2013-2014 CS Seminar Series

Title: Laboratories-on-a-Chip: The Application of Computer Engineering Principles to Biochemistry

Speaker: Prof. Philip Brisk, Department of Computer Science & Engineering, UC Riverside

Date: Friday October 11, 2013 at 11 am

Location: DBH 6011

Abstract: Programmable microfluidic technology enables the precise control of micro- to nano-liter scale quantities of fluid. When placed under control of computer, the result is a fully programmable laboratory-on-chip (LoC), which has the potential to automate and miniaturize many chemical and biochemical reactions. LoC technology is rapidly evolving through the integration of capacitive touch sensors and video monitoring, which can provide feedback to the computer that controls the device. The result is a complex cyber-physical system that is aware of its own state and can leverage this information to make dynamic decisions at runtime.

This talk focuses on programming language, compiler, and runtime design for one specific LoC technology called a "Digital Microfluidic Biochip" (DMFB), which manipulates discrete liquid droplets on a two-dimensional grid. The key innovation is the development of a dynamic runtime interpreter, rather than a static compiler, which can respond to sensory feedback obtained from the DMFB in order to engage in a complex decision-making process. As a proof of concept, we have implemented a software-based fault tolerance, which can detect and rectify soft errors involved with droplet splitting that can occur at runtime. The talk will focus on the design and implementation of the runtime system, including several optimizations that can improve performance and utilization of the DMFB.

Speaker's bio: Philip Brisk is presently an Assistant Professor in the Department of Computer Science and Engineering at the University of California Riverside. He received his Ph.D. from UCLA in 2006, and worked at EPFL in Switzerland as a postdoctoral scholar for three years, prior to taking his current position. His research interests include programmable microfluidic technologies, FPGAs and reconfigurable computing, and application-specific processors.

Host: Eli Bozorgzadeh, Associate Professor, Computer Science Department