditional EPI-DWI sequence and the modified versions of EPI-DWI sequences in both phantom and human studies.
S1007 Session 2 Presentation 8 (15:15-15:30)	Mining Frequent Patterns in Bioinformatics Workflows **C. R. Wijesinghe** and A. R. Weerasinghe University of Colombo, Sri Lanka *Abstract*—Goal of workflow systems is to put away the disadvantages of the state-of-the-art methods of scientific data analysis, mostly in Perl or similar scripting languages. Scientific workflow systems enable development of analysis pipelines, provenance management, process control, recovery, scheduling and parallelization of individual tasks, understandability and sharing of workflows among the scientific community. There are several workflow systems to design bioinformatics workflows. Objective of this work is to identify the frequent workflow patterns or substructures in a corpus of Galaxy bioinformatics workflows obtained from myExperiment. Frequent Sub Graph discovery (FSG) algorithm used in analyzing the workflows. 71 reusable workflow patterns were identified with 5% minimum support threshold. As future work planning to annotate the identified frequent patterns and to encode the identified patterns in the workflow systems with the objective of improving the usability by providing a high-level abstract interface to the user.
S3004 Session 2 Presentation 9 (15:30-15:45)	Evaluation of Liver Phantom for Testing of the Detectability Multimodal for Hepatocellular Carcinoma **Osama Makhamrah**, Muntaser S. Ahmad and Mohammad Hjouj Quds University, Palestine *Abstract*—This study aims at developing a reusable, multimodal liver phantom, which applies functional vasculature and displays some pathologies, such as Hepatocellular Carcinoma (HCC). This phantom can be used with different modalities, such as Ultrasonography (US), Computed Tomography (CT), and Magnetic Resonance Imaging (MRI). The current phantom consisted of different types of mimicked tissue; liver parenchyma; HCC and major input and output vessels. They are made of different ingredients; 4% weight of gelatin powder; 2.6% weight of hydroxyethylcellulose; 0.2 weight % of benzalkonium chloride; 3.2%

	weight of propanediol; and 90% weight of water as a volume spreader. The selected materials mimicked liver tissue under MRI, CT and US. The phantom preparation is simple, low cost, reusable, and takes about 24 hours for preparation. Additionally, comparison of ultrasound images, CT, and MRI of real patient's liver, the phantom's liver tissue with HCC and its structures are well simulated. Using different steps to cast procedures, the researchers fabricated a multimodal liver phantom, with dynamic vascular channels, and models with different sized pathologies, which give a best procedure for training in different modalities. This technique can be applied to any organ in the body.

16:00-16:15	**Coffee Break**

Session 3

Tips: The schedule for each presentation is for reference only. In order not to miss your presentation, we strongly suggest that you attend the whole session.

Afternoon, November 14, 2019 (Thursday)
Time: 16:15-18:30
Venue: Meeting Room A228 (A228会议室)
Topic: "Molecular Biology and Bioinformatics"
Session Chair: Prof. Yen-Wei Chen

S1015 Session 3 Presentation 1 (16:15-16:30)	McBel-plnc: A Deep Learning Model for Multiclass Multilabel Classification of Protein-lncRNA Interactions **Natsuda Navamajiti**, Thammakorn Saethang and Duangdao Wichadakul Chulalongkorn University, Thailand *Abstract*—One main function of long non-coding RNAs (lncRNAs) is to act as a scaffold facilitating multiple proteins to form complexes. Most of available prediction models for protein-RNA interactions, however, were proposed as a binary classifier, which limited on predicting the interaction between the non-coding RNAs and each individual RNA-binding protein (RBP). Hence, to predict if a lncRNA is acting as a scaffold, we consider this problem as a multiclass multilabel classification problem. To solve this problem, the high confident CLIP-seq data were selected from the POSTAR2 database with an augmentation of the data for the RBP classes with a small number of interacting lncRNAs. We then constructed a deep learning model for multiclass multilabel classification, called McBel-Plnc, based on the convolutional neural network (CNN) and long-short term memory (LSTM) using each of the five datasets randomly generated from the prepared data. Based on macro average, the test results showed the high precision of 0.9151 ±0.0038 averaged from the five models with the lower recall of 0.5786 ±0.0208. The small standard deviations confirmed the model stability. Comparing with iDeepE with a binary relevance method, iDeepE got the higher recall with the significantly lower precision (0.6912 and 0.1987, respectively). This result suggested that our model is competent to predict the protein-lncRNA interactions, especially with the lncRNAs targeted by multiple proteins. This suggested the potential to infer the insights of lncRNA functions and molecular mechanisms.
S1012 Session 3	Comprehensive Prediction and Interpretation of Viral Protein Subcellular Localization **Xiyu Liu** University of Southern California, USA

Presentation 2 (16:30-16:45)	*Abstract*—Determining the subcellular localization of viral proteins is indispensable for understanding the activity of the virus and inferring viral protein functions. Although previous studies about predicting viral protein subcellular localization have been developed, they often have the following disadvantages: (i) only focusing on a part of proteins of a species (ii) not considering the presence of multi-location proteins and (iii) lacking interpretability for the results. To address these problems, this paper is firstly predicting all the subcellular localization of the whole viral proteome in the UniProtKB and is interpretable for the results. This paper gives high prediction accuracy for the single-location and multi-location viral proteins by the FUEL-mLoc predictor. More importantly, we did deeply analysis and interpretation of the subcellular localization of all viral proteins. Finally, we have found some essential GO terms which are interpretable for the results and are significant in predicting the subcellular localization of the viral proteins.
S0015 Session 3 Presentation 3 (16:45-17:00)	Numerical Study on Flow Behavior of Red Blood Cells through Symmetric Capillary Bifurcations Masaaki Hirono and **Toru Hyakutake** Yokohama National University, Japan *Abstract*—The red blood cell (RBC) partitioning properties at microvascular bifurcation are largely related to heterogeneous oxygen distributions in the microcirculatory networks. Here, three-dimensional, T-type symmetric capillary bifurcation models have been prepared and the flow behavior of RBCs through the capillary bifurcations has been investigated. Simulated blood flow was computed using the lattice Boltzmann method, in conjunction with the immersed boundary method, for incorporating fluid–membrane interactions between the flow field and deformable RBCs. To do this, first the straight vessel flow was simulated to determine the RBC flow at a parent vessel of the bifurcation model. The simulation results indicated two types of RBC arrangements according to the hematocrit: (i) zigzag-slipper and (ii) aligned-parachute shapes. Next, by adopting the RBC arrangements obtained from the straight vessel analysis, RBC partitioning in the capillary bifurcation was investigated. The simulation results were in agreement with the Pries' empirical model at high hematocrit. On the other hand, the bias of RBC flux for the parachute shape was larger than that of the empirical model at low hematocrit. These results suggest that the partitioning properties of RBCs in the microvascular bifurcation depend largely on the RBC arrangement in the parent vessel.
S0020 Session 3	Exploring the Stability of Feature Selection Methods across a Palette of Gene Expression Datasets **Zahra Mungloo-Dilmohamud**, Yasmina Jaufeerally-Fakim and Carlos Peña-Reyes

Presentation 4 (17:00-17:15)	University of Mauritius, Mauritius *Abstract*—Gene expression data often need to be classified into classes or grouped into clusters for further analysis, using different machine learning techniques and an important pre-processing step is feature selection (FS). The aim of this study is to investigate the stability of some diverse FS methods on a plethora of microarray gene expression data. This experimental work is broken into three parts. Step 1 involves running some FS methods on one gene expression dataset to have a preliminary assessment on the similarity, or dissimilarity, of the resulting feature subsets across methods. Step 2 involves running two of these methods on a large number of different datasets to investigate whether the results produced by the methods are dependent on the features of the dataset: binary, multiclass, small or large dataset. The final step explores how the similarity of selected feature subsets between pairs of methods evolves as the size of the subsets are increased. Results show that the studied methods display a high amount of variability in terms of the resulting selected features. The feature subsets differed both inter- and intra-methods for different datasets. The reason behind this is not clear yet and is being further investigated. The final objective of the research, that is to define how to select a FS method, is an ongoing work whose initial findings are reported herein.
S0024 Session 3 Presentation 5 (17:15-17:30)	Effects of Trunk Rotation and Backrest Activity on Lumbar sEMG Activities, Body Pressure Distribution and Sitting Discomfort during Sitting **Zhiping Liu** Anhui University of Technology, China *Abstract*—The purpose of this study was to examine the effects of trunk rotation and backrest activity on sitting discomfort, body pressure distribution and lumbar surface Electromyographic (sEMG) activities of lumbar erector spinae muscles (LES) and lumbar multifidus muscles (LMF), so as to provide a scientific basis on dynamic chair design and optimization and human-table-chair office system design. Ten healthy male subjects sat on two kinds of office chairs (one fixed dual-back chair and one movable dual-back chair), rotating 60 °to the left and the right to simulate the common trunk activities of office work with the seatpan and backrest angle of 110 °. Four tests were performed on each subject and sEMG activities of bilateral LES and LMF and body pressure distribution data of seatpan and backrest were statically measured. Meanwhile the Body Part Discomfort (BPD) Scale (Revised) was used to measure the subjective feelings of sitting discomfort. The results showed: (1) backrest activity did not affect marginally on LES and LMF myoelectric activities (P>.05) but trunk rotation had a significant effect on sEMG activities of left LMF (P<.01); (2) trunk rotation did not affect marginally on all the

	pressure variables (P>.05) but backrest activity affected marginally on average seatpan pressure (ASP), average backrest pressure (ABP) and peak backrest pressure (PBP) (P<.05); (3) low back discomfort (LBD) and total discomfort (OD) subjective ratings were significantly affected by backrest activity which had a large difference between fixed and movable dual-back chair and the latter gained a lower rating of discomfort. This study systematically utilized the combination of objective and subjective measurement to confirm that movable dual-back chairs were significantly better than fixed dual-back chairs which showed the superiority of dynamic chairs.
S0026 Session 3 Presentation 6 (17:30-17:45)	DMBA Induction Increases H-ras Gene Expression and Decreases CD8 Count in Sprague Dawley Rats **Titiek Hidayati**, Indrayanti and Sagiran Universitas Muhammadiyah Yogyakarta, Indonesia *Abstract*—Introduction: DMBA is carcinogenic-immunosuppressant. This study was conducted to investigate the immunosuppressant effect of dimethylbenzanthracene (DMBA) on H-Ras expression, hemogram, and CD8 count I Sprague Dawley (SD) rats. Methods: We divided the test animals into three groups. The normal group received standard food and drink. We induced the DMBA group with 10x20mg/kg BW DMBA for five weeks. The solvent group received standard feeding and corn oil solutions. We conducted dissection and data retrieval in week 27. The immunosuppressant effects of DMBA are measured by number leukocytes and CD8CTL. The number of CD8 is determined by the flow cytometer. The H-Ras gene expression is assessed using densitometry after PCR. The mean intergroup difference was calculated using ANOVA. Result: The results showed that DMBA administration increases H-Ras gene expression and decreases CD8 count ($p<0.05$). 10x20 mg/kg BW DMBA administration decrease leukocytes and platelet ($p<0.05$). Conclusion: A dose of 10x20 mg/kg BW DMBA decreased CD8, leukocytes, and platelet number, while it increased H-Ras gene expression in SD rats.
S0030 Session 3 Presentation 7 (17:45-18:00)	Encoding of Stimulus-driven and Intention-driven Actions in Monkey's Primary Motor Cortex **Keyi Liu**, Wenjuan Hu and Yao Chen Shanghai Jiao Tong University, China *Abstract*—Actions can be divided into two modes, one is driven by intention without stimulus, another is in response to external stimulus. Previous studies have shown that these two modes of movement may be manipulated by different physiological pathways in the brain. However, the neural coding of them in motor cortex is still unknown. In this study, we trained rhesus monkeys performing external stimulus-driven and internal intention-driven arm movement tasks and recorded neuronal activity in primary motor cortex (M1). We aimed to compare the neuronal

	coding between stimulus-based and intention-based action modes. We found that neurons fired in different patterns while doing internal intention-driven arm movement. These neurons show no significant difference between intention-based and stimulus-based tasks during movement execution period. We also set up a general linear model to quantify the encoding strength of M1 neurons towards movement parameters in different action modes.
S0011 Session 3 Presentation 8 (18:00-18:15)	An Investigation into Audio Features and DTW Algorithms for Infant Cry Classification **Xilin Yu**, Xian Zhao, Chunmei Lu, Laishuan Wang, Xi Long and Wei Chen Fudan University, China *Abstract*—Cry is the most common phenomenon among infants, and it has been reported that babies cry for multiple reasons. Infant cry signals are thought to convey much useful information about the physiological and pathological state of the baby. Hence, in this work we analyzed these audio signals in order to classify different reasons of cries. Cry signals were especially collected for this study including three causes, namely hunger, pain and uncertainty. Modified MFCC features besides basic acoustic features were extracted from each recording. After intergroup variance examination, nine features were selected and subjected to a novel matching process based on Dynamic Time Warping (DTW) for separating infant cries. Experiment results show that nine selected features are effective to recognize cries caused by hunger, pain and other uncertain reasons. The proposed approach for infant cry analysis will provide useful information for designing towards an automatic system for detecting physiological and pathological state of the baby.
S0031 Session 3 Presentation 9 (18:15-18:30)	A Novel Method for Estimating Respiration Rate based on Ensemble Empirical Mode Decomposition and EKG Slope **Iau-Quen Chung**, Jen-Te Yu and Wei-Chih Hu Chung Yuan Christian University, Taiwan *Abstract*—The clinical monitor now mostly uses impedance IP (impedance pneumography) to measure respiratory signals. While in breathing, the movement of chest leads to position change of the EKG (Electrocardiogram) electrodes on the skin resulting in a change in impedance which can be used to estimate the respiratory rate. Measuring the EKG's impedance change for estimating the respiratory rate requires some specialized hardware. Other indirect methods for estimating respiratory rate, such as the EDR (EKG Derived Respiration), just simply utilize the EKG signal making use of the inherent variations in respiration wherein the respiratory rate is obtained from the parameter variations within the EKG waveform including RSA (Respiratory Sinus Arrhythmia) and R Peak Amplitude (RPA). This study proposes a new EDR method in

	which the square of the slope of the EKG waveform is calculated first and then followed by the moving average. The respiratory rate is obtained by the proposed algorithm that employs the modulated time series and compared to the results from RPA and RSA methods. The new method uses EEMD (Ensemble Empirical Mode Decomposition) to remove noise from EKG, reconstructs the respiratory signal by selecting the right IMF (Intrinsic Mode Function) as respiratory signal, and finally compares it with the nasal mouth pressure reference respiratory signal. The new RSS (R-peak Slope Square) method works with adaptive signal processing tool EEMD to obtain the EDR exploring the potential feasibility of clinical application in the future. The results demonstrate that the innovative methods proposed by this study are more accurate than that from RSA in elderly monitoring and nearly same performance as RPA (R-peak Amplitude) as well.

Session 4

Tips: The schedule for each presentation is for reference only. In order not to miss your presentation, we strongly suggest that you attend the whole session.

Afternoon, November 14, 2019 (Thursday)
Time: 16:15-18:30
Venue: Meeting Room A207 (A207会议室)
Topic: "Clinical Medicine and Rehabilitation Medicine"
Session Chair: Prof. Boo Ho Voon

S0006 Session 4 Presentation 1 (16:15-16:30)	Synthesis of Lower Limbs Exoskeleton for the Rehabilitation of Patients with Disorders of Motor and Proprioceptive Systems **Aleksandr Poliakov**, Vladimir Pakhaliuk, Marina Kolesova, Nikolay Lozinskiy, Dayana Koshevaya and Petro Shtanko Sevastopol State University, Russian Federation *Abstract*—In this work is presented a new design of a rehabilitation exoskeleton intended for the rehabilitation of disabled people and patients with impaired motor functions. A distinctive feature of this design is that the auxiliary legs used in it, in addition to rotational motion drives that simulate the work of the hip joints, are equipped with controlled artificial knee joints, providing biologically natural kinematics of patient during the rehabilitation process. In addition, to solve the problem of motor redundancy in the algorithms of the exoskeleton control system, synergistic quality criteria are used, which also contribute to the realization of biologically natural movements, and, consequently, the quality of rehabilitation effects. The drive control of joints is carried out using commands generated by a hierarchical control system operating based on information from inertial and resistor sensors mounted directly on the exoskeleton elements.
S0009 Session 4 Presentation 2 (16:30-16:45)	RUN-ONCO: A Highly Extensible Software Platform for Cancer Precision Medicine **Neda Peyrone** and Duangdao Wichadakul Chulalongkorn University, Thailand *Abstract*—Precision medicine is a strategy to personalize disease identification and medical care decisions through genetics. The rapid development of -omics technologies e.g., DNA and RNA sequencing, which reveal specific gene mutations in a patient's tumor or profiling of gene expressions for drug responses helps oncologists find effective treatments for individual patients based on their genetics. Hence, besides the clinical records, -omics data become essential for personalized

	diagnosis and treatments. In this paper, a web-based standalone software platform for cancer precision medicine, called RUN-ONCO, is proposed aiming to help oncologists and researchers manage and make use of the available clinical and -omics data easily and efficiently. The platform allows the management of clinical records, biospecimens, and -omics data and enables various integrative data analyses together with public databases such as STRING and OncoKB. With the increasing number of published methods for various -omics data analyses together with the availability of numerous javascript libraries for data visualization, RUN-ONCO has also been designed to be highly extensible with plugins for both visualizations and analysis methods. A demo version of RUN-ONCO is available online at http://cucpbioinfo.cp.eng.chula.ac.th:6002 and the source code for local deployment is at https://gitlab.com/peyrone/run-onco.
S0012 Session 4 Presentation 3 (16:45-17:00)	An Improved Intermittent Electrical Stimulation Therapy for Penicillin-induced Seizure Suppression **Long Liu**, Jiacheng Zhang, Shuming Ye and Kedi Xu Zhejiang University, China *Abstract*—Neuromodulation is a promising treating therapy for drug-resistant epilepsy. Studies have shown that electrical stimulation could induce post-stimulus inhibition of neural activity, making it available for aborting seizure. Considering the long-term safety, intermittent open loop electrical stimulations are commonly employed in both experimental studies and clinical trials. Commonly applied stimulations were alternation sequences between stimulation ONs and OFFs, during which both stimulation pulse trains and interval periods lasted several minutes. The long periods of stimulations may lead to damage to both tissue and electrode itself. To optimize treatment efficacy, in current study, a new stimulation paradigm was designed. To reduce charge accumulation, two pairs of cross-located electrodes were implanted for interleaved stimulation delivering. Besides, brief pulse trains with short intervals were applied instead of relatively long stimulation cycle. Key stimulation parameters were tested for efficacy comparison. And long-term seizure suppression effects were monitored and estimated by LFP signals. The results showed that in acute Penicillin-induced seizure model, the new stimulation therapy could significantly reduce seizure durations by 80.3%. The counts of seizure were also found to be reduced by 80.7%. These results demonstrated that with shortened stimulation sequences, seizures could still be suppressed efficiently, providing a new possible stimulation paradigm for seizure treatment.
S0013 Session 4	Control Algorithm for an Active Ankle-foot Orthosis (AAFOs): Adaptative Admittance Control **Joseph Tsongo Vughuma** and Olivier Verlinden

Presentation 4 (17:00-17:15)	University of Mons, Belgium *Abstract*—Most of current prostheses and orthoses use physical springs and dampers with various control strategies to replicate the compliant behavior of a normal ankle during the gait. The springs, dampers and the control strategies are usually tuned for a single patient and for a fixed gait speed which does not allow adaptation to another patient or another gait speed. In this work, we propose a control strategy that overcomes those adaptation problems. The algorithm is based on an admittance control and replicates the ankle torque-angle curve to assist level-ground gait. The particularity of this control comes from the fact that the physical spring is replaced by a mechatronic spring. It uses principally force and position sensors in order to replicate the behavior of a physical spring. Thanks to the use of a mechatronic spring, the orthosis and the control strategy can easily be adapted to any individual and can adapt themelf to any gait speed.
S0018 Session 4 Presentation 5 (17:15-17:30)	Indexing Biosignal for Integrated Health Social Networks **Yi Huang** and Insu Song James Cook University, Singapore *Abstract*—Rising medical costs and aging populations are major concerns for most countries, including developed countries. Some studies are now mining Health Social Networks (HSNs) as a way of dealing with these concerns. HSN provides a scalable, cost-effective, and fast method for collecting a large amount of user-generated data. However, patients usually have difficulty finding relevant information from social networks. This study aims to develop an Internet of Things (IoT) approach to find keywords to describe medical conditions using patients' biosignals. This study uses the Convolutional Neural Network (CNN) to encode ECG signals into word embedding vectors. Word embedding is a vector projection of words' sentimental features from a context. Similar keywords can be extracted given a vector. Therefore, keywords can be used to search for information from HSN. The average number of keywords correctly predicted is 2 to 3 out of 5. This approach improves the efficiency and effectiveness of information searching in HSNs using biosignal. This study is the first time that index biosignal in HSN.
S0028 Session 4 Presentation 6 (17:30-17:45)	Estimation of Gait Parameters from 3D pose for Elderly Care **Jyothnsa Kondragunta**, Ankit Jaiswal and Gangolf Hirtz Technische Universität Chemnitz, Germany *Abstract*—For elderly people, walking, standing up from a chair, turning and leaning are necessary for independent mobility. These mobilities such as gait depends on a complex interplay of major parts of the nervous, musculoskeletal and cardiorespiratory systems. Every individuals gait pattern is influenced by age, personality, mood, sociocultural factors and

	predominantly the persons health condition. In order to understand the health condition of an elderly person, analysis of gait patterns became an important aspect. Gait parameters such as cadence, step length, step duration etc. analyzed out of gait patterns proved as an important factor in estimation of the healthy daily living. For this purpose, gait data of several elderly individuals is collected many times over a period of time using Kinect sensor. The acquired data consist of RGB image sequences and depth data. From this data, 3D pose of the individual is identified. These 3D poses are used to extract the necessary gait parameters of the individual. The extracted gait parameters will be used in future to assess the health condition of the individual.
S0036 Session 4 Presentation 7 (17:45-18:00)	In Vitro Safety Assessment and Permeation Study of Topical Lidocaine Solution for Ocular Administration **Sirikool Thamnium**, Vipaporn Panapisal and Jittima Luckanagul Chulalongkorn University, Thailand *Abstract*—In this research, topical lidocaine solution for ocular administration was assessed for biocompatibility as a non-invasive anesthetic drug delivery. The study aimed to investigate the cytotoxicity against human corneal epithelial cells (HCECs) and study permeation. In the case of cytotoxicity, HCECs were treated with drug solution, analyzed for percent viability. For permeation study, the modified-franz diffusion method was used to study permeation partition coefficient of lidocaine solution; moreover, the drug retained on the sclera was also determined. First, HCECs were treated with lidocaine solutions with the concentration range of 0.781 –100 g/L. Significantly decrease in cell viability with the concentration above 12 g/L was detected by Resazurin metabolic rate assay. The permeation coefficient of lidocaine hydrochloride solution could not be determined because of drug absence in the receptor chamber. The entire drug loaded remained in the donor chamber and adsorbed on the surface of sclera tissue. The results suggested that topical lidocaine solution showed reasonably safe and lidocaine drops did not absorbed into the sclera. In present study, local topical anesthetic delivery of lidocaine was considered safe for ophthalmologic treatment.
S0022 Session 4 Presentation 8 (18:00-18:15)	Muscle Synergy Analysis on Upper Limb Movements of Human Arms **Hanlin Chen**, Fei Qin and Jiankang Wu University of Chinese Academy of Sciences, China *Abstract*—Upper limb movements of human arms are natural behaviors which require both the spatial and temporal coordination of multiple muscles. We now investigate how the neural strategy control upper limb movements in the human movement control. These upper limb movements include abduction, adduction, shoulder flexion and shoulder extension. According to our research, we make a hypothesis that a few muscle synergies across different subjects may have similar properties. To

	validate this hypothesis, we collected and analyzed EMG data in six healthy subjects. Nine muscles were required to reproduce the movement of each subjects. We used a nonnegative factorization approaches to identify muscle synergies during the tasks and to examine the functional significance of such synergies for natural behaviors. Through this finding, the neuromuscular control strategies of upper limb in these movements could be explained clearly, which may also provide significant evidence to support the hypothesis of muscle synergies and a basis for rehabilitation.
S1006 Session 4 Presentation 9 (18:15-18:30)	Attitudinal Factors for Personal Health **Boo Ho Voon**, Joachim Engan Sigau, Joshua E.H. Voon and Grace E.H. Voon Universiti Teknologi MARA, Malaysia *Abstract*—In this paper, the roles of attitudinal factors and fish were investigated to explore their relationships with the health performance of individuals. Specifically, the variables included were: Health Orientation (HO), Diet Orientation (DO), Life Satisfaction (LS), Attitude toward Fish (ATF), Fish Consumption (FC) Demographic variables and Health Performance (HP). A total of 300 respondents participated in the structured questionnaire survey. The data analyses included multi-item scale reliability, Chi-square, means, t-Test, ANOVA and multiple regression analyses. The influences of the various socio-demographic variables on attitudes and personal health were investigated accordingly. The attitudinal factors (i.e., Attitudes towards Health and Eating, Life Satisfaction and Attitudes towards Fish) had shown significant positive relationships with the personal health performance of individuals. The results suggested that the human factor engineering in biomedical sciences is essential. The attitudinal factors are potential determinants for personal health and should be managed effectively and efficiently.

Poster Session

Afternoon, November 14, 2019 (Thursday)
Time: 13:30-17:00
Venue: Meeting Room A228 (A228会议室)

S0016 Poster 1	Towards Quantifying Genetic Interactions among Tumor Suppressor Genes in Breast Cancer **Wenhao Jiang** and Qixuan Zhong Sun Yat-sen University, China *Abstract*—The effect of a gene's activity can be affected by the existence of another gene, termed as genetic interaction, or intragenic epistasis. Understanding genetic interactions among tumor suppressor genes will undoubtedly facilitate our understanding of the tumorigenesis and metastasis. With the wide-application of the next-generation sequencing of patient tumor samples, we have gained unprecedented resolution on the occurrence of mutations in each patient. Many previous studies have used odds ratio and Fisher's exact test to quantify such genetic interactions among tumor suppressor genes. Here, using the TCGA breast cancer dataset as an example, we have showed a potential problem for previous approaches and propose an approach that corrects for these bias. This study serves as a reminder that the interpretation of such large scale studies of mutational frequency data should proceed with reasonable caution.
S0035 Poster 2	Survival Analysis in Pan-cancer using the Cancer Genome Atlas (TCGA) Gene Expression Data for ALDH Genes In Young Choi, **Eun Mi Lee**, Sora Youn, Eunyoung Kim and Kwangsoo Kim Seoul National University Hospital, South Korea *Abstract*—Glucose metabolization is critical for living cells. In this context, cancer cells undergo metabolic reprogramming to survive and proliferate, exploiting glycolytic enzymes such as aldehyde dehydrogenase (ALDH) to presumably relieve oxidative stress and obtain energy. Previous studies have examined gene expression behind such metabolic dysregulation in diverse cancers. However, a pan-cancer analysis specific for glycolysis and its association to patient survival has rarely been attempted. Here, we analyzed each gene expressed in glycolysis using the log-rank test and univariate cox regression test, and generated a gene score function by step-wise regression for genes determined as significant (p-value<0.05) for survival across 21 cancers in TCGA. As ALDH gene risk score for numerous cancers were notable, 19

	ALDH genes from HGNC were additionally analyzed. We found heterogeneity among glycolytic genes significant for survival among the varied cancer types, yet remarkably, expression of 12 ALDH genes were found significant across 11 cancers in patient survival. ALDH have been associated with cancer stem cells, but was scarcely implicated in various cancers and overall survival. Thus this study provides a novel perspective for a gene set that may be effective in predicting patient prognosis, and even suggest a new target for gene therapy.
S1002 Poster 3	Study on Physical Strength Reserves of Diver after Underwater Delivery **Fan Wei**, Fu Xue Zhi, Liu Ping and Zhou Xing Yu Sanda University, China *Abstract*—Objective: This paper aims on the physical strength reserves of diver after long time underwater delivery, to find the reasonable underwater working time which can maintain diver's work ability. Method: Select 16 divers for underwater deliver experiment for different length of time, and carry out PWC170 measurement analysis. Result: After 2.5 hours underwater delivery, the diver still has a certain level of physical strength reserves. But after 3 hours underwater delivery, the physical strength reserves close to zero. Conclusion: Through the experiment, we conclude that the reasonable underwater delivery time is 2.5 hours, which can maintain diver's work ability.
S1003 Poster 4	Predicting Synthetic Lethal Genetic Interactions in Breast Cancer using Decision Tree **Zibo Yin**, Bowen Qian, Guowei Yang and Li Guo Nanjing University of Posts and Telecommunications, China *Abstract*—Recently, a type of genetic interaction, termed synthetic lethality, is emerging as a potential promising anticancer strategy. Synthetic lethality indicates that simultaneous silencing of two complementary signaling pathways can cause cell death, while deficiency of any single gene will not show phenotype. In this study, we aimed to analyze and predict synthetic lethal genetic interactions based on decision tree in breast cancer using TCGA data. First, candidate gene pairs were collected using mutation data based on Misl algorithm, and involved genes were found in more than 2.5% total samples. Based on this method, we obtained 51,040 candidate gene pairs containing 320 genes. Second, 281 experimentally validated gene pairs were used to classify and optimize two features of mutation coverage and copy number variations (CNV) gain/loss, and the final integrated scores were used to predict synthetic lethal genetic interactions based on decision tree. Finally, candidate gene pairs were performed multi-level integrative analysis to search potential interactions, and 11,758 pairs were primarily identified. Some key gene pairs could be further screened based on drug responses

	and amplification features for experimentally identification, and we finally screened 5 gene pairs to perform further analysis. These results may contribute to screening and identifying synthetic lethal genetic interactions to uncover potential therapeutic target.
S0032 Poster 5	Efficacy of N-acetyl-L-cysteine and Budesonide/Formoterol Combination for the Treatment of Patients with BCO from China Zeng Dewen and **Liao Suqun** Shaoguan University, China *Abstract*—The clinical efficacy and safety of N-acetylcysteine combined with budesonide/formoterol (B/F) in patients with BCO from china were investigated in this study. Between July 2017 and July 2019, One hundred and eighteen Chinese "bronchiectasis-COPD overlap"(BCO) patients with stable chronic obstructive pulmonary disease(COPD) stage were selected, who were hospitalized for acute COPD attacks and fully completed treatment in acute phase. The patients were divided into two groups, one was intervention group, the other one was control group. Sixty patients in the intervention group underwent N-acetyl-L-cysteine and B/F combination, while 58 patients in the control group received budesonide/formoterol alone. Both of two groups were accepted 12-week treatment. The clinical efficacy were measured by comparing the change of evaluation index before and after 12 weeks treatment. The evaluation index was including dyspnea on exertion (DOE), lung function measured by the forced expiratory volume in 1 second (FEV1), quality of life. The adverse events were also detail recorded to evaluate the safety for treatment. After 12-week treatment, the intervention group showed greater efficacy in DOE ($P<0.01$) in 6-minute walk test (6MWT) scale, lung function ($P<0.01$), and quality of life ($P<0.01$) measured by the St. George's Respiratory Questionnaire (SGRQ) compared with the control group at the end of the 12-week treatment. In addition, adverse events in both groups were similar and tolerable. The results suggest that both N-acetylcysteine combination with B/F and B/F alone could be safely used in the treatment of Chinese BCO patients, while the N-acetyl-L-cysteine and B/F combination was more effective than B/F alnoe for Chinese patients in stable COPD stage with BCO.
S2003 Poster 6	Segmentation of Vestibular Schwannoma from Multi-parametric Magnetic Resonance Images using Convolutional Neural Network Wei-Kai Lee, Chih-Chun Wu, Tzu Hsuan Huang, Chun-Yi Lin, Cheng-Chia Lee, Wen-Yuh Chung, Po-Shan Wang, Chia-Feng Lu, Hsiu-Mei Wu, Wan-Yuo Guo and **Yu-Te Wu** National Yang-Ming University, Taiwan *Abstract*—In this study, we aim to automatically segment the Vestibular Schwannoma (VS) from multi-parametric magnetic resonance (MR) images before the Gamma Knife (GK) treatment using the deep learning

	based Convolutional Neural Network (CNN). 516 VS subjects' MR images and tumor contours were collected from Taipei Veteran General Hospital, Taiwan. All the MR images were scanned by 1.5 T GE scanner. The tumor contours were delineated manually by experienced neuroradiologists. MR images included 1) 1) T1- weighted (T1W) with matrix size 512 x 512, voxel size 0.5 x 0.5 x 3mm;2) T1- weighted gadolinium contrast-enhanced (T1W+C) with matrix size 512 x 512 and voxel size 0.5 x 0.5 x 3mm; 3) T2 - weighted (T2W) with matrix size 512 x 512, voxel size 0.5 x 0.5 x 3mm. Since some tumors consisted of solid part, which appeared as high intensity at T1W+C, and cystic part, which appeared as high intensity at T2W, we used multi-parametric MR images and designed a deep learning based encode-decode CNN model with two convolution pathways and different convolution kernel sizes at encode part to extract feature maps from different direction of anisotropic voxel-size MR images. Our results showed that the multi-parametric input, namely, T1W, T1W+C and T2W images, for the proposed CNN achieved superior performance with Dice coefficient = 0.87±0.06 in the segmentation of VS, especially for tumors with cystic components, compared to using the single-parametric input T1W+C image with Dice coefficient = 0.83±0.11.
S2004 Poster 7	Ultrasound Tongue Image Classification using Transfer Learning **Yi Feng** and Xianglin Wang Sichuan University, China *Abstract*—The ultrasound image of the tongue consists of high-level speckle noise, and efficient approach to interpret the image sequences is desired. Automatic ultrasound tongue image classification is of great interest for the clinical linguists, as hand labeling is costly. In this paper, we explore the classification of midsagittal tongue gestures by employing transfer- learning, which can be effective with limited labeled data size. Within the transfer-learning framework, four state- of-the-art convolutional neural network (CNN) architectures are used to make a quantitatively comparison. Classification experiments are conducted using the data from two females. Based on the experimental results, we observed that the learned knowledge from one subject can be transferred to improve the classification accuracy of another subject.
S2006 Poster 8	Predicting Severity of Autism Spectrum Disorder based on Multi-center Multi-modality Data **Sijia Li** and Huifang Huang Beijing Jiaotong University, China *Abstract*—In recent years, many researchers have done a lot of research on the qualitative diagnosis of autism spectrum disorder (ASD) based on magnetic resonance imaging (MRI). However, the quantitative prediction of ASD severity is clinically more important, but there are few studies

	focused on the prediction of the ASD severity. In addition, since the heterogeneity between multi-center data for ASD is difficult to eliminate, most of studies are based on single-center and do not make full use of multi-center data. To this end, we propose a multi-modality multi-center regression (M3CR) method to apply multi-task learning to the severity prediction of ASD. Specifically, each center is treated as a task for joint learning. In addition, for each center, two types of modal information are extracted from magnetic resonance imaging for information complementation. More importantly, based on the task-task regularization term and modality-modality regularization term in the existing model, we add the feature-feature regularization term to further consider the relationship between the features. This regularization term enables the learning process to make full use of the data information shared by different centers. The experimental results on the ABIDE database demonstrate the effectiveness of the proposed method in ASD severity prediction.
S2007 Poster 9	Solar Cell Defect Recognition based on Orthogonal Learning Strategy Song Xiaoyu, **Qi Qianqian** and Chen Zhili Shenyang Jianzhu University, China *Abstract*—The quality of silicon wafers is an important factor restricting the efficiency and service life of photovoltaic power generation. In order to inspect the quality of silicon wafers, a defect recognition method based on orthogonal learning strategy is proposed where support vector machine is combined with binary tree for multi-class classification. Firstly, the adaptive threshold is set to remove the raster lines in the original image, and Fourier reconstruction image is used to enhance the defect. After that, we extract the image features. With the help of orthogonal learning strategy, an orthogonal array of feature data is established to implement the initial defect classification, and the classification results are analyzed by factor analysis. The extracted features are sorted according to their influence degree, and the improved support vector machine is used to classify the feature data accumulated one by one. Finally, genetic algorithm and grid search are introduced to optimize the parameters. The recognition accuracy of the designed classifier is up to 96.6%. The experimental results indicate the effectiveness of the proposed method.
S2008 Poster 10	An Image Segmentation Method based on Improved K-means **Wenjie Yao** and Taihui Liu Beihua University, China *Abstract*—K_means algorithm is a commonly used image segmentation algorithm, but it is easy to fall into local optimal solution because of the random selection of initial clustering centers. To solve this problem, the peak-valley principle is summarized and proposed. Under the guidance of this principle, TKM algorithm is proposed. This algorithm solves the

	problem by global thresholds. Assuming that the number of clusters is K, TKM algorithm firstly uses neighborhood valley-emphasis Otsu algorithm to select K-1 global thresholds according the quantitative principle in peak-valley principle. These thresholds divide the whole gray-level interval into several sub-intervals. Then, according to the shape invariance principle, the adjacent principle and the maximum principle in the peak-valley principle, the maximum value in the interval is selected as the initial clustering center. Finally, K_means clustering algorithm based on selected initial cluster centers is used in image segmentation. The results of experiment shows that the proposed algorithm can avoid falling into local optimal solution.
S0010 Poster 11	Low Power Consumption & Low Cost Active Suspension System of Electric Wheelchair **Ik Gyu Jang**, Seong Hyeon Jang and Young Jun Hae Gumi Electronics & Information Technology Research Institute Biomedical IT Convergence Center, South Korea *Abstract*—This study describes the control of a semi-active suspension mounted on an electric wheelchair. The purpose of this paper is to compare the variable damping force of a semi-active suspension to improve ride comfort. In this study, a semi-active suspension was mounted on a manual wheelchair and a control system was designed. Algorithm was proposed to control the vertical motion of a wheelchair mounted with a semi-active suspension. Also, actual vehicle test has demonstrated that the system is effective in improving ride comfort.

Dinner	
18:30-20:00	**Qiulin Pavilion (秋林阁)**

Academic Visit

14:00-17:00, November 13, 2019 (Wednesday)

13:45-Gathering at the lobby of meeting room A228

Note: If you do not arrive at the departure location before 14:00, we will assume that you automatically waive the academic visit.

1. Shanghai Key Laboratory of Multidimensional Information Processing
(上海市多维度信息处理重点实验室)
Web: http://mip.ecnu.edu.cn

Shanghai key laboratory of multidimensional information processing, based on relevant research of school of information science and technology of east China normal university, is established through research direction consolidation and resource integration.

Laboratory aims to meet the major needs of the state and the needs of Shanghai's economic and social development, aim at the cutting-edge scientific issues in the field of multi-dimensional information processing, and carry out original innovative, exploratory, pioneering and systematic research.

2. Key Laboratory of Polar Materials and Devices, Ministry of Education
(极化材料与器件教育部重点实验室)
Web: http://clpm.ecnu.edu.cn

Key Laboratory of Polar Materials and Devices was approved the establishment by Ministry of Education in December 2007, and officially passed the acceptance into the Ministry of Education Key Laboratory of sequence in March 2011, and passed the evaluation of Ministry of Education Key Laboratory in November 2011.

Laboratory aims on the strategic needs of country's information industry and technology development, through the discovery and study of electric charge and spin polarization discipline in the polar materials, then explore the next generation of information processing device technology.

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