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Green IoT Workshop

In-Person Only
Saji Keizo Memorial Hall,
Nakanoshima Center, Osaka U.

2024 10:00-16:00
6/20 (Thu.)

Entry Free. Please Register at https://forms.gle/z7e1KKugKGj6MBri8

IoT today is going to be NOT Green! Sensing, communications, and signal processing including ML/AI systems consume huge energy and material resources. In this workshop, future technology directions for realizing “Green IoT” systems will be discussed among eminent invited speakers from cross-boudary fields related to “Green IoT”.

Workshop Program

10:00-10:30
Opening Remarks

Yuichi Tanaka, Osaka U.

Presentations by Eminent Speakers

10:30-11:30 “Graph Signal Processing & Learning for Image Applications”

While graph signal processing (GSP) is commonly known for spectral analysis and filtering of signals on structured kernels described by graphs, graph-based optimization algorithms, based on different assumed graph signal smoothness priors like graph Laplacian regularizer (GLR) and graph total variation (GTV), can be surprisingly effective for processing of images on regular 2D grids when unrolled into feedforward neural nets, while providing mathematical interpretation. Learning few parameters compared to "black box" neural network architectures like CNNs and transformers, they are also robust to covariance shifts. We study examples of several imaging applications, including image denoising, image interpolation, image deblurring, and satellite image declouding.

Gene Cheung, York U.

11:30-12:30 “CMOS Integrated Circuits: A Versatile Platform for Affordable Low-Power Biomedical Devices”

Biomedical device technology has rapidly advanced in the last decade with CMOS integrated circuits playing an integral role due to facilitating high levels of integration and sensitivity at low costs. In this talk, I will demonstrate how manipulation and sensing of electric and magnetic fields on CMOS chips can enable the design of high-performance, low-power Point-of-Care biosensors, ingestible devices, and implantable devices. I will introduce and discuss four different devices that we have recently developed in my lab: a magnetic biosensor that supports wash-free immunodetection without any post-process modifications based on a dual-frequency concurrent oscillator, an ingestible “smart” pill that achieves sub-mm 3D localization accuracy, the first ever pulse-mode EPR spectrometer on a chip, and a high-voltage neural stimulator for optic nerve and deep brain stimulation with fully on-chip charge balancing.

Constantine Siders, U. of Southern California

12:30-14:00 Break

14:00-15:00 “Energy Implications of Terahertz Communications Across Scales: Focusing in Time and Space”

Terahertz communication is envisioned as a key technology for the next generation of wireless systems. The vast available bandwidths at terahertz frequencies lead to extremely high data rates, potentially exceeding one terabit per second. In addition, the sub-millimetric wavelength of terahertz radiation leads to tiny antennas which, on the one hand, can be embedded into effectively everything, enabling the so-called Internet of Nano-Things, and, on the other hand, can be densely integrated into large arrays offering very high directivity gains with relatively small footprints. Traditionally, terahertz communication has not been associated with energy efficiency (the contrary, in fact). Instead, this talk will discuss the opportunities for energy efficiency that terahertz systems bring to the Green Internet of Things and the Internet of Nano-Things. After providing an updated view on the state of the art of terahertz technology and terahertz channel modeling, the opportunities that ultra-short transmissions and narrow-focused beams bring for next-generation terahertz communication networks.

Josep Jornet, Northeastern U.

15:00-16:00 “How to Make Wireless Communications Greener”

In order to achieve SDGs in future wireless communications including 6G, substantially reduction of power consumption in signal transmission is required while achieving ultra high data rate with ultra high reliability. However, achieving ultra high bandwidth efficiency with ultra low power consumption should be theoretically infeasible. In this talk, we discuss how to make high speed wireless communication systems greener from a communication system engineer's viewpoint.

Hideki Ochiai, Osaka U.

For more information, please visit: https://www.greeniot.org/giotws