BEB
Conference on Biomedical Engineering and Biotechnology

The 9th International Conference on Biomedical Engineering and Biotechnology (ICBEB 2020)

November 15-18, 2020

Online via Microsoft Teams

Conference Guide

Hosted by

東南大學 SOUTHEAST UNIVERSITY

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CONFERENCE PROGRAM

November 15th-18th, 2020

China Standard Time (GMT+8:00)

ONLINE-Microsoft Teams Meeting

Table of Contents

Part I Conference Schedule Summary

Sunday, November 15, 2020 ***MS Teams: http://www.academicconf.com/teamslink?confname=ICBEB2020***	
10:00-12:00	**MS Teams Online Conference Testing and Ice Breaking**
15:00-17:00	**MS Teams Online Conference Testing and Ice Breaking**

Monday, November 16, 2020 ***MS Teams: http://www.academicconf.com/teamslink?confname=ICBEB2020***	
09:00-09:05	**OPENING CEREMONY** (chaired by) *Prof. Chengyu Liu, Southeast University*
09:05-09:15	**WELCOME SPEECH 1** *Prof. Zhongze Gu,Conference General Chair, Institute of Biomaterials and Medical Devices, Jiangsu Industrial Technology Research Institute & Institute of Biomedical Devices (Suzhou), Southeast University*
09:15-09:25	**WELCOME SPEECH 2** *Prof. Yi Peng, Chinese Academy of Medical Sciences & Pecking Union Medical College*
09:25-10:15	**Keynote Speech 1:** Health Engineering: Wearable "SUPER-MINDS" for the Precision Control of CVD and COVID *Prof. Yuan-Ting Zhang, City University of Hong Kong; Shandong University*
10:15-11:05	**Keynote Speech 2:** Using Computer Simulations to Explore Vulnerabilities in the SARS-Cov-2 Spike Glycoprotein *Prof. Carlos Simmerling, Stony Brook University*
11:05-11:20	**BREAK**
11:20-12:00	**Poster Session**
12:00-14:30	**BREAK**
14:30-14:35	**Keynote Speeches Chaired by:** *Prof. Lung-Kwang Pan, Central Taiwan University of Science and Technology*
14:35-15:25	**Keynote Speech 3:** Relation between Neck Skin Temperature Measurement and Carotid Artery Stenosis: In-Vitro Evaluation *Prof. Eddie Y. K. Ng, Nanyang Technological University*

15:25-16:15	**Keynote Speech 4:** Two-Tailed PCR for Precision Diagnostics *Prof. Mikael Kubista, TATAA Biocenter AB*
16:15-16:30	**BREAK**
16:30-17:20	**Keynote Speech 5:** The Development of the Oxford AstraZeneca COVID-19 Vaccine *Assoc. Prof. Catherine Green, University of Oxford*

Tuesday, November 17, 2020

MS Teams: http://www.academicconf.com/teamslink?confname=ICBEB2020

09:00-12:10	**Oral Session 1: The 3rd China Physiological Signal Challenge 2020**
12:10-14:00	**BREAK**
14:00-19:10	**Oral Session 2: Cell Biology, Bioinformatics & Medicinal Chemistry**

Wednesday, November 18, 2020

MS Teams: http://www.academicconf.com/teamslink?confname=ICBEB2020

08:30-12:15	**Oral Session 3:Biomedical Engineering & Biotechnology**
12:15-14:00	**BREAK**
14:00-18:35	**Oral Session 4:Medical Imaging Technology & Signal Processing**

Part IIKeynote Speeches

Keynote Speech 1: Health Engineering: Wearable “SUPER-MINDS” for the Precision Control of CVD and COVID

Prof. Yuan-Ting Zhang

City University of Hong Kong; Shandong University

Biography: Dr. Yuan-Ting Zhang is currently the Chair Professor of Biomedical Engineering at City University of Hong Kong and the Adjunct Chair Professor at Shandong University. He is a LRG member of Karolinska Institutet MWLC. He was the Sensing System Architect in Health Technology at Apple Inc., California, USA in 2015, and the founding Director of the Key Lab for Health Informatics of Chinese Academy of Sciences in 2007. Professor Zhang dedicated his service to the Chinese University of Hong Kong from 1994 to 2015 in the Department of Electronic Engineering, where he served as the first Head of the Division of Biomedical Engineering and the founding Director of the Joint Research Center for Biomedical Engineering.

Prof. Zhang serves as the Editor-in-Chief for IEEE Reviews in Biomedical Engineering, Chair of the Working Group for the development of IEEE 1708 Standard on Wearable Cuffless Blood Pressure Measuring Devices, Organizer of IEEE-MDBS series since 2002, Organizer of ISS-BHE series since 2007, and a member of IEEE Medal panel for Healthcare Technology Award since 2017. He was the Editor-in-Chief for IEEE Transactions on Information Technology in Biomedicine and the founding Editor-in-Chief of IEEE Journal of Biomedical and Health Informatics. He served as Vice Preside of IEEE EMBS, Technical Program Chair of EMBC’98 in Hong Kong, Conference Chair of EMBC’05 in Shanghai, International Committee Co-Chair of EMBC’07 in Lyon, Internationale Committee Chair of EMBC’ 11 in Boston, Internationale Committee Chair of EMBC’13 in Osaka, Technical Program Co-Chair of EMBC’17 in Jeju Island, and International Committee Co-Chair of EMBC’2020 in Montreal. He was the Chair of 2018 Gordon Research Conference on Advanced Health Informatics and Chair of 2016-2018 IEEE Award Committee in Biomedical Engineering. Prof. Zhang's research interests include cardiovascular health engineering, unobtrusive sensing and wearable devices, neural muscular modeling and pHealth technologies.

He was selected on the 2014, 2015, 2016, 2017, 2018 and 2019 lists of China’s Most Cited Researchers by Elsevier. He won a number of international awards including IEEE-EMBS best journal paper awards, IEEE-EMBS Outstanding Service Award, IEEE-SA 2014 Emerging Technology Award. Prof. Zhang is elected to be IAMBE Fellow, IEEE Fellow and AIMBE Fellow for his contributions to the development of wearable and m-Health technologies.

Abstract. The cardiovascular disease (CVD) and coronavirus disease (COVID) are the most current pressing health challenges globally today. This talk will attempt to address the grand challenges through the paradigm shift to Health Engineering based on a convergence approach to integrate technologies across multiple scales in the biological hierarchy from molecular, cell, organ to system. The presentation will focus on the development of unobtrusive wearable 'SUPER-MINDS' technologies and their integrations with biomarker sensing, medical imaging and machine learning for the early prediction of acute CVDs. Potential applications in the fast response and precise control of COVID-19 will also be discussed. Using the atherosclerotic plaque assessment as an example, this talk will illustrate that the health convergence approach should allow the practice of 8- P’s medicine that is predictive, preventive, precise, pervasive, personalized, participatory, preemptive, and patient-centralized.

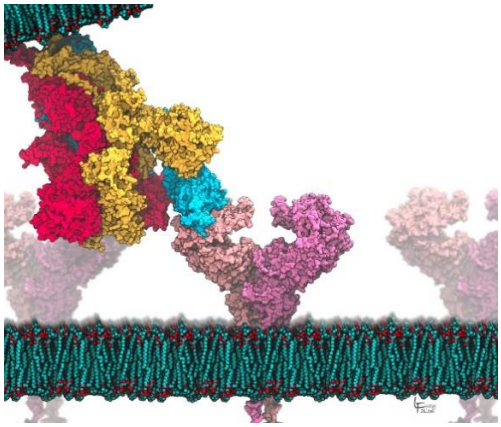
Keynote Speech 2: Using Computer Simulations to Explore Vulnerabilities in the SARS-Cov-2 Spike Glycoprotein

Prof. Carlos Simmerling

Associate Director, Laufer Center for Physical and Quantitative Biology, Stony Brook University

Biography: Prof. Carlos Simmerling obtained his Bachelor's degree (1991) and PhD (1994) in Chemistry at the University of Illinois at Chicago, performing early research on methods for computer modeling of biomolecules such as proteins. He went on to a post-doctoral fellowship in Pharmaceutical Chemistry at UCSF, where he became a lead developer of the Amber biomolecular simulation software that is used in thousands of research labs worldwide. In 1998 Prof. Simmerling joined the Chemistry department at Stony Brook University, where he is currently a Professor, and he became the Associate Director of SBU's Laufer Center for Physical & Quantitative Biology. His research is funded by the USA National Institutes of Health, National Science Foundation, and Department of Energy. His work focuses on development of improved molecular simulation methods and models,and using these tools to study biomolecular recognition mechanisms. His articles on improving the physics underlying biomolecular modeling have been cited nearly 10,000 times. Prof. Simmerling is currently the Marsha Laufer Chair of Physical & Quantitative Biology at Stony Brook University and a Fellow of the American Chemical Society.

Abstract. Coronaviruses (CoVs) are so named due to the similarity of their appearance to a crown, with small protrusions of "spike" proteins covering their surface. The virus uses these spikes as molecular keys to unlock entry into and infect a host cell. Spike proteins are the key target of neutralizing antibodies, but development of immunity is slow. The spike has an extensive glycan shield that interferes with immune surveillance. Furthermore, antibodies tend to interact with the spike in the highly variable exposed regions, thus development of immunity to one CoV strain does not provide protection against another. We hypothesize that small molecule drugs could interact with the spike prior to immunity development,and block the conformational changes that are crucial to membrane fusion and infection. Modern drug discovery methods use structure to guide drug design, however these are hampered for COVID-19 because experimental structures are missing key regions for all coronavirus spikes, and none of the hypothesized membrane fusion steps have been directly observed. We are bridging this gap with computer models that can: complete the partial structures obtained from experiments, reveal the glycan shield absent in experimental models, provide mechanistic insight into viral evolution, and identify opportunities where drugs could block viral entry. Such drugs could have the potential to be broadly neutralizing of all CoVs, leading to effective treatments for COVID-19, as well as future pandemics caused by as-yet unknown CoVs.



Keynote Speech 3: Relation between Neck Skin Temperature Measurement and Carotid Artery Stenosis: In-Vitro Evaluation

Prof. Eddie Y. K. Ng

Nanyang Technological University

Biography: Prof. Ng obtained Ph.D. at Cambridge Univ. and elected as a Fellow of The American Society of Mechanical Engineers; The Institution of Engineering and Technology [UK], and International Engineering & Technology Institute [HK]. He researches in numerical simulation in the biomedical engineering, thermal-fluids and health-related diagnosis fields. He is Editor-in-Chief for 2 ISI-journals which were captured by the JCR within 2-years of their inauguration. He has been recognized internationally for academic excellence. He received numerous best papers, service awards and has graduated 23 PhD and 26 Master students. He was awarded the SPRING-Singapore Merit Award for his work in thermal imagers to screen SARS fever and contributions to the Singapore Standardization Program. Twenty-one of his papers have been adopted as references in Singapore Standard (SS-582, Parts 1&2: 2020) and ISO/IEC 80601-2-59: 2017. He serves as a panel member for Singapore Biomedical and Health Standards Committee since 2011. Being a co-inventor of 3 US patents on software classifiers to identify the different stages of breast cancer development in iTBra-system, he was accoladed with equity in a listed company. His ongoing work on non-contact screening for carotid artery stenosis and superficial vein-finder has resulted in 3 TDs. He has notable citations in the field of infrared physics & technology.

Abstract: Carotid artery stenosis (CAS) is a form of atherosclerosis, where thrombus formation restricts the passage of blood through the carotid artery leading to irreversible damage in the brain tissue. The presence of stenosis in the carotid artery results in abnormal temperature maps on the external skin surface, which can be captured and quantified using non-contact/non-invasive infrared (IR) thermal imaging/thermography. In this study, a thermally charged in-vitro carotid artery flow loop, using 0% and 75% stenosis models, was designed to study the thermal effect on the external skin surface. The carotid artery flow was encapsulated with PDMS (polydimethylsiloxane) resembling neck tissue, of which the external surface temperature maps were studied using IR thermography. Using the mean temperature as a threshold value, the resultant thermal image was processed and normalized. Between the two stenosis models, disruption in the thermal features corresponding to the presence of stenosis was observed. The method described in this study paves the path to experimentally study the thermal effect of the presence of stenosis in the carotid artery.

Keywords: Atherosclerosis; Carotid artery stenosis; Conjugate bio-heat transfer; Infrared (IR) thermal imaging; Thermography; Thermal region of interest (TROI)

Technical Disclosure/Copyright:

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2. Ashish Saxena, E.Y.K. Ng, Vignesh Raman, and Lim Soo Teik. “Thermography based superficial vein projection system to ease real-time vein puncturing”, NTUitive Pte. Ltd., Singapore (Ref. no.: 2018-150).

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2. Ashish Saxena, E.Y.K. Ng, Vignesh Raman, Muhammad Syarifuddin Bin Mohamed Hamli, Mateusz Moderhak, Szymon Kolacz, and Jerzy Jankau. "Infrared (IR) Thermography-based Quantitative Parameters to Predict the Risk of Post-operative Cancerous Breast Resection Flap Necrosis." Infrared Physics & Technology (2019): 103, 103063 (12 pages), https://doi.org/10.1016/j.infrared.2019.103063.
3. Ashish Saxena, E.Y.K. Ng, Soo Teik Lim, " Infrared (IR) thermography as a potential screening modality for carotid artery stenosis", Computers in Biology and Medicine (2019):113, 103419 (11 pages), https://doi.org/10.1016/j.compbiomed.2019.103419.
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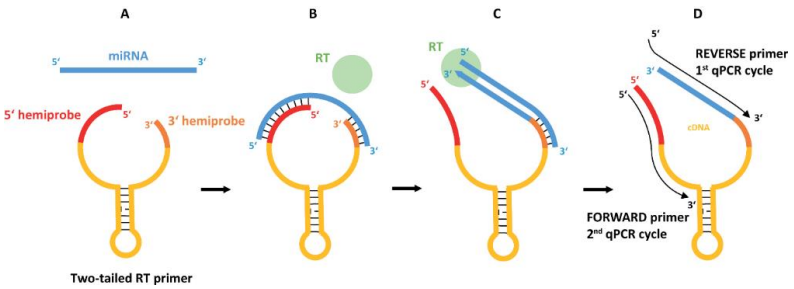
Keynote Speech 4: Two-Tailed PCR for Precision Diagnostics

Prof. Mikael Kubista

TATAA Biocenter AB

Biography: With a background as professor in Chemistry Kubista has become a serial entrepreneur in diagnostics. In 1996 he invented the light-up probes, which led to the foundation of LightUp Technologies AB as Europe´s first company focusing on qPCR-based diagnostics. In 2001 Kubista set up TATAA Biocenter as the first laboratory in Europe to obtain flexible ISO 17025 accreditation focuses on advanced services in molecular analyses to the pharmaceutical and biotech industries. in 2019 TATAA Biocenter was named “Best Nucleic Acid Analysis Service Provider – Europe” by Global Health & Pharma. Kubista introduced non-invasive prenatal testing (NIPT) in Sweden founding Life Genomics AB and direct blood genotyping co-founding LifeTest. Most recently TATAA invented the Two-tailed PCR for ultrasensitive nucleic acid detection, which has been licensed to Biovendor for microRNA analysis, and most recently SimSen Diagnostics was co-founded with the inventors of SimSen Sequencing to developed an ultrasensitive methods for molecular analyses of liquid biopsies. During the pandemic TATAA Biocenter was among the first in Europe testing for SARS-CoV-2 corona virus starting February 1, and is now contributing to the Swedish public testing effort as well as organizing testing of travelers through the platform www.coronapassport.se.

Abstract: We present a highly specific, sensitive and cost-effective system to quantify miRNA, for typing of cell-free DNA in liquid biopsies and for direct blood genotyping based on novel chemistry called Two-tailed PCR. Two-tailed PCR takes advantage of target-specific primers composed of two hemiprobes complementary to two different parts of the target molecule connected by a hairpin structure. The introduction of a short hemiprobe that senses the variable sequences confers exceeding sequence specificity while maintaining the very high sensitivity of PCR. Highly similar targets can be distinguished with superior precision irrespectively of the position of the mismatched nucleotide. Further, the target molecule can be very short, making Two-tailed PCR the preferred method for microRNA profiling as well as analysis of rare sequence variants in cell-free (cf) DNA and formalin fixed paraffine embedded (FFPE) tissue. Two-tailed RT-qPCR has a dynamic range of 7 logs and a sensitivity sufficient to detect less than ten target miRNA molecules. Two-tailed PCR is readily multiplexed and for less challenging applications such as genotyping Two-tailed PCR can be applied directly on blood samples eliminating the need for extraction. This very smooth and friendly workflow is most suitable point-of-care testing at bedside, doctor’s office or in the field. Applications for cfDNA analysis are being developed by SimSen Diagnostics AB.



(1) Two-tailed RT-qPCR: a novel method for highly accurate miRNA quantification. P Androvic, L Valihrach, J Elling, R Sjoback, M Kubista. Nucleic acids research 45 (15), e144-e144

Keynote Speech 5: The Development of the Oxford AstraZeneca COVID-19 Vaccine

Assoc. Prof. Catherine Green

Head of the Clinical BioManufacturing Facility

Nuffield Department of Medicine, University of Oxford

Biography: Catherine Green heads the Clinical Biomanufacturing Facility at the University of Oxford, she is an Associate Professor at the Wellcome Centre for Human Genetics, and a Senior Research Fellow at Exeter College Oxford. Her team at the CBF manufacture biologics at GMP for first in man and early phase clinical trials. Recently the CBF has been manufacturing simian Adenovirus vectored vaccines for a variety of pathogens with significant global disease burden, including Malaria, Zika, Rabies, Chikungunya. 2020 was a challenging year as we developed, manufactured, released and distributed into global clinical trials the ChAdOx1 nCoV-19 vaccine against COVID-19 which was recently acquired by AstraZeneca.

Abstract: The Clinical Biomanufacturing Facility (CBF) at the University of Oxford (UK) produced the first clinical batches of the ChAdOx1 nCoV-19 vaccine against SARS-coV-2 in April 2020. This vaccine is now in phase III clinical trials across the globe, and in scaled up manufacture to produce millions of doses in the hope that it will provide effective protection against COVID-19. I will present the efforts that underpinned this highly rapid development of a vaccine against a provisionally unknown pathogen, the lessons that we have learnt, as well as the results generated from our early phase trials.

Part IIIOral Presentations

Oral Presentation Guidelines

- Online Oral Presentation will be conducted via Microsoft Teams Meeting (Click to see how to join ICBEB2020 via Teams).
- All presenters are requested to reach the Online Session Room prior to the schedule time and complete their presentation on time.
- All presentation times are shown in China Standard Time (GMT+8:00).
- If a presenter is not able to show up via Teams, the session chair/conference secretary will download and play the pre-recorded video presentation during his/her scheduled presentation time, if listeners have questions about the presentation, please contact the conference secretary to forward the questions.
- If a presenter cannot show up on time or have problem with Internet connect, the session chair has the right to rearrange his/her presentation,and let the next presentation start.
- Signed and stamped electronic presentation certificate would be issued via e-mail after presentation.

Best Oral Presentations Selection

The session chair will select one best oral presentation from his/her session based on the following criteria:

- ✓ Research Quality
- ✓ Presentation Performance
- ✓ Presentation Language
- ✓ PowerPoint Design

Best Oral Presentations Award

The Best Presenter will receive an official certificate and a free registration to the ICBEB2021.

Session 1_The 3rd China Physiological Signal Challenge 2020: Searching for Premature Ventricular Contraction and Supraventricular Premature Beat from Long-term ECGs

Time: 09:00-12:10, November 17, 2020 (GMT+8:00)

Session Chair: Prof. Chengyu Liu, Southeast University

Session Room Link: http://www.academicconf.com/teamslink?confname=ICBEB2020

09:00-09:20	BEB6180	Recognition of Premature Beats in Long-term wearable single-lead ECG *Dr. Zhipeng Cai, Southeast University*
09:20-09:40	BEB6279	Premature Beats Identification using Deep Learning *Assoc. Prof. Wenjie Cai, University of Shanghai for Science and Technology*
09:40-10:00	BEB6341	Using Combination of Deep Residual Network and Bidirectional LSTM on Heartbeat Classification based on LSTM-GAN Data Enhancement *Mr. Yan Li, Northeastern University*
10:00-10:20	BEB6344	A Composite Approach to Long-term Rare Electrocardiograph Events Monitoring *Dr. Tsai-Min Chen, National Taiwan University and Academia Sinica*
10:20-10:30		**BREAK**
10:30-10:50	BEB6349	Detection of Premature Ventricular Contraction and Supraventricular Premature Beat from Single-lead ECG Recordings using Wavelet Synchrosqueezed Transform and Deep Neural Networks *Dr. Minggang Shao, Beijing University of Technology*
10:50-11:10	BEB6351	A Hybrid Hierarchical Framework for Screening and Classification of Ectopic Beats from Long-term ECGs *Mr. Min Chen, Shinall Technology*
11:10-11:30	BEB6355	Premature Beat Detection from Long-term ECGs Using Modified U-Net *Mr. Heng Xiang, Chengdu Spaceon Electronics Co., Ltd.*
11:30-11:50	BEB6358	Automatic Detection of Premature Beats by Deep Neural Networks Focusing on QRS-Centric ECG and RR intervals *Dr. Yang Liu, Harbin Institute of Technology*
11:50-12:00	BEB6370	Product and Service Empowerment of the New Generation of Internet Medical Platform *Ms. He Pei, Lenovo Group*
12:00-12:10		Awarding for the 3rd China Physiological Signal Challenge 2020

Abstracts of Session 1

BEB6180

Recognition of Premature Beats in Long-term wearable single-lead ECG

Zhipeng Cai[1], Xingyao Wang[1], Jianqing Li[1,2], Chengyu Liu[1*]
[1]*The State Key Laboratory of Bioelectronics, School of Instrument Science and Engineering, Southeast University, Nanjing, China;*
[2]*School of Biomedical Engineering and Informatics, Nanjing Medical University, Nanjing, China*

Abstract. Wearable electrocardiogram (ECG) devices can provide real-time, long-term, non-invasive and comfortable ECG monitoring for premature beats (PB) assessment (typically presenting as premature ventricular contractions (PVC) and supraventricular premature beat (SPB)), which may foreshadow stroke or sudden cardiac death. However, the poor quality, introduced by the dry electrode in wearable ECG monitoring system, leads to the inefficient recognition of the existing PB detection technologies. Therefore, we had sourced long-term single-lead ECG recordings and labels from wearable ECG recording device for the public training and hidden test sets for the CPSC 2020, and almost 100 participants from academia, industry, and elsewhere participated in the Challenge. In addition, 70 teams from all over the world had registered and submitted more than 120 working and open-source algorithms that could automatically recognize the PBs presented in each provided long-term wearable single-lead ECG recording. To better capture the importance of correctly identifying cardiac abnormalities, we evaluated participants' algorithms using evaluation metrics that assign different weights to different classification errors. Up to the deadline of final stage, the best score for PVC and SPB recognition in the hidden test set A was 12,246 and 36,640, respectively.

BEB6279

Premature Beats Identification Using Deep Learning

Wenjie Cai*, Jingying Yang, Jianjian Cao, Xuan Wang
School of Medical Instrument and Food Engineering, University of Shanghai for Science and Technology

Abstract. Premature beats including premature ventricular contraction (PVC), premature atrial contraction and premature junctional contraction. The latter two are called supraventricular premature beats (SPB). Occasional premature beats may happen in healthy people, whereas frequent ones indicate heart diseases. The China Physiological Signal Challenge (CPSC) 2020 aims to identify the premature beats in long time recorded dynamic single-lead ECGs. To solve this challenge, we proposed a deep learning architecture containing multi-dilated convolutional blocks and Squeeze-and-Excitation networks. Firstly, the data were preprocessed to correct baseline wandering and remove high-frequency noise. Secondly, the data were fed into the deep learning neural networks to extract features related to premature beats. Finally, the extracted features were further processed by a decision algorithm to get the classifications of the ECG beats and the locations of the premature beats. The proposed model was trained with CPSC 2020 dataset which contained ten long records and evaluated with the hidden dataset. The first stage results of the challenge showed that the PVC score reached 60640 and the SPB score reached 51710. In conclusion, our algorithm showed acceptable performance in detecting premature beats and is promising in real-time applications.

Keywords: Deep Learning; Premature Beat; CPSC

BEB6341

Using Combination of Deep Residual Network and Bidirectional LSTM on Heartbeat Classification based on LSTM-GAN Data Enhancement

Yan Li, Jihong Liu*, Yuxiang Li and Haixu Yang
College of Information Science and Engineering, Northeastern University

Abstract. Most of the dynamic electrocardiogram will have serious noises, such as baseline drift, myoelectric interference and other noises. For the ECG signal with atrial fibrillation symptoms, the QRS wave detection will be more difficult.In this report, based on the single-lead ECG data with multiple noises and symptoms of atrial fibrillation, we first used multi-scale wavelet decomposition and reconstruction to eliminate noise such as baseline drift and EMG interference, then the QRS is detected by a double-average detector. After detecting the R peak, the heartbeat is segmented, and the combination of deep residual network and bidirectional LSTM is used for heartbeat classification. Most of the heartbeats are normal heartbeats with noise. The number of premature ventricular contraction (PVC) and supraventricular premature beat (SPB) heartbeats is much less than that of normal heartbeats. Therefore, the Generative Adversarial Networks is used for data enhancement to achieve the balance between training samples.

Keywords: QRS Detector; LSTM-GAN; Resnet; Heartbeat Classification

BEB6344

A Composite Approach to Long-term Rare Electrocardiograph Events Monitoring

Tsai-Min Chen[1], Guo-Yuan Li[2], Chih-Yang Li[2], Yi-Dar Tang[2], Yuan-Hong Tsai[2], Chia-Tse Chang[2], and Yu Tsao[3, *]
[1]*Graduate Program of Data Science, National Taiwan University and Academia Sinica;*
[2]*Taiwan AI Academy, Science and Technology Ecosystem Development Foundation;*
[3]*Research Center for Information Technology Innovation, Academia Sinica*

Abstract. With recent advances in deep learning algorithms, computer-assisted healthcare services have rapidly grown, especially for those that combine with mobile devices. Such combination enables the wearable and portable services for continuous measurements and facilitates real-time disease alarming based on physiological signals. However, a long-term and continuous monitoring confronts challenges from digesting long recording time information and imbalanced labels. It is challenging to train a single deep learning model that can accurately detect rare events through long time period.

The China Physiological Signal Challenge 2020 (CPSC2020) provides a time-series single-lead ECG data set with premature ventricular contraction (PVC) and supraventricular premature beat (SPB) labels. Here, we propose an approach to overcome the difficulties above via cutting the data into short time segments and introducing a composite model, which includes 3 different models from CPSC2018, CPSC2019 and CPSC2020 ECG data sets.

ECG data sets of CPSC2018 and CPSC2019 were used to construct 2 different models providing latent features to construct the final model from CPSC2022 ECG data set. All the 3 models could be trained successfully under the framework of Keras with GPU version of Tensorflow and perform high-accurate probability estimations for PVC and SPB events by cooperation and averaging the predicted results of segments.

After the post-processing by Find-peaks algorithm from Python Scipy package, the CPSC2020 official ScorePVC and ScoreSPB (http://www.icbeb.org/CSPC2020) are 63192 and 80772, respectively.

Keywords: Rare Event; Time-series Data; ECG

BEB6349

Detection of Premature Ventricular Contraction and Supraventricular Premature Beat from Single-lead ECG Recordings Using Wavelet Synchrosqueezed Transform and Deep Neural Networks

Minggang Shao[1,2], Zhuhuang Zhou[1], Shuicai Wu[1,*]
[1]*College of Life Science and Bioengineering, Beijing University of Technology;*
[2]*Smart City College, Beijing Union University*

Abstract. Accurate locating of abnormal heartbeats from noisy electrocardiogram (ECG) signals is considered a challenging task. The 3rd China Physiological Signal Challenge 2020 (CPSC 2020) proposed a global competition for detection of premature ventricular contraction (PVC) and supraventricular premature beat (SPB) from long-term single-lead ECG recordings with low signal quality. In this work, we proposed an automated detection method using wavelet synchrosqueezed transform (WSST) and deep neural networks. First, the sampling rate of ECG signals was converted from 400 Hz to 250 Hz, and the WSST data were computed on the resampled ECG data, yielding 178 features for each sample. Secondly, the WSST features were used to train the deep neural networks model, which combined one-dimensional convolution layers and gated recurrent unit layers. The trained model classified each ECG sample into one of three classes: Normal, PVC and SPB. The long-term ECG recordings (n = 10) of the dataset provided by CPSC 2020 were split into short-term ones (n = 13,415) lasting about 60 seconds. The short-term recordings were divided randomly into the training subset (n = 12,073) and the test subset (n = 1,342). During the official phase, the trained model was submitted to CPSC 2020 and tested on the hidden test set; the achieved PVC score, and SPB score were 25252 and 65039, respectively. The proposed method may be potentially used for detection of PVC and SPB.

Keywords: Premature Ventricular Contraction; Supraventricular Premature Beat; Wavelet Synchrosqueezed Transform; Deep Neural Network; Cardiac Arrhythmia; Electrocardiogram

Acknowledgements: The authors would like to thank the organizers of CPSC2020 Challenge for their valuable ECG recordings and annotations. This work was supported by the National Natural Science Foundation of China (No. 71661167001). Z.Z. was supported by Beijing Natural Science Foundation (Grant No. 4184081).

BEB6351

A Hybrid Hierarchical Framework for Screening and Classification of Ectopic Beats from Long-term ECGs

Min Chen, Kui Dong
Shinall Technology

Abstract. Objective: Arrhythmia is an important manifestation of cardiovascular disease. It can be life-threatening in severe cases. ECG is the most commonly used for clinical diagnosis of arrhythmia, especially ambulatory electrocardiogram (holter) is an important tool for clinical discovery of transient and occult arrhythmias. Premature Ventricular Contraction (PVC) and Supraventricular Premature Beat (SPB) are the two most common arrhythmias. Although intelligent detection algorithms for ECG have been developed in the past few decades, the automatic detection of PVC and SPB in ECG signals with

low signal quality is still a hot spot in the medical field. This method focuses on the automatic detection framework of PVC and SPB in long-term, low-quality ECG signals. The proposed framework includes ECG signal pre-processing, QRS wave detection, noisy heartbeat recognition, atrial fibrillation recognition, PVC and SPB model detection and post-processing with clinical rules.

1) ECG signal pre-processing: the pre-processing stage filters out the high frequency noise and baseline drift in the ECG signal. This stage removes ECG signal baseline wandering, highlights the characteristic of QRS wave, and improve the signal-to-noise ratio, which is the basis of PVC and SPB detection.
2) QRS wave detection: the accurate positioning of QRS waves is key to heartbeat classification. The rhythm and the shape of the target beat relies heavily on the result of QRS positioning. Thus robust result of QRS detection is the foundation of the accuracy of PVC and SPB screening and classification.
3) Noisy beat classification: transient noise and artifacts damages the shape of the beat or create shapes like an ectopic beat, which can easily cause false positives or false negatives of PVC and SPB. Therefore, it is necessary to identify and eliminate the noise-polluted beats.
4) Atrial fibrillation recognition: it is important to remove SPB and carefully distinguish PVC and AF beats with aberrant ventricular conduction in episodes with atrial fibrillation, so the accurate recognition of atrial fibrillation directly affects the result of SPB and PVC.
5) PVC and SPB model detection: this algorithm uses the DenseNet model to classify the heartbeats into three categories: N, V, and S. The DenseNet model provides preliminary classification suggestions of PVC and SPB.
6) Post-processing with Clinical rule: we integrated a set of clinical experiences and rules including rhythm and morphological rules to suppress false positives and search for false negatives of PVC and SPB detection, which further improves the results.
The design of this framework is hierarchical with hybrid method and models. And this framework of automated PVC and SPB screening and classification is promising to provide better quality result with higher efficiency in Long-term ECG examinations.

Keywords: ECG Signal; Filtering Algorithm; QRS Wave Detection; Noisy Heartbeat Recognition; Atrial Fibrillation Recognition; Neural Network

BEB6355

Premature Beat Detection from Long-term ECGs Using Modified U-Net

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Abstract. Premature ventricular contraction (PVC) and supraventricular premature beat (SPB) are the most common arrhythmias, the detection of which plays an important role in ECG signal analysis. Accurate detection is a challenging task from 24-hour dynamic single-lead ECG recordings. The rule-based PVC and SPB detection methods largely depend on hand-crafted manual features and parameters, the fixed features and parameters of which require difficult offline tuning for adapting to new scenarios.
In the 3rd China Physiological Signal Challenge 2020 (CPSC 2020), inspired by the popular application of U-Net in medical image segmentation, the U-Net-like architecture based on 1-D convolutional neural network (CNN) is proposed. The ResNet and ResNeXt block are introduced as backbone of encoder and decoder in the 1D U-Net model. In addition, the ECG records with frequency of 400 Hz are resampled to 200Hz, and to make the length of data fed into network is suitable, zero padding and data truncation are introduced. To increase the diversity of dataset and improve the generalization performance, some common techniques of data augmentation used in this study consist of noise addition, y-axis shift, and wavelet-based filter.

The proposed method has been validated against the 3rd china physiological signal challenge data set, obtaining a PVC score of 51335, SPB score of 72488 on the hidden subtest set. Experimental results show that the proposed method acquires competitive performance.

BEB6358

Automatic Detection of Premature Beats by Deep Neural Networks Focusing on QRS-Centric ECG and RR intervals

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Abstract. Detecting and identifying premature beats (PB), mainly including premature ventricular contractions (PVC) and supraventricular premature beat (SPB), is important for assessing the heart health and forecasting the risk of malignant arrhythmias. However, the low signal quality and pathologically induced signal distortion make it tricky for a rule-based PB detector especially in the ambulatory ECG monitoring. In this work, we proposed a deep neural network (DNN) based PB detector to address this problem in the context of the CPSC 2020 challenge. Our approach can be broken down into three phases. In phase I, we detect the position of QRS complexes in the recordings by using a U-Net based DNN model which is trained on the CPSC 2019 database. In phase II, the RR intervals are extracted from the recordings according to the detected QRS positions. We then estimate the representative RR interval of sinus heartbeats in a moving-window manner. Finally, in phase III, we construct a Residual-CNN network to extract the morphological features of each heartbeat in an ECG segment. The morphological features are concatenated with handcrafted features relating to the RR intervals, and then input to a fully-connected layer for PB detection. We trained our method on the training dataset of the challenge, and tested it on a subset of the hidden test set. The achieved scores for PVC and SPB detection are -23654 and -101026 respectively.

Keywords: Eletrocardiogram; Cardiac Arrhythmia; Permature Beats; Deep Neural Network

Session 2_ Cell Biology, Bioinformatics & Medicinal Chemistry

Time: 14:00-19:10, November 17, 2020 (GMT+8)

Session Chairs:
Dr. William Cho, Queen Elizabeth Hospital
Prof. Josef Jampilek, Comenius University in Bratislava

Session Room Link: http://www.academicconf.com/teamslink?confname=ICBEB2020

14:00-14:25	BEB6339	Overcoming the Heuristic Nature of k-Means Clustering: Identification and Characterization of Binding Modes from Simulations of Molecular Recognition Complexes *Assoc. Prof. Eric J. Sorin, California State University Long Beach*
14:25-14:50	BEB6247	Molecular Diagnostic and Therapeutic Potentials for the Recurrence of Non-Small Cell Lung Cancer *Dr. William Cho, Queen Elizabeth Hospital*
14:50-15:05	BEB6324	Mechanism of Stimulation of DNA Binding of the Transcription Factors by Human Repair Protein Apurinic/Apyrimidinic Endonuclease 1, APE1 - a New Model of Regulation of Proteins Expression Involved in Cancer, Resistance to Treatment and other Diseases *Ms. Dominika Zembrzuska, University of Warsaw*
15:05-15:30	BEB6217	Why Gold Nanoparticle Stimulated by Nitrogen Cold Plasma is More Active for Anti-cancer Therapy and Antimicrobial Theme Using DFT Simulation *Dr. Abdelfattah Elgendy, Ain Shams University*
15:30-15:50	BEB6306	CellBIC: Bimodality-based Top-Down Clustering of Single-Cell RNA Sequencing Data Reveals Hierarchical Structure of The Cell Type *Dr. Junil Kim, University of Copenhagen*
15:50-16:15	BEB6331	SeMPI 2.0 – A Web Server for PKS and NRPS Predictions Combined with Metabolite Screening in Natural Product Databases *Mr. Paul Zierep, Albert-Ludwigs-University Freiburg*
16:15-16:30	BEB6303	Cell-Type-Specific Analysis of Alternative Polyadenylation Using Single-Cell Transcriptomics Data *Mr. Eldad David Shulman, Tel Aviv University*
16:30-16:40		**BREAK**
16:40-17:05	BEB6153	Multi-Target Compounds based on Cinnamic Acid Scaffold *Prof. Josef Jampilek, Comenius University in Bratislava*
17:05-17:20	BEB6238	Differentiation of Induced Pluripotent Stem Cells towards Mesenchymal Stromal Cells Is Hampered by Culture in 3D Hydrogel *Dr. Roman Goetzke, RWTH Aachen Medical School*

17:20-17:45	BEB6203	Dual Ionic-Covalent Alginate based Hydrogels Presenting Drug Eluting Properties for Cell Transplantation Applications *Prof. Sandrine Gerber, Swiss Federal Institute of Technology in Lausanne*
17:45-18:00	BEB6280	Curcumin Induces Apoptosis in JAK2-Mutated Cells by The Inhibition of JAK2/STAT and Mtorc1 Pathways *Dr. Jessica Petiti, University of Turin*
18:00-18:25	BEB6267	The Pharmacological Efficacy of Endemic Mushrooms and Underlying Mechanisms in Changbai Mountain Area *Prof. Di Wang, Jilin University*
18:25-18:40	BEB6281	Indian Scenario on Fixed Dose Combinations *Assoc. Prof. Sangeeta S. Tanavade, Appasaheb Birnale College of Pharmacy Sangli*
18:40-19:10	BEB6028	Application of Plant Proteolytic Cysteinases: Their Anti-Inflammatory Activity Is Relevant to Healing Improvement? *Prof. Carlos Salas, Federal University of Minas Gerais*

Abstracts of Session 2

BEB6339

Overcoming the Heuristic Nature of k-Means Clustering: Identification and Characterization of Binding Modes from Simulations of Molecular Recognition Complexes

Parker Ladd Bremer[1], Danna De Boer[1], Walter Alvarado[2], Xavier Martinez[3], & Eric J. Sorin[1,*]

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Abstract. The accurate and reproducible detection and description of thermodynamic states in computational data is a nontrivial problem, particularly when the number of states is unknown a priori and for large, flexible chemical systems and complexes. To this end, we report a novel clustering protocol that combines high-resolution structural representation, brute-force repeat clustering, and optimization of clustering statistics to reproducibly identify the number of clusters present in a data set (k) for simulated ensembles of butyrylcholinesterase in complex with two previously studied organophosphate inhibitors. Each structure within our simulated ensembles was depicted as a high-dimensionality vector with components defined by specific protein−inhibitor contacts at the chemical group level and the magnitudes of these components defined by their respective extents of pair-wise atomic contact, thus allowing for algorithmic differentiation between varying degrees of interaction. These surface-weighted interaction fingerprints were tabulated for each of over 1 million structures from more than 100 μs of all-atom molecular dynamics simulation per complex and used as the input for repetitive k-means clustering. Minimization of cluster population variance and range afforded accurate and reproducible identification of k, thereby allowing for the characterization of discrete binding modes from molecular simulation data in the form of contact tables that concisely encapsulate the observed intermolecular contact motifs. While the protocol presented herein to determine k and achieve non-heuristic clustering is demonstrated on data from massive atomistic simulation, our approach is generalizable to other data types and clustering algorithms, and is tractable with limited computational resources.

Keywords: Molecular Dynamics; Enzyme Inhibition; Interaction Fingerprint; Contact Motif; Contact Table

BEB6247

Molecular Diagnostic and Therapeutic Potentials for The Recurrence of Non-Small Cell Lung Cancer

William Chi Shing CHO

Department of Clinical Oncology, Queen Elizabeth Hospital

Abstract. About 80-85% of lung cancers are non-small cell lung cancer (NSCLC), which is the leading cause of cancer-related death in the world. Surgery is the potentially curative treatment for early-stage NSCLC patients. However, 30-55% of patients with NSCLC develop recurrence despite curative resection. Thus, the identification of genetic alterations related to recurrence in NSCLC patients may help better stratify high-risk individuals and guide treatment strategies. Targeted therapy is another treatment modality for NSCLC. Nevertheless, drug resistance is a major cause for therapeutic failure in NSCLC leading to tumor recurrence and disease progression, the personalized prediction of therapeutic resistance, recurrence or metastatic disease progression still remains an unsolved problem. Our previous studies attempted to identify the molecular biomarkers of recurrence and drug resistance in NSCLC. Besides, we also tried to find the biomarkers and therapeutic targets that play critical roles in the tumorigenesis of NSCLC.

In this presentation, I would like to share my studies on the identification of genetic alterations in recurrence and the plausible mechanism(s) involving in resistance and recurrence, finally end up with some studies on the treatment of NSCLC.

Keywords: Drug Repurposing; Genetic Alterations; Next-Generation Sequencing; Non-Coding RNA; Non-Small Cell Lung Cancer

BEB6324

Mechanism of Stimulation of DNA Binding of the Transcription Factors by Human Repair Protein Apurinic/Apyrimidinic Endonuclease 1, APE1 - a New Model of Regulation of Proteins Expression Involved in Cancer, Resistance to Treatment and other Diseases

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Abstract. Research showing a new mechanism of stimulation of DNA binding of the transcription factors AP-1 and NF-κB, which enables the expression of these genes due to the multifunctional activity of the major human apurinic/apyrimidinic endonuclease APE1 has been carried out. APE1 endonuclease combines base excision repair (BER) and nucleotide incision repair (NIR) pathways with transcription regulation. Collected evidences contradict the previous common hypothesis that APE1 stimulates binding of transcription factors (TFs) to DNA by reducing cysteine residues - disulfide bonds in the DNA binding domains of transcription factors. It has been established that APE1 stimulates binding of TFs to DNA independently of the TFs redox state. The new model proposes that APE1 stimulates binding of TFs to DNA by transient oligomerization of APE1 along DNA and changing the conformation of the DNA helix. APE1 polymerizes along DNA, at the site of strand breaks and at the site of the internal curvature of DNA duplexes. Polymerization of APE1 along DNA increases pre-existing distortions in DNA and enables both NIR repair pathways action and enables binding of oxidized and reduced TFs to DNA. The APE1 protein polymerization along DNA duplex enables scanning for base damage and promotes DNA bending, which in turn facilitates TFs binding to their cognate sites in DNA.

The studies were conducted by EMSA technique, UV-crosslinks method, DNA repair test, electron microscopy and by computer modeling of protein structure.

This knowledge can be used to create for example new cancer therapies. Knowing how APE1 stimulates the binding of TFs (AP-1 and NF-κB) to DNA, it is possible to regulate the transcription of these TFs more precisely and inhibit their expression. The transcription factors AP-1 and NF-κB are overexpressed in many types of cancer. They control genes responsible for cancer cell survival and drug resistance. Inhibition of AP-1 and NF-κB binding to DNA by preventing APE1 from polymerizing on DNA would inhibit cell functions leading to tumor progression as well as resistance to chemotherapeutic and photodynamic treatments.

Keywords: Human Apurinic/Apyrimidinic Endonuclease 1; APE1; Transcription Factors; Transcription Regulation; DNA Repair; Cancer Therapies

BEB6217

Why Gold Nanoparticle Stimulated by Nitrogen Cold Plasma is More Active than the Argon species for Anti-cancer Therapy and Antimicrobial Theme

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Abstract. Biomedical applications with cold plasma are a very rapidly developing trend in biological research. Recently, the combined system of using gold nanoparticles (AuNPs) excited by reactive species of ionized gas of plasma is applying in anti-cancer therapy. We study the mechanism of the cell death using a combined system of AuNPs stimulated by nitrogen and argon plasma of cervical carcinoma cell line (HELA), bacteria, fungi, and yeast. Our result shows that the combined system with nitrogen plasma is more effective and safer in biological treatments. We apply the density functional theory (DFT) simulation to get the answer to why nitrogen is more active than argon. It shows that the nitrogen is more permeable to the cell membrane and more interact with the protein and could change

its structure than argon. Nitrogen is more hydrophilic. So, it reacts as a sink that collects all reaction chains of amino acids of protein around it. The theoretical calculation shows that the ion energy of nitrogen is working at lower energy (2.1 eV) than the argon (5.2 eV). This therapy could be a soft and safe biological treatment. A wide range of transition levels of ionized nitrogen that is related to more vacancies attracts more hydrogen bound to combine with it. The study of using specific reactive species with mixed techniques may open a novel area to develop better, direct, efficient, and selective targeting for different kinds of bio-threats.

Keywords: Argon-Nitrogen Cold Plasma; AuNPs; Anti-cancer; Antimicrobial

BEB6306

CellBIC: Bimodality-based Top-Down Clustering of Single-Cell RNA Sequencing Data Reveals Hierarchical Structure of The Cell Type

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Abstract. Single-cell RNA sequencing (scRNA-seq) is a powerful tool to study heterogeneity and dynamic changes in cell populations. Clustering scRNA-seq is important step in identifying new cell types and studying their characteristics. Conventional hierarchical clustering methods usually use cell-to-cell distance metric, which often fail to identify a large group due to the conflict the distance between multiple groups. Here, we develop CellBIC (single Cell BImodal Clustering), a novel clustering approach to cluster scRNA-seq data based on modality in the gene expression distribution without relying on a distance metric. CellBIC performs hierarchical clustering in a top-down manner. Applied to various scRNA-seq data including human pancreas, mouse cortex, and mouse lung, CellBIC outperformed the bottom-up hierarchical clustering approach and other recently developed clustering algorithms while maintaining the hierarchical structure of cells. Importantly, CellBIC identifies type 2 diabetes and age specific beta cell signatures characterized by SIX3 and CDH2, respectively. In conclusion, CellBIC shows algorithmic advantages of using the distribution of data instead of cell-to-cell distance metric to identify not only large groups of cells but also recursive subtypes of cells. Input files for the benchmarking datasets and a MATLAB source code for CellBIC are available at https://github.com/neocaleb/CellBIC.

Keywords: Single-cell RNA Sequencing; Bimodality; Top-down Hierarchical Clustering; Pancreatic Development; SIX3; CDH2

BEB6331

SeMPI 2.0–A Web Server for PKS and NRPS Predictions Combined with Metabolite Screening in Natural Product Databases

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Abstract. Microorganisms produce secondary metabolites (SMs) with a remarkably range of bioactive properties. The constantly increasing amount of published genomic data provides the opportunity for an efficient identification of gene clusters by genome mining. Conversely, for many natural products with resolved structures, the encoding gene clusters have not been identified yet. Of those SMs the scaffolds of nonribosomal peptides and polyketides type I can be predicted quiet reasonably, due to their building block like assembly.

SeMPI 2.0 provides a comprehensive prediction pipeline, which includes the screening of the scaffold in publicly available natural compound databases. The screening algorithm was designed to detect homologue structures even for partial incomplete clusters. The pipeline allows to link gene clusters to known natural products and therefore also provides a metric to estimate the novelty of the cluster if a matching scaffold cannot be found. Whereas currently available tools attempt to provide comprehensive information about a wide range of gene clusters, SeMPI aims to focus on precise predictions. Therefore, the cluster detection algorithm, including building block generation and domain substrate prediction, was thoroughly refined and benchmarked, in order to provide high quality SM predictions. Additionally, SeMPI provides features which can help to further investigate a submitted gene cluster, such as the incorporation of a genome browser and the possibility to modify a predicted scaffold in a workbench before the database screening.

Keywords: Natural Products; Secondary Metabolites; Genome-Minning; Polyketide Synthases; Nonribosomal Peptide Synthetases; Machine Learning

BEB6303

Cell-Type-Specific Analysis of Alternative Polyadenylation Using Single-Cell Transcriptomics Data

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Abstract. Alternative polyadenylation (APA) is emerging as an important layer of gene regulation because the majority of mammalian protein-coding genes contain multiple polyadenylation (pA) sites in their 3’ UTR. By alteration of 3’ UTR length, APA can considerably affect post-transcriptional gene regulation. Yet, our understanding of APA remains rudimentary. Novel single-cell RNA sequencing (scRNA-seq) techniques allow molecular characterization of different cell types to an unprecedented degree. Notably, the most popular scRNA-seq protocols specifically sequence the 3’ end of transcripts. Building on this property, we implemented a method for analysing patterns of APA regulation from such data. Analyzing multiple datasets from diverse tissues, we identified widespread modulation of APA in different cell types resulting in global 3’ UTR shortening/lengthening and enhanced cleavage at intronic pA sites. Our results provide a proof-of-concept demonstration that the huge volume of scRNA-seq data that accumulates in the public domain offers a unique resource for the exploration of APA based on a very broad collection of cell types and biological conditions.

Keywords: Single-cell RNA-sequanceing; Alternative polyadenylation; Genetics; Genomics; Bioinformatics

BEB6153

Multi-Target Compounds based on Cinnamic Acid Scaffold

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Abstract. Multi-target drug discovery represents an innovative approach of medicinal chemistry to overcoming a crisis in drug design, especially of anti-invasive drugs, reflected in the small number of newly approved drugs. This approach is based on the concepts of privileged scaffolds, polypharmacology and multifactorial diseases. Thus it seems to be a very useful tool in the design of antineoplastic and anti-infectious agents, as therapeutic agents designed in this way interact with multiple targets and thus prevent resistance, acting against various classes of pathogens and simultaneously against tumor cells. Similarly, multi-target drugs can be designed for the simultaneous treatment of autoimmune, inflammatory and invasive diseases. This contribution is focused especially on the investigation of new ring-substituted cinnamic acid-based compounds with estimated antimicrobial and anti-inflammatory activity. Structure-activity relationships and the supposed mechanism of action are discussed.

Keywords: Multi-Target Compounds; Privileged Scaffolds; Cinnamic Acid

BEB6238

Differentiation of Induced Pluripotent Stem Cells towards Mesenchymal Stromal Cells Is Hampered by Culture in 3D Hydrogel

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Abstract. Differentiation of induced pluripotent stem cells (iPSCs) towards mesenchymal stromal cells (MSCs) remains a major challenge in regenerative medicine. On conventional tissue culture plastic, this differentiation process is incomplete, at least on epigenetic level. However, there is evidence, that differentiation of iPSCs can be guided by matrix elasticity and therefore, we investigated if this process can be triggered by differentiation in a 3D hydrogel matrix.

iPSCs were embedded into fibrin hydrogels to enable a one-step differentiation procedure towards MSCs within a scaffold. Differentiation of iPSCs on tissue culture plastic or on top of fibrin hydrogels resulted in a typical MSC-like morphology and immunophenotype. In contrast, iPSCs embedded into fibrin gel gave rise to much smaller cells with heterogeneous growth patterns, absence of fibronectin, faint expression of CD73 and CD105, and reduced differentiation potential towards osteogenic and adipogenic lineages. Global gene expression profiles of differentiated iPSCs demonstrated that MSC-specific genes were only up-regulated on flat substrates, whereas genes of neural development were up-regulated in 3D culture. Furthermore, global DNA methylation profiles were very similar if iPSCs were differentiated towards MSCs either on tissue culture plastic or on top of hydrogels. In contrast, there were marked epigenetic differences if iPSCs were differentiated within fibrin gels, pointing towards neural differentiation.

Taken together, iPSCs could be differentiated towards MSCs on tissue culture plastic or on a flat fibrin hydrogel. In contrast, the differentiation process was heterogeneous and not directed towards MSCs if

iPSCs were embedded into the hydrogel.

Keywords: Induced Pluripotent Stem Cells; Mesenchymal Stromal Cells; Hydrogel;iPSC-derived MSCs; 3D Differentiation

BEB6203

Dual Ionic-Covalent Alginate based Hydrogels Presenting Drug Eluting Properties for Cell Transplantation Applications

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Abstract. Following the pioneering work of Bisceglie on the immobilization of insulin producing cells1 and the concept of "artificial cells" introduced in 1964 by Chang,2 the immuno-isolation of endocrine cells into three-dimensional semi-permeable hydrogels has emerged as a promising strategy for cell-based therapies.3 Among the many polymers which have been evaluated for cell microencapsulation, the natural polysaccharide sodium alginate (Na-alg) emerged as the reference material for cell immobilization due to its fast gelation in the presence of divalent cations and its high cell compatibility and in vivo tolerance.4-6 Despite these promising properties, the transfer to clinical applications is hampered by the lack of durability of alg hydrogels in vivo,7,8 the shorage of human cell material suitable for transplantation and the frequently observed pericapsular fibrotic overgrowth following the transplantation of alginate-based microencapsulated cells.9 We herein present several strategies aiming at maintaining the favorable properties of alg hydrogels while improving their stability in vivo by covalent conjugation of the hydroxyl groups of the alg backbone to cross-reactive poly(ethylene glycol) derivatives providing reinforcement of the hydrogel ionic network by covalent crosslinking interactions.10,11 Our recent approach for the controlled delivery of anti-inflammatory agents from the encapsulation matrix will be presented in the context of the transplantation of insulin producing cells, resulting in the mitigation of adverse fibrotic response.12 The development of porcine cell batches as alternative cells source for transplantation will also be discussed.

Keywords: Alginate; Cross-Linked Hydrogel; Drug Eluting Hydrogel; Cell Microencapsulation; Fibrotic Overgrowth; Cell Transplantation

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BEB6280

Curcumin Induces Apoptosis in JAK2-Mutated Cells by The Inhibition of JAK2/STAT and Mtorc1 Pathways

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Abstract. Myeloproliferative neoplasms are chronic myeloid cancers divided in Philadelphia positive and negative. The JAK2 V617F is the most common mutation in Philadelphia negative patients and results in a constitutive activation of the JAK/STAT pathway, conferring a proliferative advantage and apoptosis inhibition. Recent studies identified a functional crosstalk between the JAK/STAT and mTOR pathways. The identification of an effective therapy is often difficult, so the availability of new therapeutic approaches might be attractive. Previous studies showed that curcumin, the active principle of the Curcuma longa, can suppress JAK2/STAT pathways in different type of cancer and injuries. In this study, we investigated the anti-proliferative and pro-apoptotic effects of curcumin in JAK2 V617F-mutated cells. HEL cell line and cells from patients JAK2 V617F mutated have been incubated with increasing concentrations of curcumin for different time. Apoptosis and proliferation were evaluated. Subsequently, JAK2/STAT and AKT/mTOR pathways were investigated at both RNA and protein levels. We found that curcumin induces apoptosis and inhibition of proliferation in HEL cells. Furthermore, we showed that curcumin inhibits JAK2/STAT and mTORC1 pathways in JAK2 V617F-mutated cells. This inhibition suggests that curcumin could represent an alternative strategy to be explored for the treatment of patients with myeloproliferative neoplasms.

Keywords: Curcumin; JAK/STAT; JAK2 V617F; mTORC1; Myeloproliferative Neoplasms

BEB6267

The Pharmacological Efficacy of Endemic Mushrooms and Underlying Mechanisms in Changbai Mountain Area

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Abstract. According to the statistical data, there are 1789 edible and 798 medicinal fungi in China. In Changbai Mountain area of Jilin province in China, there are still unrevealed mushrooms. We focused our research on the pharmacological functions of edible and/or medicinal mushrooms and their effective constituents. Till now, we successfully developed over 30 types of mouse and/or rat models for evaluation the effects of agents on 13 kinds of diseases, such as depression, diabetes, osteoporosis, alcohol-induced liver injury, Alzheimer's Disease, colitis and colon cancer, and et al. Based on these animal models and related cell models, we have detected the functions of over 19 types of mushrooms, and their constituents including polysaccharides, triterpene, alkaloid and flavone. By combining the proteomics, metabonomics, western blot, and ELISA, we further investigated the mechanisms of the revealed functions, most of which were focused on the modulation of oxidative stress system. Encouragingly, based on our research results, four functional food contained different mushrooms with the effects on renal protection, anti-diabetes and anti-fatigue have got into declaring stage in China.

Keywords: Mushrooms; Function Screening; Product Development

BEB6281

Indian Scenario on Fixed Dose Combinations

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Abstract. The development of fixed-dose combinations (FDCs) is becoming increasingly important from a public health perspective. For chronic diseases and HIV/AIDS infections FDCs are justified for the sake of patient compliance. They are also useful in areas of cardiology, oncology, neurological and respiratory infections. The basic rationale of making FDCs is either to improve adherence or to benefit from the added effects of the two medicinal products given together. Growing number of FDCs are launched by pharmaceutical companies worldwide and there are no particular guidelines for their approval. In India to approve FDCs, permission from State Licensing Authority and Drug Controller General of India is essential. It is a current hot topic of deliberation in Indian pharmaceutical industry, Drug Controller general of India and pharmaceutical trade. A critical review and rationalization of FDCs is required. As popularity of FDCs is increasing rapidly, drug regulatory authorities should pay attention to make standards to evaluate them by conducting extensive study so that those FDCs can be continued for patients benefit and this is the basis of this article.

Keywords: Fixed dose combinations (FDC); Drug Controller General of India; DCG(I); State Licensing Authority (SLA);Indian manufacturers Association (IMA)

Acknowledgements: Special thanks to university grant commission for sanctioning grant for our research project on “Establishment of Consultancy Centre for getting approval of fixed dose combination from Drug Controller General of India”.

BEB6028

Application of Plant Proteolytic Cysteinases: Their Anti-Inflammatory Activity Is Relevant to Healing Improvement?

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Abstract. Two plant proteolytic enzymes: bromelain (A comosus) and papain (C. papaya), are well studied and there is abundant literature describing their applications. Both, papain and bromelain are composed by several isoforms. The lactiferous species Vasconcellea cundinamarcensis (ex Carica candamarcensis), native to Latin America, source of edible fruit, belongs to the Caricaceae family. Like papain and bromelain, holds a set of isomorphous proteolytic enzymes in its latex; its role has been associated to plant protection against predation. We theorize that plant latex plays a role akin to blood in mammalian circulatory system during clot formation. Some of the isoforms in V. cundinamarcensis display mitogenic activity in mammalian cells, setting the basis to study their potential as healing agents. The results confirmed the healing effect in various animal ulcer models including humans and a mechanism has been proposed to explain the healing stimulus. More recent studies show that these latex proteinases are immunomodulatory, anti-inflammatory, dissolve thrombus and display anti-tumor/antimetastasic activity. In clinical trials using the V. curdinamarcensis fraction to heal diabetic-foot chronic wounds, it was found 2.95-fold increase in wound rate compared to hydrogel-Coloplast control. In topical assays, a 10% formulation containing the proteolytic fraction shows a transitory sign of inflammation that recedes within 24 h. The i.v. or s.c. toxicity assays demonstrate that P1G10 at $\leq$ 20 mg/Kg is non-lethal after single injection, while parental administration (p.o.) >300 mg/kg cause death. In sum these data suggest the potential of this fraction to treat chronic wounds.

Session 3_Biomedical Engineering & Biotechnology

Time: 08:30-12:15, November 18, 2020 (GMT+8)

Session Chairs:

Dr. Ching Yee Yong, University College of Technology Sarawak

Prof. Tao Gong, Donghua University

Session Room Link: http://www.academicconf.com/teamslink?confname=ICBEB2020

08:30-08:45	BEB6242	Computational Modelling of Patient-Specific Craniosynostosis Correction *Dr. Selim Bozkurt, University College London*
08:45-08:55	BEB6008	Effects of the Insertion of an Archwire Thin-Walled Sleeve in Accelerating the Canine's Translation *Dr. Yongqing Cai, Hainan University*
08:55-09:10	BEB6118	Non-Invasive Auditory Attention Decoding Approach to Cocktail Party Problem Using Deep Learning *Mr. John Rho, Plano West Senior High School*
09:10-09:25	BEB6013	Effectiveness of a Nutritional Education Intervention on the Prevention of Frailty among Elderly in Northern Taiwan *Dr. Cheng-Fen Chang, Asia University*
09:25-09:40	BEB6052	Effect of Electroacupuncture Serum for Autophagy of Muscle Satellite Cells based on PI3K/Akt Signaling Pathway *Dr. Tong Liu, Guangdong Second Hospital of Traditional Chinese Medicine*
09:40-09:50	BEB6063	3D-Printing Rapid Prototyping for Acetabular Fracture Classification and Educating Young Surgeons *Ms. Yangyang Jiang, Xi'an Medical University*
09:50-10:10	BEB6090	Clinical Outcome Analysis of Single Embryo Transfer --12 Years of Clinical Data from a Single Center *Ms. Yingqin Huang, Maternal and Child Health Hospital and Obstetrics and Gynecology Hospital of Guangxi Zhuang Autonomous Region*
10:10-10:20		**BREAK**
10:20-10:40	BEB6181	Mechanical Characteristics Analysis of a Bionic Muscle Cable-Driven Lower Limb Rehabilitation Robot *Dr. Yan-lin Wang, Harbin Engineering University*
10:40-10:50	BEB6348	An Isolated Posterior Spinal Aneurysm in which Intraoperative Electrophysiological Monitoring was successfully used to Locate the Lesion and to Detect the Possibility of Ischemic Complications *Dr. Megumu Takata, Otsu Municipal Hospital*
10:50-11:10	BEB6289	Rehabilitation Device: An IoT Portable Human-Human Interface (HHI) Neuromuscular Electrical Stimulator (NMES) *Dr. Ching Yee Yong, University College of Technology Sarawak*
11:10-11:25	BEB6133	Quantitative Assessments of Firmness and Automatic Optimization Methods of Trajectory for Pedicle Screw *Dr. Xiaozhao Chen, Shenyang Pharmaceutical University*
11:25-12:00	BEB6312	Clinical Applications of TD-NIRS: from Neuroscience to Muscle Rehabilitation *Asst. Prof. Rebecca Re, Polytechnic University of Milan*
12:00-12:15	BEB6220	Non-invasive Evaluation of the Pulmonary Vascular Function in Obesity *Dr. Na Zhou, Free University of Brussels*

Abstracts of Session 3

BEB6242

Computational Modelling of Patient-Specific Craniosynostosis Correction

Selim Bozkurt[1,2,*], Alessandro Borghi[2,3], Lara S. van de Lande[2,3], N.U. Owase Jeelani[2,3], David J. Dunaway[2,3], Silvia Schievano[2,3]
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Abstract. Craniosynostosis is a condition in which fibrous sutures in an infant skull fuses prematurely and turns into bone. Unicoronal craniosynostosis (UC) and Lambdoid Craniosynostosis (LC) are two different types craniosynostosis affecting the forehead and back of the head. UC is the second most common type of nonsyndromic craniosynostosis and characterised by ipsilateral forehead and fronto-parietal region flattening with contralateral compensatory bossing. It is a complex condition; therefore, difficult to treat because of the asymmetry in the orbits and cranium. LC is a rare non-syndromic craniosynostosis characterised by fusion of the lambdoid sutures at the back of the head. Surgical correction including the spring assisted cranioplasty is the only option to correct the asymmetry at the skull in LC. However, the aesthetic outcome from spring assisted cranioplasty may remain suboptimal. Computational simulations allow testing of the effect of different osteotomies, spring locations and required forces, therefore, parametric finite element (FE) models could allow optimisation of function and aesthetic outcomes in surgical craniosynostosis corrections. The aim of this study is to develop patient-specific parametric FE models for the patients affected by UC and LC, which simulate spring assisted skull correction and biological mechanisms such as skull growth. The skull geometries from UC and LC patients who underwent surgical correction were reconstructed from the pre-operative computed tomography (CT) images in Simpleware ScanIP. Skull growth and surgical intervention were simulated using MSC Marc FE software. The simulation results show a good agreement with post-operative CT scans and provide insights about the potential treatment techniques which can be used to correct craniosynostosis in future.

Keywords: Craniosynostosis; Spring Assisted Cranioplasty; Unicoronal Craniosynostosis; Lambdoid Craniosynostosis; Finite Element Analyses

BEB6008

Effects of The Insertion of an Archwire Thin-Walled Sleeve in Accelerating the Canine's Translation

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Abstract. In sliding mechanics, resistance to sliding (RS), including friction, binding, and notching, generated at a wire–bracket interface has a bearing on the force transmitted to the teeth and further influences the biomechanical behavior associated with tooth movement efficiency. Objective: This study aimed to propose and verify the insertion of a rectangular thin-walled sleeve between an archwire and a bracket to minimize the resistance effect on the biomechanical behavior of tooth movement by using the finite element (FE) method. Material and methods: A 3D FE solid model was constructed and composed of mandibular dentitions, including the surrounding tooth-supporting structures and fixed self-ligating appliances. The translation of the left mandibular canine was simulated (0.1 and 0.3mm) from the labial side to the lingual side with or without the thin-walled sleeve by using eight kinds of

archwires with various dimensions and cross sections by FE methods. Results: FE analysis indicated that the canine's maximum initial displacement and the highest periodontal ligament (PDL) von Mises stress were mainly influenced by the orthodontic wire and the insertion of the thin-walled sleeve. Without the thin-walled sleeve, rectangular archwires could initiate a more optimal tissue response than round archwires. However, the insertion of the thin-walled sleeve between the small round archwire and the bracket significantly presented the most optimal biological responses in all of the cases. Conclusion: FE results revealed that the insertion of a thin-walled sleeve in a small round archwire and a bracket could have a positive influence on final tooth movement.

Keywords: Resistance to Sliding; Tooth Movement; Thin-walled Sleeve; Finite Element

BEB6118

Non-Invasive Auditory Attention Decoding Approach to Cocktail Party Problem Using Deep Learning

John Rho, Govardhan Poondi
Plano West Senior High School

Abstract. Aims: For individuals with hearing loss, distinguishing between various voices in noisy environments is difficult. Current hearing aids are unable to identify and attenuate background voices due to software limitations and a single-microphone design. Methods: The current audiological approach to this issue (the cocktail party problem) is auditory attention decoding, a process that harnesses the natural ability of the brain to identify and attenuate background noise. Non-invasive EEG data produced a predicted audio file through an existing state-of-the-art AAD framework, incorporating deep learning. A Deep Attractor Network was then employed to separate this file into its component voices using attractor points. To compare the attended audio file and its component voices, a novel methodology implementing a Fast Fourier Transform deconstructed these files into their constituent frequencies. A correlation analysis then determined the component voice with the highest match to the attended audio file. Results: The degree of correlation between the component voices and the predicted audio file was measured by a Perceptual Evaluation of Speech Quality index and Mean Opinion Score index using a TensorFlow program. Both indices demonstrated correlation at ~90%, indicating excellent audio quality and comprehension from both the human and computer perspective. Thus, the integrated AAD approach developed is suitable for EEG-based speech separation and attenuation. Conclusions: Since the algorithm functions in real-time and trains on unclean speech sources, it is ideal for implementation into hearing aids. The developed AAD technology also shows potential in military environments with heavy background noise and existing smart home devices.

BEB6013

Effectiveness of a Nutritional Education Intervention on the Prevention of Frailty among Elderly in Northern Taiwan

Cheng-Fen Chang[1,2,*], Jiun-Yi Wang[1], Huang-YuChang[3],Sheng-Hua Tsai[4], Pei-Ti Hsu[2]
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[3]*Department of Dietetics, Keelung Hospital, Ministry of Health and Welfare;*
[4]*Department of Social Work, Keelung Hospital, Ministry of Health and Welfare*

Abstract. Aims: As reported by the Ministry of Health in 2017, the prevalence of frailty among Taiwan elderly (65 y or older) population had reached 5.4%, and of pre-frailty was 41.5%. The aim of the study was to explore the effect of a nutritional education intervention on the prevention of frailty among the

elderly in Taiwan. Methods: The alone participants (65 y) were recruited by the Huashan Foundation and social workers in Keelung Hospital (from April and December, 2018); and participated in a nutrition education designed monthly by dietitians and meal sharing by weekly. The Nutritional Education was combined with a series of DIY electric cooker cooking courses, simple knowledge and skills improved self-prepare food convenience. Primary outcomes were analysed by the paired Student's T test used SPSS 22.0 statistic software. Results: Among the 37 participants (45 enrolled, 8 withdraw), consisted of 15 males (40.5%) and 22 females (59.5%). The mean of age was male77(±6.0) and female 80.5(±5.6). After 9 months intervention, the before and after of the average hand grip strength were 20.2±4.81 and 19.4±5.67 kg (p = .124).and score of KCL-C were 8.14±3.71 and 6.5±4.0(p=.006). In addition, there was a significant difference in the score of KCL-C for men (t=-3.623, p.003), especially in participants over 75 y of age (t=-4.243, p.003). Finally, the Nutritional Education intervention can effectively improve daily life dysfunction and weak of elderly illustrated by KCL-C(p=.004-.035). Conclusions: The Nutritional Education intervention could be benefited to prevent frailty among elderly population and should be deserved more attentions in promotion of health aging.

Keywords: Frailty; Elderly; Nutritional Education; KCL-C

BEB6052

Effect of Electroacupuncture Serum for Autophagy of Muscle Satellite Cells based on PI3K/Akt Signaling Pathway

Tong Liu[1], Jia-Ni Yu[2], Yue Liu[1,*], Wei-Chuan Kuang[1], Xiao-Yin Wang[1], Xi Wen[1], Ye Jiang[1], Xiao-Jia Qiu[1], YAO Zeng[1], Han-Hong Zou[1]

[1]*Department of Acupuncture and Rehabilitation, Guangdong Second Hospital of Traditional Chinese Medicine;*

[2]*Department of Rehabilitation, Guangdong Hospital of Traditional Chinese Medicine*

Abstract. Aims: To explore the effect of electroacupuncture serum for autophagy of muscle satellite cells based on PI3K/Akt signaling pathway. Methods: Isolate and culture primary multifidus muscle satellite cells of rat and obtain electroacupuncture serum according to experimental methods as our previous research. The 3rd generation of cells was selected and induced for autophagy by applying blank serum (culture medium only without serum) for 12h. Then the cells will be randomly assigned to blank serum group, 10% electroacupuncture serum group, 10% electroacupuncture serum group plus LY294002 group and 3-MA group. Proliferation capacity and expression of Akt, p-Akt, Beclin1, LC3-II, Pax7 will be detected after 12h and after 24h of intervention by CCK-8 and Western-blot respectively. Results: CCK-8 indicated that proliferation capacity in 10% electroacupuncture serum group was better than other groups ($P<0.05$) at 12h, while no significant difference was found among blank serum group, 10% electroacupuncture serum group plus LY294002 group and 3-MA group groups ($P>0.05$). The proliferation capacity in 10% electroacupuncture serum group was better than other groups ($P<0.01$ or $P<0.05$) at 24h, while 10% electroacupuncture serum group plus LY294002 group and 3-MA group groups was better than blank serum group ($P<0.01$).Western-blot analysis demonstrated the expression of p-Akt and Pax7 in the 10% electroacupuncture serum and 3-MA group was higher than blank serum group and 10% electroacupuncture serum group plus LY294002 group ($P<0.01$ or $P<0.05$) while the expression of Beclin1 and LC3-II significantly decreased ($P<0.01$ or $P<0.05$) at 12h. The expression of p-Akt in the 10% electroacupuncture serum and 3-MA group was higher than blank serum group and 10% electroacupuncture serum group plus LY294002 group ($P<0.01$) while the expression of Beclin1 and LC3-II significantly decreased ($P<0.01$) at 24h. The expression of Pax7 in 10% electroacupuncture serum group was higher than blank serum group and 10% electroacupuncture serum group plus LY294002 group ($P<0.01$) while the expression of Pax7 in 3-MA group was higher than blank serum group ($P<0.01$).The expression of Beclin1, LC3-II at 24h in the

blank serum group was higher than 12h while the expression of Pax7 was lower ($P<0.01$). There is a significant difference in the 10% electroacupuncture serum group between 24h and 12h in termed with the expression of Pax7 ($P<0.01$). Conclusions: Electroacupuncture serum could improve the excessive autophagy to promote its proliferation, which maybe achieved by activating PI3K/Akt Signaling Pathway.

Acknowledgements: This work was supported by a project grant from National Science Foundation for Young Scientists of China (Grand No. 81704179).

BEB6063

3D-Printing Rapid Prototyping for Acetabular Fracture Classification and Educating Young Surgeons

Yangyang Jiang[1,*], Cheng Ren[2], Liang Sun[2], Zhong Li[2], Kun Zhang[2], Ming Li[2,*]
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[2]*Department of Orthopaedics Trauma, Xi'an Honghui Hospital, Xi'an Jiaotong University Health Science Center*

Abstract. Aims: To evaluate the application of 3D-printing rapid prototyping in the classification of acetabular fracture and education of young surgeons. Methods: Twenty patients with acetabular fractures were retrospectively analyzed in this study. Random number for each 3D-printing models and series of conventional radiographs (AP pelvis, Judet views and CT scans) in the blind. Then, three professional orthopaedic surgeons and three resident orthopaedic surgeons independently classified each fracture using 3D-printing model alone and conventional radiographs alone. 4 weeks later, marked with random number again and repeated the above experiment. The kappa statistic was used to evaluate inter- and intraobserver agreement. Results: At the first assessment, interobserver agreement of the conventional radiographs and 3D-printing model was 0.887 and 0.962 between professional surgeons, for the resident surgeons was 0.659 and 0.849. The second assessment showed intraobserver agreement was 0.906 for conventional radiographs and 0.925 for 3D-printing model in professional surgeons group. For the resident surgeons group the kappa statistic using conventional radiographs was 0.696, while using the model was 0.849. Conclusions: Compared with conventional radiographs, 3D-printing could effectively enhance the reliability of acetabular fracture classification,and is more helpful for young surgeons understanding of these injuries that contribute to the medical education.

Acknowledgements: This work was supported by a project grant from the Scientific Research Program Funded by Shaanxi Provincial Education Department (Grand No.19JK0769).

BEB6090

Clinical Outcome Analysis of Single Embryo Transfer -12 Years of Clinical Data from A Single Center

Yingqin Huang, Dongmei Huang, Ling Huang, Enyan Huang, Qianqian Wen, Lin Liang, Mei Yin, Bo Zhang[*]
Department of Reproductive Center, Maternal and Child Health Hospital and Obstetrics and Gynecology Hospital of Guangxi Zhuang Autonomous Region

Abstract. Aims: To evaluate the application of 3D-printing rapid prototyping in the classification of acetabular fracture and education of young surgeons. Methods: Twenty patients with acetabular fractures were retrospectively analyzed in this study. Random number for each 3D-printing models and series of conventional radiographs (AP pelvis, Judet views and CT scans) in the blind. Then, three

professional orthopaedic surgeons and three resident orthopaedic surgeons independently classified each fracture using 3D-printing model alone and conventional radiographs alone. 4 weeks later, marked with random number again and repeated the above experiment. The kappa statistic was used to evaluate inter- and intraobserver agreement. Results: At the first assessment, interobserver agreement of the conventional radiographs and 3D-printing model was 0.887 and 0.962 between professional surgeons, for the resident surgeons was 0.659 and 0.849. The second assessment showed intraobserver agreement was 0.906 for conventional radiographs and 0.925 for 3D-printing model in professional surgeons group. For the resident surgeons group the kappa statistic using conventional radiographs was 0.696, while using the model was 0.849. Conclusions: Compared with conventional radiographs, 3D-printing could effectively enhance the reliability of acetabular fracture classification, and is more helpful for young surgeons understanding of these injuries that contribute to the medical education.

Acknowledgements: This work was supported by a project grant from the Scientific Research Program Funded by Shaanxi Provincial Education Department (Grand No.19JK0769).

BEB6348

An Isolated Posterior Spinal Aneurysm Resection in Which Intraoperative Electrophysiological Monitoring Was Successfully Used to Locate the Lesion and to Detect the Possibility of Ischemic Complications

Megumu Takata, Motohiro Takayama, Yohei Yokoyama, Hideki Hayashi, and Natsue Kishida
Department of Neurosurgery, Otsu Municipal Hospital

Abstract. To report the successful use of electrophysiological monitoring in the surgical resection of a ruptured spinal artery (SA) aneurysm to locate the lesion, and to predict ischemic complications. Summary of Background Data. Isolated aneurysm of the posterior SA is an extremely rare event without established treatment and diagnosis procedures. Reports describing the surgical intervention of aneurysm of the posterior SA using electrophysiological monitoring are scant. Methods. We performed the surgical resection of a dissected posterior SA aneurysm in an older patient who presented with spinal subarachnoid hemorrhage using intraoperative electrophysiological monitoring. Results. Intraoperatively, motor evoked potentials decreased over 50% when a distal site of the lesion was clipped, indicating that site was the posterior SA. This led to further investigation of the vascular anatomy around the lesion, which revealed the descending part of the posterior SA buried deeply in a thick thrombus. Clipping and resection were successful, and ischemia of the posterior SA was avoided. The postoperative clinical course was good, and there was no recurrence or long-term squeal. Conclusion. Electrophysiological monitoring might be useful when intraoperative anatomical findings of the hemodynamic structure are inadequate. Moreover, in our case, intraoperative changes in motor evoked potentials indicated the risk to occlude one of posterior SAs, although it is said that posterior circulation of spinal cord has ischemic tolerance. Key words: spinal aneurysm, posterior spinal artery, pathology, electrophysiological monitoring, ischemic complication, motor evoked potentials, somatosensory evoked potentials, surgical resection, ischemic tolerance, posterior circulation of spinal cord.

BEB6289

Rehabilitation Device: An IoT Portable Human-Human Interface (HHI) Neuromuscular Electrical Stimulator (NMES)

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Abstract. Neuromuscular electrical stimulation (NMES) has been widely used in rehabilitation hub to restore or replace motor function of individuals who have upper neuron damage such as stroke and spinal cord injury. However, the utilization of sensors in NMES is limited and resulting in lacking of data for upper limb movement analysis. The proposed system implemented NMES integrated with human to human interface (HHI) in the rehabilitation process for stroke patients. The HHI required both controller (physiotherapist) and subject (patient) to complete the NMES process.The physiotherapist (controller) can coach the motion of patients (subject) by injecting his own signal for the patients to follow. Ten (10) subjects were tested with five (5) repeating trials. The EMG value was extracted from the finger flexion and extension at controller side, then injected into control unit for further stimulate the same signal to the subject. In order to evaluate the repeating motion by the subject, an accelerometer was attached on the finger. Performance evaluation of the subject was executed by comparing the flexion angle with controller side. The result showed that the error of the system was less than 10.29% for the first trial. The error was gradually reduced after several trials. This home-based rehabilitation device allows the patients to perform NMES at home thus help them to regain the independence in performing daily activities.

Keywords: Human-Human Interface (HHI), Neuromuscular Stimulation (NMES), Motion, EMG, Accelerometer, Rehabilitation.

Acknowledgements: The authors are deeply indebted and would like to express our gratitude to the University College of Technology Sarawak for supporting and funding this study.

BEB6312

Clinical Applications of TD-NIRS: from Neuroscience to Muscle Rehabilitation

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Abstract. Time Domain (TD) Near infrared spectroscopy (NIRS) is a spectroscopic optical technique which makes use of light in the 600-1100 nm window to assess the optical tissue properties, i.e. absorption and scattering coefficient. This technique is fast and non-invasive, therefore it can be widely used in real-time, in-vivo applications on humans allowing to determine the absolute values of the hemodynamic tissue's parameters and to follow their variation in time. Applications to brain (ischemic stroke patients, glaucoma patients) and muscle (rehabilitation evaluation together with electromyography) on healthy and pathological subjects will be presented. Example of other clinical applications can include breast (SOLUS project) and thyroid (LUCA project) monitoring. From an instrumental point of view, recently we are witnessing a drastic decrease in size and costs, which will make TD-NIRS portable and wearable allowing new applications in the field of athletes' performances assessment or personalized patient monitoring at home.

Keywords: NIRS; fNIRS; Diffusion Theory; Hemodynamics; Brain; Oxidative Metabolism; Muscle

BEB6220

Non-invasive Evaluation of the Pulmonary Vascular Function in Obesity

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[1]*Laboratory of Cardio-Pulmonary Exercise Physiology, Faculty of Motorskills Sciences, Université Libre de Bruxelles;*
[2]*Department of Surgery, Erasmus Hospital, Free University of Belgium;*

[3]*Laboratory of Biometry and exercise Nutrition, Faculty of Motorskills Sciences, Université Libre de Bruxelles*

Abstract. Background: Previous studies have shown that mean pulmonary artery pressure (mPAP) and cardiac output (CO) or indexed (CI) measured during stress echocardiography can assess pulmonary vascular function and predict exercise capacity. How obesity affects the pulmonary circulation remain unknown. Methods: 17 pairs of subjects (obese vs healthy matched controls for height, sex and age, gender: 25% men, age: 44 ± 11 vs 46 ± 12 years, height: 1.7 ± 0.1 vs 1.7 ± 0.1 m, weight: 111 ± 17 vs 64 ± 11 kg, BMI: 38 ± 4 vs 22 ± 2 kg/m2) performed an echocardiography on a semi-recumbent cycle ergometer at rest and increasing levels of exercise. Pulmonary artery pressure (PAP) and CO were measured during the last minute of each workload step until exhaustion. Total pulmonary vascular resistance (TPR) was calculated as mPAP/CI, and pulmonary vascular distensibility coefficient α was mathematically determined from the slight natural curvilinearity of multipoint mPAP–CO plots. Results: No difference in pulmonary vascular function were observed at rest between the two groups. During exercise (at maximum common exercise level), the mPAP and TPR were higher in obesity with a higher mPAP/CI slope. The pulmonary vascular distensibility coefficient α was not statistically different between both experimental groups. Conclusion: While pulmonary vascular function seems to be preserved preserved at rest in obese subjects, exercise induced mPAP increase is exacerbated increasing pulmonary vascular resistance and potentially affecting maximal CO.

Keywords: Exercise; Stress Echocardiography; Cardiac Output; Pulmonary Vascular Resistance; Obesity

Table 1. Results of Exercise Stress Echocardiography

	Obese subjects (n=17)	**Control subjects** (n=17)
Rest		
BSA, m^2	1.73 ± 0.18	2.19 ± 0.21***
CO, L/min	5.4 ± 1.7	4.5 ± 0.9
CI, L/min/m^2	2.5 ± 0.7	2.6 ± 0.6
mPAP, mmHg	16 ± 2	15 ± 2
PVRi, Woods units/m^2	7.13 ± 2.74	5.83 ± 1.57
Common maximum exercise level		
CI “max” normalized, L/min/m^2	5.1 ± 1.2	5.1 ± 1.9
mPAP “max” normalized, mmHg	26 ± 5	22 ± 5*
PVRi “max” normalized, Woods units/m^2	5.3 ± 1.1	4.3 ± 0.7**
Slope		

mPAP-CI, mmHg/L/min/m^2	3.7 ± 1.6	3.1 ± 0.8**
α, %	1.7 ± 0.8	1.4 ± 0.6

Abbreviations: BSA: body surface area; CO: cardiac output; CI: cardiac index; mPAP: mean pulmonary artery pressure; TPR: indexed total pulmonary vascular resistance; α: distensibility coefficient; * $p<0.05$, ** $p<0.01$, *** $p<0.001$;

Note: To avoid repeatability issue, the abstracts of BEB6181 and BEB6133 will be available after the full paper is published in journals.

Session 4_Medical Imaging Technology & Signal Processing

Time: 14:00-18:35, November 18, 2020 (GMT+8)

Session Chairs:

Prof. Lung-Kwang Pan, Central Taiwan University of Science and Technology

Prof. Yudong Zhang

Session Room Link: http://www.academicconf.com/teamslink?confname=ICBEB2020

14:00-14:25	BEB6269	Correlation between Produced Positron Emitters and Proton Dose Distribution at Proton Therapy *Dr. Ahmad Esmaili Torshabi, Graduate University of Advanced Technology*
14:25-14:45	BEB6317	Signal Alterations of Glutamate-weighted Chemical Exchange Saturation Transfer in the Demyelination and Remyelination *Asst. Prof. Dong-Hoon Lee, Yonsei University*
14:45-15:05	BEB6175	Integration of Taguchi Analysis with Phantom and Innovative Gauges: Optimization of the CT Scan Protocol for Peripheral Arterial Occlusive Disease (PAOD) Syndrome *Mr. Tsung-Min Lee, Central Taiwan University of Science and Technology*
15:05-15:20	BEB6156	Gastrointestinal Stromal Tumors Diagnosis on Multi-Center Endoscopic Ultrasound Images Using Multi-Scale Image Normalization and Transfer Learning *Ms. Chengcheng Liu, Fudan University*
15:20-15:40	BEB6250	Use of Hysterosalpingo-Foam Sonography for Assessment of the Efficacy of Essure Hysteroscopic Sterilization *Asst. Prof. Maja Rosič, General Hospital Ptuj*
15:40-16:05	BEB6340	Recent Progresses of Chest CT based COVID-19 Detection *Prof. Yudong Zhang, University of Leicester*
16:05-16:20	BEB6260	A Six-parameter Semi-quantitative Analysis of 251 Patients for the Enhanced Triggered Timing of Head and Neck CT Angiography Scanning via the Inverse Problem Algorithm *Mr. Chih-Sheng Lin, The Affiliated BenQ Hospital of the Nanjing Medical University*
16:20-16:30		**BREAK**
16:30-16:55	BEB6288	New Developments in Ocular Imaging: from Functional Imaging to Nervous System Assessment *Prof. António Miguel Morgado, University of Coimbra*
16:55-17:15	BEB6157	Computer-Aided Differentiation between Benign and Malignant of IPMN and MCN: The Combined Diagnosis of Radiomics and Clinical Indexes with a Novel Feature Selection Algorithm *Mr. Chengkang Li, Fudan University*
17:15-17:35	BEB6301	A Micro-Dosimetry Study on Annihilation Gamma-Rays and Produced Secondaries at PET Monitoring Proton Therapy *Mr. Siamak Hooshmand Koochi, Graduate University of Advanced Technology*
17:35-17:50	CSPR1021	Application of Mirror Image Method in EIT to Detect Lung Lesions *Ms. Zeying Wang, Tianjin University*
17:50-18:05	BEB6075	A Submatrix Spatial Coherence Approach to Minimum Variance Beamforming Combined with Sign Coherence Factor for Coherent Plane Wave Compounding *Ms. Xin Yan, Fudan University*
18:05-18:20	BEB6263	Prototype Methods *Dr. Monjoy Saha, Emory University*
18:20-18:35	BEB6184	The Amplification and Visualization of Respiration in Video *Ms. Yuxin Liu, Beihang University, China*

Abstracts of Session 4

BEB6269

Correlation between Produced Positron Emitters and Proton Dose Distribution at Proton Therapy

Ahmad Esmaili Torshabi*
Faculty of Sciences and Modern Technologies, Graduate University of Advanced Technology

Abstract. A successful proton therapy strongly depends on accurate comprehension of 3D dose distribution and range verification of therapeutic beam while protons penetrate inside patient body to reach tumor volume, according to Bragg peak. One of the proposed strategies to estimate the Bragg peak position is using online monitoring system by means of Positron Emission Tomography (PET). PET monitoring strategy is based on the detection of 0.511 MeV photons, resulting from the annihilation phenomena of positrons emitted by radioactive positron emitters, such as C-11, O-15. Theses latter isotopes are generated by colliding incident protons with nuclei of tissues via non-elastic nuclear reaction. Produced positrons move through the matter and deposit their energy via coulomb scattering and then annihilation is happened at rest. The produced positron emitters are the base of imaging process from protons tracing and Bragg curve information extraction. It should be noted that, the spatial relation between dose distribution of protons and produced positron emitters is complex. The main aim of this contribution is to investigate nuclear interactions and to find any possible correlation among proton dose distribution and produced isotopes and coordinate of annihilation phenomena by means of Monte Carlo FLUKA simulation code. Final analysed results represent that there an agreement between the location of protons Bragg peak and the position of produced positron emitters. Moreover, the coordinate of annihilation phenomena and the position of Bragg peak are related with each other.

Keywords: Proton Therapy; Dose Distribution; Positron, Radoactive Positron Emitter; Annihilation Phenomena

BEB6317

Signal Alterations of Glutamate-weighted Chemical Exchange Saturation Transfer in the Demyelination and Remyelination

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Abstract. Evaluation and study of demyelination and remyelination may be a major factor in determining the outcome of myelin degeneration with substantial axonal and neuronal cell loss in diseases such as multiple sclerosis. It has become increasingly apparent in recent years that in vivo pathophysiological changes in glutamate occur during demyelination and remyelination in the brain's white matter. Therefore, observation and evaluation of changes in glutamate levels, a potential essential biomarker, are important to estimate brain metabolism during myelination. Glutamate-weighted chemical exchange saturation transfer (GluCEST) has been introduced as a useful imaging tool that could be used to detect changes in glutamate levels in vivo. In this study, we investigated in vivo changes in glutamate level in the cerebral white matter using GluCEST imaging on a 7 Tesla magnetic resonance imaging (MRI) system, on the premise that changes in glutamate may serve as a significant bio-imaging marker in the processes of demyelination and remyelination.

Keywords: Glutamate; Chemical Exchange Saturation Transfer; Demyelination; Remyelination; Cuprizone

Acknowledgements: This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea Government (No. 2018R1C1B6004521).

BEB6175

Integration of Taguchi Analysis with Phantom and Innovative Gauges: Optimization of the CT Scan Protocol for Peripheral Arterial Occlusive Disease (PAOD) Syndrome

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4Department of Orthopedic Surgery, Tri-Service General Hospital, National Defense Medical Center;
[5]*Department of Radiology, Taichung Armed Forces General Hospital;*
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Abstract. Seven factors of CT (kVp, mAs, pitch, FOV, slice thickness, rotation time, and matrix size) were organized into Taguchi unique L18 orthogonal array to optimize the CT scan protocol for peripheral arterial occlusive disease (PAOD) syndrome. An indigenous line group gauge was adopted to quantify the minimum detectable difference (MDD) in the optimizing process. The optimal combination of CT scan protocols was obtained from three well-trained radiologists who ranked the scanned images of the gauge three times according to the double-blind criterion. The optimal setting of CT scan protocol for PAOD was 100 kVp, 240 mAs, 0.513 pitch, 320 FOV, 4.0 slice thickness, rotation time of 0.75s, and 768×768 matrix size. The smallest MDD was verified as 1.43 mm at a 0.45 mm depth of the gauge by the revised Student's t-test and ANOVA. The ranking process was found to be preferable to grading in the optimizing process because the imaging correlation among groups could be magnified and emphasized. The comparative analysis of various MDDs obtained from different medical facilities and literary sources was performed, which revealed that the cardiac X-ray provided the finest spatial resolution according to the quantified MDD. Meanwhile, the CT scan protocol for PAOD adopted in this study had finer MDD than that for the abdomen due to comparatively low kVp or/and mAs.

Keywords: CT Scan Imaging; Line Group Gauge; Taguchi; Orthogonal Array; MATLAB; Student's t-test

BEB6250

Use of Hysterosalpingo-Foam Sonography for Assessment of The Efficacy of Essure Hysteroscopic Sterilization

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Abstract. After Essure (Bayer AG, Leverkusen, Germany) hysteroscopic sterilization procedure, a confirmation test is performed to evaluate the micro-insert position or tubal occlusion and assess the

success of sterilization. The reference standard for confirmation of tubal occlusion is hysterosalpingography (HSG). 2-dimensional (2D) transvaginal ultrasonography was proposed to be an adequate noninvasive method for assessment of micro-insert position. However, when sterilization is complicated or when the confirmation with 2D transvaginal ultrasonography is unsatisfactory, HSG for evaluation of tubal occlusion is still indicated. Recently, hysterosalpingo-foam sonography (HyFoSy) was introduced and was suggested to be a possible less invasive alternative to HSG during infertility workup. Our prospective study included patients, who underwent Essure hysteroscopic sterilization, followed by 2D transvaginal ultrasonography, HyFoSy and HSG 12 weeks after sterilization. 2D transvaginal ultrasonography was performed to assess the microinsert position. It was followed by HyFoSy and HSG for evaluation of tubal occlusion. The purpose of our study was to evaluate the accuracy HyFoSy compared to HSG for assessment of the efficacy of Essure hysteroscopic sterilization.

Keywords: Hysteroscopic Sterilization; 2D Transvaginal Ultrasonography; Hysterosalpingo-Foam Sonography; Hysterosalpingography

Acknowledgements: We would like to thank the University Medical Center Maribor for help and support.

BEB6340

Recent Progresses of Chest CT based COVID-19 Detection

Yudong Zhang
University of Leicester

Abstract. Deep learning is a rapidly advancing field in recent years, in terms of both methodological development and practical applications. It allows computational models of multiple processing layers to learn and represent data with multiple levels of abstraction. It is able to implicitly capture intricate structures of large-scale data and ideally suited to some of the hardware architectures that are currently available. COVID-19 is a pandemic disease, which already caused more than 1 million deaths till now. This invited speak presents the recent progresses of using transfer learning and graph convolutional network technologies in COVID-19 detection.

Keywords: COVID-19; Transfer Learning; Graph Convolutional Network

BEB6288

New Developments in Ocular Imaging: from Functional Imaging to Nervous System Assessment

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Abstract. The eye is the only tissue of the human body that is transparent to optical radiation, making it ideally suited for inspection by non-invasive optical methods. Ocular imaging started by addressing the need for structural assessment in the context of ophthalmological practice and evolved towards functional imaging of ocular tissues. Currently, the eye is also regarded as a window to different human body systems, like the cardiovascular and nervous systems. In this talk, we will present past and present work in ocular imaging. We will travel from the assessment of corneal microstructure to current work on corneal metabolic imaging. Finally, the talk will address current research on retinal imaging. Here,

the goal is to use the eye as window to the central nervous system for neurodegeneration evaluation, through imaging techniques like optical coherence tomography (OCT) and optical coherence elastography (OCE).

BEB6301

A Micro-Dosimetry Study on Annihilation Gamma-Rays and Produced Secondaries at PET Monitoring Proton Therapy

Siamak Hooshmand Koochi, Ahmad Esmaili Torshabi*
Faculty of Sciences and Modern Technologies, Graduate University of Advanced Technology

Abstract. At cancer treatment with ionizing radiation, proton therapy is known as highly efficient treatment strategy due to physical properties of protons interaction with cancer cell and normal surrounding organs by following Bragg curve. One of the main challenging issue at proton therapy is a lack of direct monitoring from protons penetration inside patient body and position of Bragg peak. Positron Emission Tomography has been proposed as promising solution for 3D dose distribution detection using annihilation gamma rays. While protons are irradiating as therapeutic beam, positron emitters are produced on the beam path length through nuclear reactions and the spatial distribution of positrons and then annihilation gamma rays are correlated with Bragg peak information. The position of produced positron emitters and also annihilation gamma rays are still under investigation. But, there is a lack of information concerning the share of gamma rays produced in other devices located in front of the beam and makes a possible error during dose distribution monitoring. In this work, a micro-dosimetry study has been done for tracking true annihilation gamma rays inside phantom. Moreover, the gamma rays produced outside patient body and reach to PET detecting system has been calculated, accordingly to access this possible error. For this aim, a virtual phantom with different materials has been simulated in front of proton beam using Monte Carlo FLUKA code. Final results show that the share of gamma rays produced outside patient body is almost negligible if related devices will be located at proper distance from patient body.

Keywords: Proton Therapy; Micro-Dosimetry; Monte Carlo Simulation; FLUKA Code

CSPR1021

Application of Mirror Image Method in EIT to Detect Lung Lesions

Zeying Wang, Shihong Yue*, Qi Li, Huaxiang Wang
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Abstract. Aims: Electrical impedance tomography (EIT) has the potential to visualize the real-time human respiratory system owing to its advantages of nondestructive, safety and fast-response. However, the spatial resolution of EIT images is restricted by ill-posed solution and soft-field effect, making it difficult to locate pulmonary lesions accurately. It is necessary to further improve the reconstruction ability of EIT. Methods: In this study, half of adjacent electrodes are excited by voltages with symmetrical voltage intensity distributions, and the currents on the other half are measured. Then, by the mirror image method, each measurement set can be converted into a so-called mirror point, with higher sensitivity than that in the existing method, in the detected field. This exciting strategy reduces the soft-field effect, and with various voltage intensity distributions, independent measurements are greatly increase, i.e., the ill-posed solution problem is alleviated. A group of simulated lung lesions are performed to validate the proposed method and compared with the existing measuring methods. The typical linear back projection imaging method is adopted in reconstructions. Results: Using the existing measuring method, the correlation coefficient and the relative error of the experimental data are

calculated individually as 0.6823 and 0.1355, while under the proposed method, the two evaluation indexes are 0.8821 and 0.0972. Conclusions: Compared to the existing measuring methods, the proposed method can detect lesions more efficiently. Combined with the XCT images, furthermore, the proposed measuring method can infer more specificity, e.g., determining the size and location of lesions.

Acknowledgements: This work was supported by a project grant from the National Natural Science Foundation of China (Grand No. 61973232).

Note: To avoid repeatability issue, the abstracts of BEB6156, BEB6260, BEB6157, BEB6075, BEB6263 and BEB6184 will be available after the full paper is published in journals.

Part IV Poster Presentations

Poster Presentation Guidelines

- There is no size constraint for the e-poster, if you have difficult to decide one, then A1 size (594mm×841mm) is recommended.
- Signed and stamped electronic presentation certificate would be issued via e-mail after presentation.

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- Research Quality
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- **3** Best Poster Presentations among the Top 5 Poster Presentations will be selected by Conference Chair.
- Final Results will be demonstrated on the website on December 7, 2020.

List of Posters:

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BEB5865	Three-Dimensional Reconstruction based on Improved Marching Cubes Algorithm *Prof. Monan Wang, Harbin University of Science and Technology*
BEB5951	Determining the Correct Number of Clusters in the CT Image Segmentation *Ms. Qi Li, Tianjin University*
BEB6059	Aggregated Deep Global Feature Representation for Breast Cancer Histopathology Image Classification *Mr. Jianxin Zhang, Dalian Minzu University*
BEB6072	Performance Test and Experimental Study of Special Stent for Treatment of Iliac Vein Stenosis *Prof. Kun Wang, Inner Mongolia University of Technology*
BEB6084	A Study on Somatosensory Evoked Potential Patterns According to Various Vibrotactile Stimulation: Frequencies and Intensities *Dr. Mi-Hyun Choi, Konkuk University*
BEB6087 Present Online	The Effects of Masticatory Exercise on Cognitive Function in Community-Dwelling Older Adults *Dr. Tae-Hoon Kim, Dongseo University*
BEB6096	A Basic Study on the Effects of Vibrator-attached Leg-Press on the Knee and Ankle Joint Torques *Dr. Jin-Seung Choi, Konkuk University*
BEB6134	Study of Acoustic Source excited by Pulsed Magnetic Field *Dr. Yanju Yang, Engineering Research Center of New Energy Storage Devices and Applications*
BEB6154 Present Online	Assessing the Potential Influence of Different Walking Strategies on Plantar Pressure Distribution Triggered by A Portable Biofeedback-based Gait Training Device *Mr. JimingYing, University of Shanghai for Science and Technology*
BEB6155	Semi-Supervised Sparse Representation Classification for Sleep EEG Recognition with Imbalanced Sample Sets *Dr. Xiaojie Zhao, Beijing Normal University*
BEB6158	Elevated NT-Probnp Is Associated with Poor Activity Outcome in Patients with Sub-Acute Ischemic Stroke: A Prospective Cohort Study *Dr. Mingchao Zhou, The First Affiliated Hospital of Shenzhen University*
BEB6176	Altered Spontaneous Brain Activity and Functional Connectivity Implicated in Cognitive Impairment of Type 2 Diabetes Mellitus *Dr. ShouLiang Qi, The Second Affiliated Hospital of Dalian Medical University*
BEB6183	Semi-Quantitative Analysis of Carotid Stenosis for 272 Patients with Ischemic Stroke Symptoms Using The Inverse Problem Algorithm with Five Risk Factors *Mr. Ya-Hui Lin, Central Taiwan University of Science and Technology*

CSPR1011 Present Online	Discovery of 2, 5-diketopiperazine Derivatives as Selective HDAC6 Inhibitors with Potent Neuroprotective Effects *Dr. Xin Chen, Northwest A&F University*
BEB6188	Optimizing the Tld-100h Readout System Under Various Radioactive I-131 Doses via The Revised Taguchi Dynamic Quality Loss Function *Dr. Lung-Fa Pan, Central Taiwan University of Science and Technology*
BEB6213 Present Online	Interpretable One-Dimensional Alexnet for Detecting Ineffective Efforts During Expiration in Mechanical Ventilation *Mr. Lingwei Zhang,Zhejiang University of Technology*
BEB6237 Present Online	The Detection and Estimation of the Air Leakage in Non-invasive Ventilation: Platform Study *Dr. Huiting Qiao, Beihang University*
BEB6241	Refined Taylor Series Expansion-based Prediction of The Overall Survival for Non-Small Lung Cancer Patients of Clinical Stage IIIA-N2 after Various Treatments: Taiwan Population-based Study of 2665 Cases from 2010 To 2017 *Mr. Kai-Yu Hsiao, Central Taiwan University of Science and Technology*
BEB6259 Present Online	CD44 Enhances Tumor Cell Rigidity via Rho Gtpase-Regulated Actomyosin Contractility *Dr. Yan Su, University of Science and Technology of China*
BEB6265	Transferring Image-based Deep Learning Model to the Detection of Patient-Ventilator Asynchrony with Small Datasets *Mr. Mengzhe Jia, Zhejiang University of Technology*
BEB6297 Present Online	The Effect of Fuzzy Correlation Model Parameters on Real Time Tumor Tracking at Radiotherapy with External Surrogates *Mr. Seyyed Amirreza Dastyar,Graduate University of Advanced Technology*
BEB6326 Present Online	A Method for Detecting Coronary Artery Stenosis based on ECG Signals *Ms. Huan Zhang, Shandong University*
BEB6329 Present Online	Complications Developed Under Ventricular Assist Device Support in Children *Ms. Andrea Nicola George,University College London*
BEB6330	Design and Development of The Expression Cassette for Plant Production of Dengue Virus NS1 Protein *Dr. Anna S. Dolgova,Pasteur Institute*
BEB6343	Effects of Manual Acupuncture Therapy on Malondialdehid Enzymes (Mda), Superoxide Dismutase (Sod), Numeric Analog Scale (Nas), and Quality of Life Scores in Post-Radiation Cancer Head and Neck Cancer *Dr. Hasan Mihardja, Faculty of Medicine, Universitas Indonesia*
BEB6360 Present Online	Soonview algorithm for CPSC 2020 Challenge *Mr. Chi Wang, Shenzhen Soonview Technology Co., Ltd.*

Abstracts of Poster Session

BEB5865

Three-Dimensional Reconstruction based on Improved Marching Cubes Algorithm

Monan Wang, Haiyang Luo, Qi Cui
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Abstract. Based on the standard Marching Cubes (MC) algorithm, this paper proposes an improved MC algorithm. Firstly, the original 15 topological configurations in the MC algorithm are increased to 24, which effectively avoids the generation of voids phenomenon. To further improve the speed of three-dimensional (3D) reconstruction, in this paper, the midpoint selection method is used instead of the linear interpolation method, and the 24 configurations are divided into three types. Each class corresponds to a thread. The multi-thread parallel processing is used to improve the calculation speed. The critical region is used to realize multi-thread synchronization, and then we designed a protocol mapping table according to the idea of the message mapping table. The function pointer is triggered by macro. Processing function is called by function pointer and completes the encapsulation of the protocol mapping table, which maintains the opening and closing principle of the class and ensures the scalability of the class. Through the improved MC algorithm accuracy verification and reconstruction speed verification, it is concluded that the improved MC algorithm can make up for the voids problem. By comparing the calculation time under the two platforms of Windows and Linux, the reconstruction speed of the improved MC algorithm is approximately 30% faster than the standard MC algorithm, 40% faster than the Masala algorithm. Finally, the algorithm is applied to the medical image 3D reconstruction system, and the accuracy and applicability of the algorithm are demonstrated by two sets of examples.

Keywords: 3D Reconstruction; MC Algorithm; Topological Configuration; Protocol Mapping Table

BEB5951

Determining the Correct Number of Clusters in the CT Image Segmentation

Qi Li
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Abstract. Clustering algorithm plays an essential role in CT image segmentation, and cluster validity index is an essential component in clustering analysis. There are a lot of validity indices used for assessing clustering results, that is, determine the optimal cluster number. But the existing validity indices are often ineffective for the datasets with irregular-shaped clusters and corrupted by noise. This study aims to define a novel validity index which cannot be affected by the shapes of clusters and corrupted by noise of the investigated datasets. Chain-based distance different from original Euclidean distance is defined first, then by a multidimensional scaling (MDS) transformation, all points are mapped into a new data space. After evaluation of compactness and separation twice in datasets, a novel validity index is proposed. A lot of synthetic datasets and several typical CT images were used for validating the proposed validity index. Experimental results validate the proposed index and this index is applicable to the datasets with arbitrary-shaped clusters and corrupted by noise, which is helpful in clustering analysis and computer-aided detection system.

BEB6059

Aggregated Deep Global Feature Representation for Breast Cancer Histopathology Image Classification

Jianxin Zhang
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Abstract. Convolutional neural networks (CNNs), successfully used in a great number of medical image analysis applications, have also achieved the state-of-the-art performance in breast cancer histopathology image (BCHI) classification problem recently. However, due to the large varieties among within-class images and insufficient data volume, it is still a challenge to obtain more competitive results by using deep CNN models alone. In this paper, we aim to explore the combination of CNN models with a milestone feature representation method in visual tasks, i.e., vector of locally aggregated descriptors (VLAD), for the BCHI classification, and further propose a novel aggregated deep global feature representation (ADGFR) for this problem. ADGFR adopts the deep features that are extracted from the fully connected layer to form an individual descriptor vector, and augments input images to generate different descriptors for achieving the final aggregated descriptor vector. The individual descriptor vector can effectively keep the global features of benign and malignant image, whose discriminability is further reinforced by the aggregate operation, leading to the more discriminant capability of ADGFR for BCHI. Extensive experiments on the public Break His dataset illuminate that our ADGFR can achieve the optimal classification accuracies of 95.05% at image level and 95.50% at patient level, respectively.

BEB6072

Performance Test and Experimental Study of Special Stent for Treatment of Iliac Vein Stenosis

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[2]*Suzhou Venmed Technology Co., Ltd.;*
[3]*Changzhou Second People's Hospital Affiliated to Nanjing Medical University*

Abstract. Objective: To research the structure design and performance test method of a new stent for the treatment of iliac vein stenosis, and to verify it through animal experiments and clinical trials. Methods: The new iliac vein stent and the control stent were implanted into the iliac vein of 12 experimental pigs, Digital Subtraction Angiography was done respectively at the same day, 14th, 30th, 60th and 90th day after stent implantation to observe the stent deployment. One patient was implanted with a new iliac vein stent. Digital Subtraction Angiography (DSA) was performed at 12 months follow-up to calculate the lumen loss value and lumen loss rate of the stent and evaluate the performance of the new iliac vein stent. Results: Through the measurement of the radial support force of the stent and finite element analysis, the radial support performance of the new stent is significantly better than that of the control stent. In animal experimental verification, both groups of stents were released satisfactorily during implantation. No obvious stent displacement was found at all time points. The patency rate of stents was 100%. Except for a small amount of old thrombosis in the stent in the control group, no other stents were found that condition. The diameter of stent lumen was retracted in different degree in both groups after operation, but no significant statistical difference was found in the comparison of stent lumen loss rate at each relative inspection day. Conclusion: The new NiTi alloy iliac vein stent has excellent radial support performance, which is an ideal iliac vein stent.

Keywords: Iliac Vein Stent; Mechanical Properties; Animal Experiments; Clinical Trials.

BEB6084

A Study on Somatosensory Evoked Potential Patterns According to Various Vibrotactile Stimulation: Frequencies and Intensities

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[2]*Department of Obstetrics and Gynecology, Konkuk University School of Medicine;*
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Abstract. This study was to investigate somatosensory evoked potential (SEP) patterns in the C3 somatosensory area with varying frequency and intensity of vibrotactile stimuli. The study subjects included 13 men (23.2±0.8 years) and 7 women (22.3±1.5 years) who were right-handed and had normal cognitive function. The participants were subjected to three intensity levels (0.25, 0.38, and 1.3 g) and eight frequencies (10, 50, 100, 150, 200, 225, 250, and 300 Hz) of vibrotactile stimuli on the distal phalanx of their right index finger. The peak values of SEP patterns generated in response to high-frequency vibrotactile stimuli were greater than those generated because of low-frequency flutter. Moreover, the peak values increased as the stimulus intensity increased from 1 g to 3 g. In these results, the maximum and minimum peak, and peak to peak values of SEP pattern in the C3 somatosensory area increased with increase in the stimulation intensity and frequency of the vibrotactile stimuli. Data on the SEP patterns generated in response to various frequencies and intensities of somatosensory stimuli and the development of relevant databases will elucidate the various clinical applications and applicable domains where SEP assessment can be beneficial.

Keywords: Vibration; Frequency; Intensity; SEP pattern.

BEB6096

A Basic Study on The Effects of Vibrator-Attached Leg-Press on The Knee and Ankle Joint Torques

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Abstract. In this study, we compare the effects of vibration on the knee and ankle torque after performing leg-press exercises for four weeks. A total of 20 participants were randomly assigned to a group for leg-press with vibration (VLP, nine males, one female, 25.8 years old, 172.3 cm, 73.8 kg), and another group for regular leg-press (LP, eight males, two females, 25.6 years old, 169.6 cm, 65 kg), wherein they performed exercises for four weeks (four times a week). The frequency and amplitude of vibration applied during the exercise were 30 Hz and 1.5 mm, respectively. To examine the effects of the exercise, the isometric and isokinetic joint torque of the knee and ankle were measured using Biodex (Biodex medical systems, USA) for a total of three times, namely: before exercising and after two and four weeks . The results showed that the isometric and isokinetic joint torque of the knee and ankle improved overall for both groups after four weeks. However, the effects of the leg-press with vibration were not observed. Therefore, further studies are required to investigate the method of applying vibration to each muscle and the frequency and amplitude of vibration, as well as the effects of vibration on the elderly and patients under rehabilitation.

Keywords: Vibration; Leg-press; Resistance Exercise; Knee and Ankle Joint Torque; Training

BEB6158

Elevated NT-Probnp Is Associated with Poor Activity Outcome in Patients with Sub-Acute Ischemic Stroke: A Prospective Cohort Study

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Abstract. Aims: N-terminal pro-B-type natriuretic peptide (NT-proBNP) is a risk factor of cardiovascular events in acute ischemic stroke. However, it remains unclear whether NT-proBNP is associated with activity outcome in sub-acute ischemic stroke. Therefore, this study aims to investigate the functional prognostic value of NT-proBNP in sub-acute ischemic stroke patients. Methods: This is a prospective cohort study. 120 patients were recruited from the rehabilitation center of the First Affiliated Hospital of Shenzhen University between May 2018 and May 2019. Serum NT-proBNP and other baseline characteristics were measured within 48 hours of admission. Barthel Index (BI) levels were assessed at average 12 months of follow up after discharged. BI less than 80 was defined as poor activity outcome. The association between the NT-proBNP and activity outcome was analysed using multivariate logistic regression analysis. Results: 93 patients (68.8% male) with a mean age of 62.5 years completed the follow up. The LogNT-proBNP levels in poor outcome patients were significant higher than that in favorable outcome patients (2.32±0.78 pg/mL vs 1.86±0.62pg/mL, p=0.002). The optimal cutoff in LogNT-proBNP used to distinguish a poor outcome was 1.95 pg/ml (NT-proBNP 90 pg/mL) whereas the sensitivity and specificity were 66.7% and 66.7%, respectively, with an area under the curve of 0.671 (p = 0.005). Results of fully adjusted logistic regression analysis showed that high level of LogNT-proBNP was independently associated with poor activity outcome (risk ratio=4.779, 95% confidence intervals=1.080 to 21.154, p= 0.039). Conclusions: Elevated NT-proBNP level during hospitalization in patients with sub-acute ischemic stroke was associated with long term poor activity outcome.

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BEB6183

Semi-Quantitative Analysis of Carotid Stenosis for 272 Patients with Ischemic Stroke Symptoms Using the Inverse Problem Algorithm with Five Risk Factors

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Abstract.A semi-quantitative analysis of carotid stenosis using the inverse problem algorithm (IPA) with five risk factors was performed for 272 patients with ischemic stroke symptoms. As a kernel function of the machine learning technique, the IPA provides a substantiated prediction of the expected outcomes by solving an inverse matrix of variable coefficients. In doing so, five risk factors, namely age, low-density lipoprotein-cholesterol (LDL-C), mean arterial pressure (MAP), glucose AC, and C-Reactive protein (CRP), quoted from 217 patients were selected to predict the carotid stenosis. The first-order nonlinear semi-empirical formula was derived with sixteen terms, which were computed by STATISTICA program with a customized loss function (Φ). The latter was defined according to total fluctuation between the theoretically projected and real carotid stenosis cases (%) for all 217 patients. Thus, 217×16= 3488 individual data points were included in the algorithm to optimize the compromised solution array [16×1= 16] of the carotid stenosis (%). The results showed a complete regression with loss function Φ=2.3543, correlation coefficient r2=0.9352, and variance of 87.46%. Another group of 55 patients with similar symptoms was selected to verify the prediction accuracy and exhibited a high coincidence. The three dominant risk factors were ranked in the decreasing order: CRP, Glucose AC, and MAP, whereas age and LDL-C weakly influenced the program computation results. The inverse problem algorithm showed a strong convergence by its default characteristic. The reduction of the number of variables in computation deteriorated the prediction accuracy, exhibiting the algorithm's high sensitivity to the number of variables.

Keywords: Machine Learning; Inverse Problem Analysis; Risk Factor; Carotid Stenosis; Ischemic Stroke

CSPR1011

Discovery of 2, 5-diketopiperazine Derivatives as Selective HDAC6 Inhibitors with Potent Neuroprotective Effects

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Abstract. Histone deacetylase 6 (HDAC6) is a promising epigenetic target for the treatment of Alzheimer's disease (AD). In this paper, a series of 1, 3, 6-trisubstituented 2, 5-diketopiperazine derivatives were synthesized and evaluated for neuroprotective effects based on our previous research. Most of the compounds showed potent inhibitory activities against HDAC6, especially 20d, with an IC50 of 1.82 nM. Molecular simulation of 20d was conducted to rationalize the high binding affinity for HDAC6. Besides, compound 20d displayed differential nerve growth factor-induced neurite outgrowth-promoting activity in PC-12 cells at concentrations of 10 μM. The current study evidently showed that 20d is a potent neuroprotective agent and might serve as a promising lead candidate for the treatment of AD.

Keywords:HDAC6; Diketopiperazine; Synthesis; Neuroprotective

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BEB6213

Interpretable One-Dimensional Alexnet for Detecting Ineffective Efforts During Expiration in Mechanical Ventilation

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Abstract. In intensive care units (ICU), mechanical ventilation (MV) is the most important life support technology for patients with acute respiratory failure (ARF). Patient-ventilator asynchrony (PVA) occurs when either the initiation or termination of MV is not in agreement with the initiation or termination of neural inspiration of a patient. Ineffective efforts during expiration (IEE) is one of the most common manifestation of PVA in mechanically ventilated patients. Because the poor interaction between the patient and the ventilator is associated with inferior clinical outcomes, every effort should be made to identify and correct their occurrence. Deep learning has shown promising ability in PVA detection. However, lack of interpretability hampers its application in clinic. We proposed an interpretable one-dimensional convolutional neural network (1DCNN) to detect IEE. Class activation mappings (CAM) was incorporated with the 1DCNN model to visualize the sections of the waveform that was focused on when the model made a classification. The proposed interpretable 1DCNN exhibits comparable performance with the state-of-the-art deep learning model, with the F1 score of 0.973 for IEE detection. The sections highlighted by the CAM mostly agree with the recognition of the clinical experts. The findings suggest that the proposed 1DCNN can help detect PVA, and enhance the interpretability of the classification process to help clinicians to better understand the deep learning technology.

Keywords: Mechanical Ventilation; Patient-Ventilator Asynchrony; Ineffective Efforts During Expiration; Deep Learning; Convolutional Neural Network; Interpretability

BEB6259

CD44 Enhances Tumor Cell Rigidity via Rho Gtpase-Regulated Actomyosin Contractility

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Abstract. Cellular rigidity homeostasis plays a key role in many biological processes, including cell differentiation, proliferation, migration, and tissue morphogenesis and the like. Many membrane proteins on the cell surface could sense the hardness of the extracellular matrix (ECM) and regulate cellular rigidity. CD44, a major receptor for the extracellular hyaluronan, coordinates the motility and proliferative responses to ECM stiffening. However, its roles in regulating cellular rigidity are not well understood. By taking advantage of the compression assay using agarose overlay, we analysed the cellular rigidity of two isogenic clones, which express CD44 in different levels, isolated from PLC/PRF/5 liver tumour cells, named A4S and F6ft. We also evaluated the influence of altered CD44 expression on cellular rigidity by RNA interference-mediated knockdown and ectopic overexpression. Quantitative real-time PCR and Western Blot were employed to evaluate gene expression at mRNA and protein levels, respectively. The isogenic cells A4S, which expresses low level of CD44, got faster and

larger deformation than F6ft, the CD44 highly expressed isogenic cell, when covered by agarose of same gravity density, indicating that CD44 expression is negatively correlated to cell stiffness. In agreement with which, CD44 knockdown in F6ft cells reduced cell stiffness leading to enhanced deformability, whereas CD44 overexpression in A4S cells displayed reduced deformability. Moreover, we found that CD44 upregulated the expression of RhoA and pMLC (phosphorylated myosin light chain) while down-regulating Rac1 expression. And knocking down the expression of RhoA or Rac1 resulted in enhanced or reduced cell deformation, respectively. CD44 enhanced liver tumour cell rigidity associated with enhanced Rho GTPase-regulated actomyosin contractility.

Keywords: Cellular Rigidity; CD44; Rho GTPase; Actomyosin Contractility

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BEB6265

Transferring Image-based Deep Learning Model to the Detection of Patient-Ventilator Asynchrony with Small Datasets

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Abstract. Ineffective efforts during expiration (IEE) and double triggering (DT) in mechanically ventilated patients are two main patterns of patient-ventilator asynchrony (PVA). PVA occurs when the support provided by the ventilator does not match the needs of the patient. The traditional deep learning method has a strong discrimination ability in PVA detection, but it is based on sufficient labelled data, which is difficult to obtain. We developed a transfer learning architecture based on pre-trained model and used it for ventilator waveform analysis and recognition. The one-dimensional signal was mapped to the two-dimensional image, and then features were extracted by the pretrained models with different weights for classification and comparison. As the number of training data shrinks proportionally, the accuracy of the non-transfer learning model decreases, while the accuracy of the transfer learning model does not drop significantly. The findings suggest that the proposed transfer learning method can help identify PVA, thereby helping to solve the problem of insufficient labelled data.

Keywords: Mechanical Ventilation; Patient-Ventilator Asynchrony; Deep Learning; Convolutional Neural Network; Transfer Learning; Pretrained Model

BEB6297

The Effect of Fuzzy Correlation Model Parameters on Real Time Tumor Tracking at Radiotherapy with External Surrogates

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Abstract. In this study, a correlation model based on the fuzzy logic concept is proposed for real time tumor tracking during tumor treatment with external surrogates radiotherapy. Several approaches have been proposed for this aim using linear and non-linear prediction models, but a fuzzy environment may

be optimal due to its robustness and benefits. The correlation model is configured using training motion dataset provided by motion monitoring systems. This dataset includes internal tumor motion and external rib-cage and abdomen motion, in synchronized fashion. After model configuring, it is ready to trace tumor motion during beam irradiation using only rib cage motion data points as input. In this work, the effect of data clustering and inference system type of correlation model has been investigated, comprehensively. To do this, the motion dataset of five real patients treated with Cyberknife Synchrony system at Georgetown University Hospital were utilized. In order to assess the performance of our model, the predicted tumor motion was compared with respect to the state of the art model. The final results represent that an optimum data clustering for each patient can significantly improve targeting accuracy during beam irradiation. Therefore, an adaptive data clustering should be taken into account for each patient, uniquely.

Keywords: External Surrogates Radiotherapy, Fuzzy Correlation Model, Data Clustering, Fuzzy Inference System

BEB6329

Complications Developed Under Ventricular Assist Device Support in Children

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Abstract. Paediatric heart failure is a major cause of mortality in children. The treatment of heart failure depends on the patients' symptoms, age, and severity of their condition. However, in some cases, treatment is unsuccessful for numerous reasons, meaning heart transplantation is required. Yet, as there is a lack of fitting donor organs, many patients are either left untreated, or their transplant is delayed. In these patients, ventricular assist devices (VADs) are used to bridge to heart transplant. Despite this advantage, VADs cause various complications, including bleeding, thrombosis, infections, and neurological injury. The aim of this project was to compile, review and analyse the studies reporting risk factors and aetiologies of complications under different VAD supports in paediatric patients. Using PubMed as the main database, publications investigating VAD support in paediatric patients with heart failure were analysed. Once the eligible papers were selected, a meta-analysis was performed, and forest plots were created. The meta-analysis showed that continuous devices have a reduced complications rate, yet similar survival rates, when compared to pulsatile devices. It also showed that patient characteristics, for instance body surface area (BSA), cannot be recognised as causal factors of death, as results remain debatable. Patients' diagnosis can affect survival rates on VAD support as cardiomyopathy and myocarditis patients have higher survival rates than congenital heart disease patients. The meta-analysis provided insights into the outcome of VAD support for different devices, diseases, and factors including BSA. Although continuous devices have reduced complications rates, the outcome of VAD therapy depends on other factors, for instance anti-coagulation therapy provided with VAD support and the severity of heart failure. Therefore, more research is needed to understand the exact nature of complications and improve VAD support in children.

Keywords: Paediatrics; Ventrcicular Assist Device; VAD; Review; Meta-Analyses

BEB6330

Design and Development of The Expression Cassette for Plant Production of Dengue Virus NS1 Protein

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Abstract. Specific drugs for the treatment of hemorrhagic fevers caused by Flavivirus genus have not yet been developed. The only way for epidemic containment is timely diagnosis. One of the most promising proteins of the Flavivirus genus for use in a candidate vaccines or diagnostic systems is NS1 (because of its low level of cross-reactivity). However, to obtain this protein in recombinant form aneukaryotic post-translational modification system is required.
We showed the possibility of expression of the NS1 proteins of West Nile, Dengue and Zika in n Nicotiana tabacum. But for use recombinant NS1 on an industrial scale expression construct needs improvement for a higher protein yield.
A number of regulatory elements were used to develop the most efficient expression mechanism in the target construct. To avoid negative regulation by plant immunity, the MAR sequences of the Rb7 gene (U67919.1) were used. To increase the expression level were used the UBQ10 intron (AT1G67090), acting through intron-mediated amplification, and the 5 'and 3' non-coding regions of RuBisCO (AT1G67090), carrying tissue-specific and enhancer motifs. Several constitutive and tissue-specific promoters were also tested to select the optimal expression conditions.
The result of our work is the design of an expression cassette capable of providing a high level of expression of the recombinant NS1 protein of the Dengue virus or any other flavivirus. Evaluation of the effectiveness of the developed design was confirmed by a number of bioinformatics tools (WoLF PSORT / NetGene2 / NetOGlyc / (http://www.kazusa.or.jp/).

Keywords: Flavivirus; NS1; Recombinant Proteins; Transgene Expression

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BEB6360

Soonview algorithm for CPSC 2020 Challenge

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Abstract. This document describe the design, implementation of Soonview algorithm for CPSC 2020 Challenge; Traditional algorithm design normally has two steps. First does beat detection, then followed by beat classification. But for CPSC 2020, it will be difficult to use traditional design. The ECG data here is 24-hour dynamic signal-lead recordings usually with low signal quality and/or abnormal rhythm waveforms. It is really difficult to do reliable beat detection for noisy ECG data. The unreliable first stage beat detection will cause problem in the second stage beat classification. We use end-to-end deep learning design here for beat classifications bypass the first beat detection stage. converts beat detection and classification problem into a simple classification problem, avoids the potential risk of unreliable beat detection.

Note: To avoid repeatability issue, the abstracts of BEB6087, BEB6134, BEB6154, BEB6155, BEB6176, BEB6188, BEB6237, BEB6241, BEB6326 andBEB6343will be available after the full paper is published in journals.

Part VCall for Papers for Peer Review Journals

Part VI Acknowledgements

On behalf of the ICBEB2020 Organizing Committee, we would like to take this opportunity to express our sincere gratitude to our participants. Without their support and contributions, we would not be able to hold the conference successfully in this special year. We would also like to express our acknowledgements to the Technical Program Committee members who have given their professional guidance and valuable advice as reviewers. For those who contribute to the success of the conference organization without listing the name below, we would love to say thanks as well.

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