College of Science and Engineering

Department of Biomedical Sciences

Seminar

A Real-time Cerebellum on FPGA and A self-recalibrating sEMG pattern recognition system for neuroprosthetic control

Dr. Tin Chung

Assistant Professor

Department of Mechanical and Biomedical Engineering,

City University of Hong Kong

Date:	**30 March 2017 (Thursday)**
Time:	**12:00 nn–1:30 pm (Reception with light lunch starts at 11:45 am. To facilitate the order of lunch, please register through email yyfung2222@cityu.edu.hk.)**
Venue:	**Y5302, Academic 1, City University of Hong Kong**
Language:	**English**

Abstract

Advanced hardware tool and computational algorithm enable decoding of neural signal to interface the biological system to man-made system more efficiently and robustly. They are critical for development of reliable neuroprosthetics to restore or replace damaged neural functions. In this talk, I will introduce (1) the development of high performance silicon cerebellum as a replacement to the motor learning of a damage cerebellum and (2) a self-recalibrating surface EMG pattern recognition algorithm for more robust neuroprosthetics application.

In the first part of the talk, I will describe the development of a frame-based Network-on-chip (NoC) hardware architecture for implementing a bio-realistic cerebellum model with low timing distortion for proper interfacing with biological system. Here, we showed that our system can reproduce the classical cerebellum-mediated delayed eyeblink conditioning as demonstrated in animal experiments. Our system is power efficient, highly scalable and can operate at ~40 times faster than real-time with 100k neurons.

In the second part, I will describe a self-recalibrating classifier based on convolutional neural network (CNN) using short latency dimension-reduced sEMG spectrograms as inputs for hand gesture classification. The system reuses the predictions from the previous testing to routinely fine-tune the classifier. Our system provides a more stable classification performance over time despite non-stationary sEMG input.

Biography

Dr. Tin is currently an Assistant Professor in Department of Mechanical and Biomedical Engineering at City University of Hong Kong. He received his BEng. degree (1st Class) from University of Hong Kong in Mechanical Engineering in 2002. He then moved to the United States and obtained his S.M. and PhD. degrees, both in Mechanical Engineering, from Massachusetts Institute of Technology, in 2004 and 2011, respectively. He continued as a postdoctoral associate in MIT until he returned to Hong Kong in 2012. He has been awarded Croucher Foundation Scholarship (HK), American Heart Association Predoctoral Fellowship, and Early Career Award (Research Grant Council, Hong Kong). His research interests include neuroprosthetic systems, brain-machine interface, neural computation and sensorimotor learning and control.

**** All ARE WELCOME ****

Enquiry: Prof. Ying Li, Department of Biomedical Sciences, City University of Hong Kong.
Tel.: 3442 2669, Fax: 3442 0549, Email: yingli@cityu.edu.hk
Prof. Stella Pang, Department of Electronic Engineering, City University of Hong Kong.
Tel.: 3442 7838, Fax: 3442 0562, Email: pang@cityu.edu.hk