해외석학 특별강연

일자_ 2025년 6월 18일(수) 15:00~18:00, 6월 19일(목) 10:00~11:00
장소_ 제주 신화월드 랜딩 컨벤션 센터 LG층 랜딩볼룸A

프로그램

시간	발표주제	발표자(소속)
6월 18일(수)		
15:00~16:00	5G evolution and 6G	Mr. Takehiro Nakamura (NTT DOCOMO, Inc.)
16:00~17:00	Electromagnetic Information Theory for 6G: Challenges and Opportunities at the Physical Intelligence Frontier	Prof. Merouane Debbah (Khalifa University, Abu Dhabi, UAE)
17:00~18:00	Stacked Intelligent Metasurfaces: Communication, Computing and Sensing in the Wave Domain	Prof. Marco Di Renzo (King's College London (UK) & CNRS-CentraleSupelec (France))
6월 19일(목)		
10:00~11:00	Soft and flexible bioelectronics for brain-machine interfaces	Prof. Jia Liu (School of Engineering and Applied Sciences, Harvard University)

강연 소개

5G evolution and 6G

Mr. Takehiro Nakamura
NTT DOCOMO, Inc.

Mr. Takehiro Nakamura joined NTT Laboratories in 1990 and is currently the Chief Standardization Officer at NTT DOCOMO, Inc. With extensive experience in R&D and standardization, he has played a pivotal role in advancing radio and network technologies such as W-CDMA, HSPA, LTE/LTE-Advanced, 5G, and 6G, while strengthening inter-industry collaboration.
Since 1997, Mr. Nakamura has contributed to standardization activities in ARIB, ITU, and 3GPP, serving as vice chair and chair of 3GPP TSG-RAN from 2005 to 2013. He has played a significant role in promoting and accelerating 5G and 6G both in Japan and globally, as one of the leaders in the 5G Mobile Promotion Forum, Beyond 5G Promotion Consortium, and ITS Info-communications Forum in Japan.
Currently, he leads several projects on Local 5G, millimeter wave and 6G in the XG Mobile Promotion Forum (XGMF), and serves as a board member of 5G-ACIA and a sub-leader of Human Augmentation Consortium.

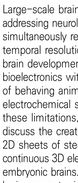
Research, development, and standardization of technologies for the evolution of 5G are ongoing, addressing emerging market needs. Simultaneously, research on technologies and services for 6G is accelerating worldwide. From 2025, 6G standardization activities have been started in 3GPP. NTT DOCOMO is actively engaged in the study and development of technologies for 5G evolution and 6G, including millimeter wave, RIS, NTN, sub-Tera Hz, AI-native networks, and ISAC. This presentation will explain our vision and the latest technical activities for 5G Evolution and 6G.

Electromagnetic Information Theory for 6G: Challenges and Opportunities at the Physical Intelligence Frontier

Prof. Merouane Debbah
Khalifa University, Abu Dhabi, UAE

Mérouane Debbah is a researcher, educator and technology entrepreneur. Over his career, he has founded several public and industrial research centers, start-ups and is now Professor at Khalifa University of Science and Technology in Abu Dhabi and founding Director of the KU 6G Research Center. He is a frequent keynote speaker at international events in the field of telecommunication and AI. His research has been lying at the interface of fundamental mathematics, algorithms, statistics, information and communication sciences with a special focus on random matrix theory and learning algorithms. In the Communication field, he has been at the heart of the development of small cells (4G), Massive MIMO (5G) and Large Intelligent Surfaces (6G) technologies. In the AI field, he is known for his work on Large Language Models, distributed AI systems for networks and semantic communications. He received multiple prestigious distinctions, prizes and best paper awards (more than 50 IEEE best paper awards) for his contributions to both fields and according to research.com is ranked as the best scientist in France in the field of Electronics and Electrical Engineering. He is an IEEE Fellow, a WWRF Fellow, a Eurasip Fellow, an AAIA Fellow, an Institut Louis Bachelier Fellow, an AIIA Fellow and a Membre émérite SEE. His recent work led to the development of NOOR (upon it release, largest language model in Arabic) released in 2022, Falcon LLM (upon its release, top ranked open source large language model) released in 2023 and the Falcon Foundation in 2024. The Falcon Model Series and The Falcon Foundation have positioned the UAE as a global leader in the generative AI field. He is actually chair of the IEEE Large Generative AI Models in Telecom (GenAINet) Emerging Technology Initiative and a member of the Marconi Prize Selection Advisory Committee.

The upcoming 6G era pushes the boundaries of wireless communication beyond conventional paradigms. At its core lies the emerging field of Electromagnetic Information Theory (EIT)—a foundational shift that treats the electromagnetic field not merely as a medium, but as a source of structure, intelligence, and meaning.
In this talk, I will explore the evolving role of EIT, where information representation, transmission, and interpretation are guided by both physical and semantic principles. We will discuss how EIT reshapes classic notions of capacity, modulation, and signal design, especially in the context of reconfigurable intelligent surfaces, near-field MIMO, and semantic-aware transceivers.



Stacked Intelligent Metasurfaces: Communication, Computing and Sensing in the Wave Domain

Prof. Marco Di Renzo
King's College London (UK) & CNRS-CentraleSupelec (France)

Marco Di Renzo (Fellow, IEEE) received the Laurea (cum laude) and Ph.D. degrees in electrical engineering from the University of L'Aquila, Italy, in 2003 and 2007, respectively, and the Habilitation a Diriger des Recherches (Doctor of Science) degree from University Paris-Sud (currently Paris-Saclay University), France, in 2013. Currently, he is a CNRS Research Director (Professor) and the Head of the Intelligent Physical Communications group with the Laboratory of Signals and Systems (L2S) at CNRS \& CentraleSupélec, Paris-Saclay University, Paris, France, as well as a Chair Professor in Telecommunications Engineering with the Centre for Telecommunications Research -- Department of Engineering, King's College London, London, United Kingdom. He was a France-Nokia Chair of Excellence in ICT at the University of Oulu (Finland), a Tan Chin Tuan Exchange Fellow in Engineering at Nanyang Technological University (Singapore), a Fulbright Fellow at The City University of New York (USA), a Nokia Foundation Visiting Professor at Aalto University (Finland), and a Royal Academy of Engineering Distinguished Visiting Fellow at Queen's University Belfast (U.K.). He is a Fellow of the IEEE, IET, EURASIP, and AAIA; an Academician of AIIA; an Ordinary Member of the European Academy of Sciences and Arts, an Ordinary Member of the Academia Europaea; an Ambassador of the European Association on Antennas and Propagation; and a Highly Cited Researcher. His recent research awards include the Michel Monpetit Prize conferred by the French Academy of Sciences, the IEEE Communications Society Heinrich Hertz Award, and the IEEE Communications Society Marconi Prize Paper Award in Wireless Communications. He served as the Editor-in-Chief of IEEE Communications Letters from 2019 to 2023. His current main roles within the IEEE Communications Society include serving as a Voting Member of the Fellow Evaluation Standing Committee, as the Chair of the Publications Misconduct Ad Hoc Committee, and as the Director of Journals.

Next-generation wireless networks are expected to utilize the limited radio frequency resources more efficiently with the aid of intelligent transceivers. In this talk, we propose a recent transceiver architecture that relies on stacked intelligent metasurfaces (SIM). An SIM is constructed by stacking an array of programmable metasurface layers, where each layer consists of a massive number of simple meta-atoms that individually manipulate the electromagnetic waves. We provide an overview of SIM-aided MIMO transceivers, including their novelty, hardware architecture, and potential benefits over state-of-the-art solutions for communication, computing, and sensing applications.

Soft and flexible bioelectronics for brain-machine interfaces

Prof. Jia Liu
School of Engineering and Applied Sciences, Harvard University

Professor Liu received his PhD in Chemistry from Harvard University in 2014, after which he completed postdoctoral research at Stanford University from 2015-2018. He joined the faculty at the Harvard School of Engineering and Applied Sciences as an Assistant Professor in 2019. At Harvard University, Professor Liu's lab focuses on the development of soft bioelectronics, cyborg engineering, genetic/genomic engineering, and computational tools for addressing questions in brain-machine interfaces, neuroscience, cardiac diseases, and developmental disorders. Professor Liu has pioneered in bioelectronics where he developed new paradigms for soft electronic materials and nanoelectronics architectures for "tissue-like electronics", as well as their applications for long-term stable brain-machine interface, high-density cardiac mapping, stem cell maturation, and multimodal spatial biology. His work has been recognized as a milestone in bioelectronics by Science in 2013 and 2017, and as Most Notable Chemistry Research and Top 10 World-Changing Ideas in 2015. He has received numerous awards for his independent career, including the 2022 Inventors Under 35 (Global List) by MIT Technology Review, the 2022 Young Investigator Program (YIP) Award from the Air Force Office of Scientific Research (AFOSR), the 2021 NIH/NIDDK Catalyst Award from the NIH Director's Pioneer Award Program, the 2020 William F. Milton Award, and the 2019 Aramont Award for Emerging Science Research Fellowship. He is also the cofounder and scientific advisor of Axoft, Inc., a brain-machine interface company.

Large-scale brain mapping through brain-machine interfaces is important for deciphering neuron dynamics, addressing neurological disorders, and developing advanced neuroprosthetics. Ultimately, brain mapping aims to simultaneously record activities from millions, if not billions, of neurons with single-cell resolution, millisecond temporal resolution and cell-type specificity, across three-dimensional (3D) brain tissues over the course of brain development, learning, and aging. In this talk, I will first introduce the development of flexible and soft bioelectronics with tissue-like properties that can track electrical activity from the same neurons in the brain of behaving animals over their entire adult life. Specifically, I will discuss the fundamental limitations of the electrochemical stability of soft electronic materials in bioelectronics and present our strategies to overcome these limitations, enabling a scalable platform for large-scale, long-term, stable brain mapping. Then, I will discuss the creation of "cyborg organisms", achieved by embedding stretchable mesh-like electrode arrays in 2D sheets of stem/progenitor cells and reconfiguring them through 2D-to-3D organogenesis, which enables continuous 3D electrophysiology during the development of human stem cell-derived brain organoids and animal embryonic brains. Next, I will highlight our translational efforts to apply these flexible and soft bioelectronics in brain-computer interfaces and deep tissue stimulation for clinical applications. Finally, I will discuss our recent efforts integrating 3D single-cell spatial transcriptomics, machine learning, and electrophysiology to enable cell-type-specific brain activity mapping. Look ahead, I will discuss the fusion of soft and flexible bioelectronics, spatial transcriptomics, and AI to create a comprehensive brain cell functional atlas, advancing the future of brain-machine interface and neurotechnology.