e-TEC Talks @ SNU Winter 2024

Emerging Technology in Electrical and Computer engineering Talks at Seoul National University Winter 2024, January 11, 2024

On-line [Zoom] * 50 min. per presentation **(45 min talk + 5 min QnA)**

PROGRAM

09:00-12:20PM : https://snu-ac-kr.zoom.us/j/95571558049?pwd=d0Z3K2FtVWpVblczOGFXUmZhTlJYUT09

Meeting ID: 955 7155 8049

Password: 390702

Bio-Electronics : January 11, 2024

[ZS1] 09:00AM-09:50AM, **Prof. Jiyun Kim**, Department of Material Science and Engineering, Ulsan National Institute of Science and Technology, "**Digitizing Material: Programmable Electromagnetic Actuators**"

Traditional electromagnetic actuators are designed to apply forces and generate motions within a system, supporting loads and facilitating movement at jointed links. However, with the evolving form and function of machines taking on diverse physical roles, these actuators struggle to meet the demands for intelligent and adaptive functionality. Thus, it necessitates to redefine the role of actuation components and diversify the form and function of these components, making them highly programmable. Our group is committed to proposing and developing advanced actuation systems that can program their morphology, physical properties, interface, and function. This paradigm shift in actuation necessitates innovation across various aspects, including materials, components, architectures, manufacturing processes, data processing, and operations. During this presentation, I will cover (1) the development of programmable electromagnetic actuators and devices utilizing electric or magnetic materials, (2) the exploration of algorithmic metamaterial architectures in designing actuator, (3) the application of additive manufacturing methods to realize these architectures and functions, and (4) the investigation of component design and operation methods using machine learning.

[ZS2] 09:50AM-10:40AM, **Dr. Andrew Hyungsuk Song**, Post-doctoral associate, Harvard Medical School, "**A tour of 2D and 3D computational pathology**,"

Advances in digitizing 2D tissue slides and the fast-paced progress in artificial intelligence, including deep learning, have boosted the field of computational pathology. I will briefly introduce the methodological advances in the field to unlock tremendous potential for automating clinical diagnosis, predicting patient prognosis and response to therapy, and discovering new morphological biomarkers from tissue images. I will then discuss how the drawbacks of current 2D-based clinical pathology practice can be addressed by transitioning into 3D pathology. This will lead to an introduction of our recent work Modality-Agnostic Multiple instance learning for volumetric Block Analysis (MAMBA), a deep-learning-based platform for processing 3D tissue images and predicting patient outcomes.

[ZS3] 10:40AM-11:30AM, **Prof. Munyoung Chang**, Department of Otorhinolaryngology-Head and Neck Surgery, Chung-Ang University College of Medicine, Chung-Ang University Hospital, "**Advances in the auditory system through engineering: neural prosthesis, signal processing, and deep learning-based prediction model**"

The auditory system is a sensory system for hearing, consisting of the outer ear, middle ear, inner ear and the central auditory pathway in the brain. As engineering has advanced, so have the techniques for diagnosing, treating and predicting diseases of the auditory system. One of the most common auditory treatments developed through advances in engineering is a neural prosthesis called a cochlear implant. The cochlea is an organ in the inner ear that converts sound into electrical signals that can be perceived by the brain. In cases of profound hearing loss due to cochlear dysfunction, the cochlea can now be replaced with a cochlear implant. Cochlear implantation has become the standard treatment for profound hearing loss. One of the most influential diagnostic technologies for the auditory system is a signal processing technology called auditory brainstem response (ABR). ABR is a signal processing technology that measures the electroencephalography generated in the central auditory pathway in response to sound stimulation. It has become a representative, objective method of measuring hearing level. ABR can be used to diagnose and predict various disorders of the auditory system. Finally, emerging predictive technologies for the auditory system are related to genomics/epigenomics. Several studies have been conducted to discover microRNAs associated with diseases of the auditory system. MicroRNAs can be used as biomarkers for early diagnosis of disease or as targets for disease treatment. As engineering advances, computational models are being developed that can predict disease-associated microRNAs without animal experiments. This presentation is about my research on cochlear implants, ABR and deep learning-based prediction models for genomics/epigenomics.

[ZS4] 11:30AM-12:20PM, **Dr. Amos Chungwon Lee**, CEO, Co-founder, Meteor Biotech, Co. Ltd., "**Spatially-Resolved Laser Activated Cell Sorting Unravels the Circuitry of Life**"

The inception of Spatially-Resolved Laser Activated Cell Sorting (SLACS) marks a transformative era in spatial omics, akin to assembling intricate circuits in electrical and computer engineering. Developed and commercialized as the world's first, SLACS technology unravels the genetic and epigenetic intricacies underlying diseases by dissecting the tumor microenvironment (TME) and cellular heterogeneity at a granular level. Applying SLACS to triple-negative breast cancer (TNBC), we have illuminated the complex landscape of cancer stem cell-like microniches. This precision technology isolates regions of interest from immunofluorescence-stained tissue, enabling the extraction of full-length transcriptomic data. Through this method, we have identified key epitranscriptomic features, such as adenosine-to-inosine (A-to-I) editing in the GPX4 transcript, which contribute to ferroptosis in TNBC microniches. Beyond cancer research, the versatility of SLACS is demonstrated in its global application across various diseases, including neurodevelopmental disorders. By commercializing SLACS, we have not only provided a tool for high-resolution molecular analysis but also laid the groundwork for groundbreaking advancements in precision medicine and therapeutic interventions. SLACS stands as a testament to the synergy between engineering and biology, decoding life's circuitry and paving the way for transformative discoveries in medical science.

End of PROGRAM

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