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RECENT ADVANCES IN

INTELLIGENT ENGINEERING

ÓBUDA UNIVERSITY, BUDAPEST
SEPTEMBER 12 | 2023

Óbuda University, Budapest, Hungary

with the participation of eminent scholars from the following universities:

University of Geneva, Switzerland

University of Adelaide, Australia

Tashkent Institute of Chemical Technology, Uzbekistan

Tashkent Institute of Irrigation and Agricultural Mechanisation, Uzbekistan

Recent Advances in Intelligent Engineering; Artificial intelligence in practice: usability and explainability

Óbuda University, Budapest

September 12, 2023

Room F09, Óbuda University

Bécsi út 96/b, 1034 Budapest, Hungary

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The Rector Magnificus of Óbuda University announces that



Prof. Imomov Shavkat Jakhonovich, Honorary Professor
(Tashkent Institute of Irrigation and Agricultural, Bukhara Branch, Uzbekistan)

Prof. Botir Usmonov, Honorary Professor
(Tashkent Institute of Chemical Technology, Uzbekistan)

Prof. Habib Zaidi Distinguished Professor
(University of Geneva, Switzerland)

Prof. Peng Shi Distinguished Professor
(University of Adelaide, Australia)



appointed as Honorary Professors and Distinguished Professors
of Óbuda University, Budapest, accept this position with the delivery
of an inaugural lecture on September 12, 2023, in Room F09,
Óbuda University

Interested parties are invited to attend this ceremony.

Prof. Dr. Levente Kovács
Rector Magnificus

Recent Advances in Intelligent Engineering; Artificial intelligence in practice: usability and explainability

Date and Time: 9:00 am September 12, 2023 (Tuesday)

Venue: Óbuda University, Room F09

Address: Bécsi út 96/b, H-1034 Budapest, Hungary

INTRODUCTION

The aim of this symposium is to provide a platform to introduce recent advance in innovation, research and science by worldwide well-known outstanding scientists, whom were awarded by the 'Honorary Professor of Óbuda University' title, one of the most prestigious awards of Óbuda University.

Óbuda University announced its second Excellence Program in 2023, with three categories: Distinguished Professor, Consolidator Researcher and Starting Excellence Researcher. A committee of distinguished scholars from Óbuda University selected the best applicants. The winning candidates are working between 2023 and 2027 at Óbuda University in the University Research and Innovation Center.

During the symposium, excellence winners and honorary professors will give inaugural presentations. During the symposium, the speakers will present their successful research and their plans for the future, with a special focus on the research planned with colleagues from Óbuda University during 2023-2027.

PROGRAM

9:00-9:15 Opening Ceremony: Prof. Dr. Levente Kovács, Rector

Moderator:

Prof. Dr. László Gulácsi, DSc, Vice Rector for Research

9:15-09:50 Artificial intelligence- powered multimodality medical imaging: Challenges and opportunities

Prof. Habib Zaidi, Professor, Head of PET Instrumentation and Neuroimaging Laboratory (PINLab), Geneva University Hospital, Switzerland, Distinguished Professor of Óbuda University, Budapest

Abstract: Positron emission tomography (PET), x-ray computed tomography (CT) and magnetic resonance imaging (MRI) and their combinations (PET/CT and PET/MRI) provide powerful multimodality techniques for in vivo imaging. This talk presents the fundamental principles of multimodality imaging and reviews the major applications of artificial intelligence (AI), in particular deep learning approaches, in multimodality medical imaging. It will inform the audience about a series of advanced development recently carried out at the PET instrumentation & Neuroimaging Lab of Geneva University Hospital and other active research

groups. To this end, the applications of deep learning in five generic fields of multimodality medical imaging, including imaging instrumentation design, image denoising (low-dose imaging), image reconstruction quantification and segmentation, radiation dosimetry and computer-aided diagnosis and outcome prediction are discussed. Deep learning algorithms have been widely utilized in various medical image analysis problems owing to the promising results achieved in image reconstruction, segmentation, regression, denoising (low-dose scanning) and radiomics analysis. This talk reflects the tremendous increase in interest in quantitative molecular imaging using deep learning techniques in the past decade to improve image quality by reducing artefacts and to obtain quantitatively accurate data from dedicated standalone (CT, MRI, SPECT, PET) and combined PET/CT and PET/MRI imaging systems. The deployment of AI-based methods when exposed to a different test dataset requires ensuring that the developed model has sufficient generalizability. This is an important part of quality control measures prior to implementation in the clinic. Novel deep learning techniques are revolutionizing clinical practice and are now offering unique capabilities to the clinical medical imaging community. Future opportunities and the challenges facing the adoption of deep learning approaches and their role in molecular imaging research are also addressed. Future research plans at Óbuda University will also be highlighted.

Sanaat A, Shooli H, Böhringer AS, Sadeghi M, Shiri I, Salimi Y, Ginovart N, Garibotto V, Arabi H and Zaidi H "A cycle-consistent adversarial network for brain PET partial volume correction without prior anatomical information" *Eur J Nucl Med Mol Imaging* Vol. 50, No. 7, pp 1881-1896 (2023). doi: 10.1007/s00259-023-06152-0

Shiri I, Sadr AV, Akhavan A, Salimi Y, Sanaat A, Amini M, Razeghi B, Saberi A, Arabi H, Ferdowsi S, Voloshynovskiy S, Gündüz D, Rahmim A and Zaidi H "Decentralized collaborative multi-institutional PET attenuation and scatter correction using federated deep learning" *Eur J Nucl Med Mol Imaging* Vol. 50, No. 4, pp 1034-1050 (2023). doi: 10.1007/s00259-022-06053-8

Mecheter I, Abbod M, Amira A and Zaidi H "Deep learning with multiresolution handcrafted features for brain MRI segmentation" *Art Intell Med* Vol. 131, pp 102365 (2022). doi: 10.1016/j.artmed.2022.102365

Arabi H, Zeng G, Zheng G and Zaidi H "Novel adversarial semantic structure deep learning for MRI-guided attenuation correction in brain PET/MRI" *Eur J Nucl Med Mol Imaging* Vol. 46, No. 13, pp 2746-2759 (2019). DOI: 10.1007/s00259-019-04380-x

Zaidi H, Ojha N, Morich M, Griesmer J, Hu Z, Maniawski P, Ratib O, Izquierdo D, Fayad Z, and Shao L "Design and performance evaluation of a whole-body Ingenuity TF PET-MRI system" *Phys Med Biol* Vol. 56, No. 10, pp 3091-3106 (2011). doi: 10.1088/0031-9155/56/10/013

09:50-10:00 Discussion

10:00-10:35 Cyber-physical systems: Analysis and Design

Prof. Peng Shi, Professor, Director of Laboratory of Advanced Unmanned Systems, University of Adelaide, Australia, Distinguished Professor of Óbuda University, Budapest

Abstract: Cyber-physical systems (CPS), such as smart grids and intelligent transportation systems, are complex systems where software and hardware components are seamlessly integrated towards performing well-defined tasks. However, this integration increases the vulnerability of CPS with more chances/higher possibility of cyber-attack that could cause severe consequences to economics, society, and human beings. Hence, cyber-security is a critical and important issue to be addressed in CPS. In this talk, the security of CPS is discussed from the perspectives of attackers. We will introduce the background of CPS and security issues, and some existing work on cyber-attacks. We then present our recent work on the design of stealthy hybrid attacks to CPS, which enables attackers to launch hybrid cyber-attacks more effectively to maximize system performance degradation with less chance to be detected. In turn, the attack strategies proposed would challenge the defenders to develop more effective, efficient and resilient methodologies to possibly detect hackers' intrusions, and maintain the systems operating in a secure, reliable and desired mode.

Z. Lian, P. Shi, C. C. Lim and X. Yuan, Fuzzy-model-based lateral control for networked autonomous vehicle systems under hybrid cyber-attacks, *IEEE Trans on Cybernetics*, 53(4): 2600-2609, 2023.

Y. Zhang, Z. Wu, P. Shi, T. Huang and P. Chakrabarti, Quantization-based Event-triggered Consensus of Multi-agent Systems against Aperiodic DoS Attacks, *IEEE Trans on Systems, Man and Cybernetics: Systems*, 53(6): 3774-3783, 2023.

Y. Zhang, Z. Wu and P. Shi, Resilient event-/self-triggering leader-following consensus control of multi-agent systems against DoS attacks, IEEE Trans on Industrial Informatics, 19(4): 5925-5934, 2023.

Z. Lian, P. Shi and C. C. Lim, Adaptive resilient control for cyber-physical systems under cyber-attack and input saturation, IEEE Trans on Industrial Informatics, 19(5): 6513-6524, 2022.

Z. Lian, P. Shi and C. C. Lim, Dynamic hybrid-triggered-based fuzzy control for nonlinear networks under multiple cyberattacks, IEEE Trans on Fuzzy Systems, 30(9): 3940-3951, 2022.

N. Zhao, P. Shi, W. Xing and C. P. Lim, Resilient adaptive event-triggered fuzzy tracking control and filtering for nonlinear networked systems under denial-of-service attacks, IEEE Trans on Fuzzy Systems, 30(8): 3191-3201, 2022.

N. Zhao, P. Shi, W. Xing and R. K. Agarwal, Resilient event-triggered control for networked cascade control systems under denial-of-service attacks and actuator saturation, IEEE Systems Journal, 16(1): 1114-1122, 2022.

N. Zhao, P. Shi, W. Xing and C. P. Lim, Event-triggered control for networked systems under denial-of-service attacks and applications, IEEE Trans on Circuits and Systems I: Regular Papers, 69(2): 811-820, 2022.

10:35-10:45 Discussion

10:45-11:05 Coffee break

11:05-11:40 Science and innovation of the Republic of Uzbekistan

Prof. Imomov Shavkat Jakhonovich, Bukhara Institute of Natural Resources Management of the National Research University of Tashkent Institute of Irrigation and Agricultural Mechnaization Engineers Uzbekistan

Abstract: In the text of the report, changes in the higher education, science and innovations of the Republic of Uzbekistan, the priority directions of the socio-economic development of the country, the fact that more than 400 madrasas operated in Bukhara in the Middle Ages, the foundations of their higher educational institutions, the establishment of the Forjak madrasa, which can be called the first university, in the 10th century, about Muhammad Al Khorazmi's foundation of Algebra. Also, the construction of the Astronomical Observatory by Mirzo Ulugbek, the grandson of the ruler of Samarkand, the great ruler Amir Temur. About the fact that "TIAME" NRU took 14th place in the Central Asian region and 1st place in the Republic in the list of TOP-500 universities of the world in the QS World University Ranking by subjects published in 2023 by the QS International Rating Agency. Currently, special attention is being paid to the training of personnel in the engineering and technical directions of education in the Republic, achievements in international cooperation, brief science and innovation achievements of the Bukhara oasis, and the author's brief science and science achievements and the professors and scientists of the world's prestigious universities organically draw more attention to those who will be engaged in agriculture and farming in the future. Working in the field of agriculture, proposals for elimination of ecological and epidemiological disasters are presented. In particular, in cooperation with the leading universities and scientific centers of the Hungarian state, proposals are presented to all European countries to reduce the use of mineral and chemical elements that are harmful to human health in agriculture.

11:40-11:50 Discussion

11:50-12:25 Performance of green economic development and achievements in sustainable development goals in Uzbekistan

Prof. Botir Usmonov, DSc, Rector of Tashkent Institute of Chemical Technology

Abstract: The Republic of Uzbekistan seeks to realize the sustainable development goals, especially that it characterized with economic development and continuous population growth coupled with the rapid urbanization. On this regard, Uzbekistan needs more than a traditional economy, an economy which goes in line with the achievement of the SDGs of the 2030 Agenda. The 'Strategy 2030' program based on three pillars a vibrant society, a thriving economy and an ambitious nation represents a departure of Uzbekistan to a novel economy and society. To accomplish this program, several series of policies and strategies are necessary to be developed based on a framework for the implementation of environmental and economic sustainability and promoting social well-being. For instance, to realize these policies, the government launches several projects such as the Uzbekistan Green Initiative ("Yashil Makon" program launched in 2021, to plant 1 billion trees and shrubs across the country over the next five years).

This paper aims to examine how policies in Uzbekistan performs to achieve sustainable development during the period 2021-2026 to adopt EEPSE Green Economy Index (EEPSE GEI). The index shows the importance of the relationship among the economic actors: education, industry, government, society and environment. Our theoretical and empirical contributions in this paper are two fold. First, most of the contemporary research has been focused on the renewable energy consumption-environment nexus without admitting how green economy can close the

gap between economic activity and sustainable development in Uzbekistan. Second, from an empirical side and compared to existing studies, we adopt a novel index system technique that assesses the performance of green economic development and reflect the sustainable development goals achievement for the case of Uzbekistan.

Congress of Local and Regional Authorities.: SDGs - Agenda 2030. Council of Europe Portal. <https://www.coe.int/en/web/congress/sdg> (2019).

Congress of local and regional authorities.: Sustainable Development: High level political forum in New-York - Council of Europe Portal. <https://www.coe.int/en/web/congress/high-level-politicalforum-on-sustainable-development#%7B%2250459471%22:%5B%5D%7D> (2019).

UNDP.: 2030 Agenda for Sustainable Development – Sustainable Development Goals. United Nations. https://www.undp.org/content/dam/undp/library/corporate/brochure/SDGs_Booklet_Web_En.pdf (2015).

Guterres, A.: The Sustainable Development Goals Report 2017. United Nations. <https://www.un.org/development/desa/publications/sdg-report-2017.html> (2017).

Rieckmann, M.: Education for sustainable development goals: learning objectives. Paris, France (2017). https://www.researchgate.net/publication/337440344_Education_for_Sustainable_Development_Competencies_for_Educators

12:25-12:40 Discussion and take-home message

12:40 Lunch



Imomov Shavkat Jakhonovich - mechanical engineer, doctor of technical sciences, professor. Rector of Bukhara Institute of Natural Resources Management of National Research University "Tashkent Institute of Irrigation and Agricultural Mechanization Engineers". In 1987-1988, he started his career as an assistant at the "Tractors and Automobiles" department of the Tashkent Institute of Irrigation and Agricultural Mechanization Engineers, a senior teacher, professor, head of the scientific problem laboratory "Resource-saving techniques and technologies", Deputy director for economic issues of the Bukhara branch of the Tashkent Institute of Irrigation and Reclamation. He worked as deputy head of the Institute's Scientific Research, Innovations and Training of Scientific and Pedagogical Personnel Department.

During his scientific-pedagogical activity, he has been working as a senior researcher in 2 international grant authors (in the Republic of Korea and the Republic of Belarus), the head of 14 state scientific-practical grants and the responsible executor of 8 state scientific-practical grants. The plant for the development of technology and equipment for the treatment of organic waste and city wastewater, established on the basis of an international agreement, is currently operating. ("Uzbekistan - Korea 2010"), TIAME, Sc.R.I report. MK-09- 2010. Implementation of high-quality fertilizer and biogas extraction device from organic waste in rural settlements, Turin Polytechnic University in Tashkent, Sc.R.I report. BV-Itex-2018-37 In 2015, the Republic of Uzbekistan launched a "Biogas plant" in the Karaulbazar district of the Bukhara

**IMOMOV
SHAVKAT
JAKHONOVICH**

region During his scientific and pedagogical activity, he published a total of 215 scientific and methodological works, including 5 educational manuals, 3 textbooks, 25 educational and methodological collections, 200 scientific articles, 18 certificates and patents, and 18 stylistic instructions. In the last 3 years, 3 monographs, 4 textbooks, 45 scientific articles (15 in prestigious foreign scientific journals) and 8 methodological guides have been published. According to the order of the Minister of Innovative Development of the Republic of Uzbekistan No. 133 of July 16, 2020, he is the deputy chairman of the Scientific and Technical Council for "Technology" under the Ministry of Innovative Development, a member of the editorial board of the journal "Irrigation and reclamation" specialized in the scientific-practical, agrarian-economic sphere and "Eurasian education, science and innovation" member of the editorial board of the German scientific and popular magazines. He is a member of the scientific and technical council of TIAME and the scientific coordinator of the direction "Mechanization of agriculture".

Scopus citations: 126

Scopus h-index: 8



Prof. Dr. Botir Shukurillaevich Usmonov Rector of Tashkent Institute of Chemical Technology. He is an accomplished academic and leader with a rich background in mechanical engineering, information and communication technologies, and mechatronics. With a strong foundation in education, research, and industry integration, Prof. Dr. Usmonov has made significant contributions to multiple fields.

**PROFESSOR
DR. BOTIR
SHUKURILLAEVICH
USMONOV**

His dedication to research led him to earn his PhD in Technical Science in Aerodynamics and Design of Aircrafts from Tashkent State Aviation Institute in 1999. Prof. Dr. Usomov's commitment to advancing knowledge continued with a DSc in Innovative Development of Higher Education, Science, and Industry Integration based on Cluster Approaches from the Institute of Retraining and Advanced Training of Leaders and Specialists of the Public Education System in 2020. He further expanded his academic portfolio by earning another DSc in Scientific Bases of Vibrations of Hereditary Deformable Structural Elements of an Aircraft in a Gas Flow from Bukhara Institute of Engineering and Technology in 2023. Throughout his career, Dr. [Last Name] has held various esteemed positions. He has been a Rector of Tashkent Institute of Chemical Technology since 2020 and previously served as the Deputy Minister of Economy and Industry of the Republic of Uzbekistan from 2019 to 2020. His academic leadership also includes roles as Vice-Rector for Scientific Affairs and Innovations at Tashkent University of Information Technologies, Associate Professor at Moscow State University (branch in Tashkent), Deputy Minister of Higher and Secondary Specialized Education of Uzbekistan, and more.



**PROFESSOR
HABIB
ZAIDI, FIEEE,
FAIMBE,
FAAPM,
FIOMP,
FAAIA, FBIR**

Habib Zaidi is Chief physicist and head of the PET Instrumentation & Neuroimaging Laboratory at Geneva University Hospital and full Professor at the medical school of Geneva University. He is also a Professor at the University of Groningen (Netherlands), the University of Southern Denmark (Denmark). His research is supported by the Swiss National Foundation, the European Commission, private foundations and industry (Total 8.8M US\$) and centres on hybrid imaging instrumentation (PET/CT and PET/MRI), computational modelling and radiation dosimetry and deep learning. He was guest editor for 13 special issues of peer-reviewed journals, serves as founding Editor-in-Chief (scientific) of the British Journal of Radiology (BJR)|Open, Deputy Editor for Medical Physics and on the editorial board of leading journals in medical physics and medical imaging. He has been elevated to the grade of fellow of the IEEE, AIMBE, AAPM, IOMP, AAIA and the BIR. His academic accomplishments in the area of quantitative PET imaging have been well recognized by his peers since he is a recipient of many awards and distinctions among which the prestigious (100'000\$) 2010 Kuwait Prize of Applied Sciences (known as the Middle Eastern Nobel Prize) and the 2019 Khwarizmi International Award given by the Iranian Research Organization for Science and Technology (IROST). Prof. Zaidi has been an invited speaker of over 160 keynote lectures and talks at an International level, has authored over 385 peer-reviewed articles in prominent journals and is the editor of four textbooks.

Citations 19'600

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**PROFESSOR
PENG SHI,
FIEEE, FIET,
FIEAUST,
FCAA, MAE,
CPENG**

Peng Shi received the PhD degree in Electrical Engineering from the University of Newcastle, Australia, the PhD degree in Mathematics from the University of South Australia, the Doctor of Science degree from the University of Glamorgan, UK, and the Doctor of Engineering degree from the University of Adelaide, Australia. He is now a Distinguished Professor at the School of Electrical and Mechanical Engineering, and the Director of Advanced Unmanned Systems Laboratory, at The University of Adelaide, Australia. His research interests include systems and control theory and applications to autonomous and robotic systems, cyber-physical systems, and multi-agent systems.

He received the Ramesh Agarwal Life-time Achievement Award from the International Engineering and Technology Institute in 2023, the MA Sargent Medal Award from Engineers Australia in 2022; the honor of Life-time Achiever Leader-Board and Field Leader from The AUSTRALIAN Research Review from 2019-2022, the recognition of a Highly Cited Researcher from Thomson Reuters from 2014-2022, the Outstanding Research Achievement Award from The University of Adelaide in 2020, the Chancellor's Medal for Outstanding Research Performance from Victoria University, Australia in 2018. He has received a number of Best Paper awards, including the Andrew Sage Best Transactions Paper Award from IEEE SMC Society in 2016, Most Cited Paper Award from Signal Processing in 2009, and the Lotfi Zadeh Best Paper Award from the International Conference on Machine Learning and Cybernetics in 2019. Currently he serves as the Editor-in-Chief of IEEE Transactions on Cybernetics, a Senior Editor of IEEE Access, and an editorial member for a number of journals, including Automatica and IEEE Transactions on (Artificial Intelligence, and Circuits and Systems).

His professional services also include as the President of the International Academy for

Systems and Cybernetic Sciences, the Vice President of IEEE SMC Society, and IEEE SMC Society Distinguished Lecturer. He is a Fellow of IEEE, IET, IEAust and CAA, and a Member of the Academy of Europe.

Citations 85'295

Hirsh index 157

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