THE CHINESE UNIVERSITY OF HONG KONG
Department of Electronic Engineering
Seminar

Wireless Multi-mode Brain Machine Interfaces for Freely Moving Subjects

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Time: 11:30 a.m.
Venue: Room 222, 2/F, Ho Sin Hang Engineering Building, CUHK

Abstract

As a gateway to fuse artificial and biological intelligence, brain machine interfaces (BMIs) aiming to create direct connections between our brains and machines, may not only open new paradigms for curing neural diseases, but also reshape almost every aspect of our future communities. What makes this opportunity unique is that BMIs have already gone from scientific fiction to physical prototype. It is an enabling, core technology for future healthcare, education, service and high-tech industries.

My lab focuses on biocompatible, light-weight, multi-mode, wireless BMIs for freely moving subjects. Our custom-designed high-density, high-throughput electrodes have been implanted in multiple marmoset monkeys for over 6 months—the longest & highest channel ECoG implementation yet in the open literature. These electrodes have maintained excellent neural signal acquisition rate for over 93% of channels. Importantly, the BMI system was built by my lab from scratch using 6 series of proprietary electrodes, 3 generations of integrated circuit-chip systems, and PC/smart phone-deployable analog-digital mixed signal acquisition, amplification, A/D conversion and wireless transfer chips along with our proprietary neural signal compression, detection and sorting algorithms. Our closed-loop neural modulation utilizes my lab's unique nonlinear neural dynamics modeling and computational techniques integrated with multi-mode stimulation hardware, including electrical, optical signals and chemicals (drugs). After completing validations on mice, pigs, canines, and marmoset monkeys, we began clinical studies at the National Center for Neural Diseases in Sept 2024.

Biography

Professor and National Distinguished Foreign Scholar. Chief scientist for national key R&D project on brain-machine intelligence fusion and behavior enhancement. D.Sc. ESE (Washington Univ. St. Louis), PhD Indus. Auto. (Zhejiang Univ.), MS BioE & MS EE (Stanford Univ.), BS ME (Zhejiang Univ.). After working as an R&D engineer (Agilent, 2001-2007), associate professor (tenured, University of Tennessee–Knoxville, 2008-2013), full professor (tenured, Ohio State University, 2014-2019), he joined Tsinghua University as a tenured professor in 2020. Received early career award (IEEE Rob. & Auto. Soc.), Young Investigator Award (ONR, USA), Innovation Award (Agilent). Nature Nanotechnology journal highlighted his research "paves the way for a new front in peptide optics, News & Views, Jan. 2016." Received over $8 millions research grants as PI (participated over $11 millions) from NSF, DoD, NIH of USA, and NSFC, Dept. S&T of China. Research results featured by Science, Nature, NSF, NSFC, AAAS among many others.

*** ALL ARE WELCOME ***

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