

Session 10 - Sensors, MEMS and Bioelectronics/Optoelectronics, Displays, and Imagers - Focus Session:  
Human Machine Interface

Monday, December 9, 1:30 p.m.

Imperial Ballroom B

Co-Chairs: H. Lee, KAIST

A. Tournier, STMicroelectronics

**1:35 PM 10.1** The Neuropixels Probe: A CMOS Based Integrated Microsystems Platform for Neuroscience and Brain-computer Interfaces (Invited)

Barunde Dutta, Alexandru Andrei, Timothy Harris, Carolina Mora-Lopez, John O'Callaghan, Jan Putzeys, Bogdan Raducanu, Simone Severi, Sergey Stavisky, Eric Trautmann, Marleen Welkenhuysen, Krishna Shenoy, imec, Stanford University, HHMI Janelia Research Campus

CMOS enabled high-density electrophysiology probes are enabling transformational neuroscience experiments, e.g., single neuron precision, multi region, neuronal activity recording. They have enabled recording in multi-probe experiments with large neuronal populations (> 3000 neurons). Initial studies in primates indicate their transformational potential in brain computer interfaces and research in neural disorders.

**2:00 PM 10.2** Microfabricated Bioelectronic Systems for Prevention, Diagnostics and Treatment of Neurological Disorders (Invited)

Giuseppe Schiavone, Florian Fallegger, Philip Schönle, Qiting Huang, Stephanie Lacour, EPFL, ETH-Zurich

Direct, physical interfacing of electrical probes with the neural tissue enables monitoring and modulating neural activity. We report on current progress and remaining challenges in miniaturized, biomimetic and integrated implantable neural systems.

**2:25 PM 10.3** Haptics-Led Innovation for Coming Society (Invited)

Kouhei Ohnishi, Takahiro Nozaki, Yuki Saito, Tomoyuki Shimono, Takahiro Mizoguchi, KISTEC, Keio University, Yokohama National University, Motion Lib Inc.

The real haptics based on the Hadamard transformation brings not only the vivid sensation of contact task without any force sensor but also two important applications into the coming society. One is a high-quality tele-operation and the other is a playback of skilled motion by human.

**2:50 PM 10.4** Challenges in the Development of Wearable Human Machine Interface Systems (Invited)

Brendan O'Flynn, Javier Sanchez-Torres, Salvatore Tedesco, Michael Walsh, Tyndall National Institute

Tyndall National Institute has developed a glove-like device for Human Computer Interaction based on inertial sensors. Industry 4.0 represents one of the main applications for the possibility to control and monitor integrated systems. Current research focuses on enhancing bidirectional latency, sensor modalities, haptic feedback, interoperability, mainly concerning collaborative robotics scenarios.

*3:15 PM COFFEE BREAK*

**3:40 PM 10.5** Intelligent Vision Systems – Bringing Human-Machine Interface to AR/VR (Invited)

Chiao Liu, Andrew Berkovich, Song Chen, Hans Reyserhove, Syed Shakib Sarwar, Tsung-Hsun Tsai, Facebook Reality Labs

An all-day wearable AR/VR device in a glasses form factor needs new input modalities. The candidates include voice, eye gazing, hand/body/head gestures, and BCI. This paper describes computer vision based modalities and the sensor and system specifications, and propose solutions to the extremely stringent power, form factor and performance challenges.

**4:05 PM      10.6      Low-Latency Interactive Sensing for Machine Vision (Invited)**

Paul K. J. Park, Jun-Seok Kim, Chang-Woo Shin, Hyunku Lee, Weiheng Liu, Qiang Wang, Yohan J. Roh, Jeonghan Kim, Yotam Ater, Evgeny Soloveichik, Hyunsurk Ryu, Samsung Electronics

We introduce the low-latency interactive sensing and processing solution for machine vision applications. The event-based vision sensor can compress the information of moving objects in cost-effective way, which in turn, enables the energy-efficient and real-time processing in various applications such as person detection, motion recognition, and Simultaneous Localization and Mapping.

**4:30 PM      10.7      High-speed Image Processing Devices and Its Applications (Invited),**

Masatoshi Ishikawa, The University of Tokyo

We have developed a high-speed and low-latency image processing devices and systems. In this talk, their architectures and applications such as robotics, factory automation, human interface, bio/medical applications, 3D achieving, and vehicles will be explained by using videos.