Time & Location: July 7, 2015 at 3:00 PM in HEC 356
Title: Worldwide Infrastructure for Neuroevolution: a Modular Library to Turn Any Evolutionary Domain into an Online Interactive Platform

Across many scientific disciplines, there has emerged an open opportunity to utilize the scale and reach of the Internet to collect scientific contributions from scientists and non-scientists alike. This process, called citizen science, has already shown great promise in the fields of biology and astronomy. Within the fields of artificial life (ALife) and evolutionary computation (EC) experiments in collaborative interactive evolution (CIE) have demonstrated the ability to collect thousands of experimental contributions from hundreds of users across the globe. However, such collaborative evolutionary systems can take nearly a year to build with a small team of researchers. This dissertation introduces a new developer framework enabling researchers to easily build fully persistent online collaborative experiments around almost any evolutionary domain, thereby reducing the time to create such systems to weeks for a single researcher. To add collaborative functionality to any potential domain, this framework, called Worldwide Infrastructure for Neuroevolution (WIN), exploits an important unifying principle among all evolutionary algorithms: regardless of the overall methods and parameters of the evolutionary experiment, every individual created has an explicit parent-child relationship, wherein one individual is considered the direct descendant of another. This principle alone is enough to capture and preserve the relationships and results for a wide variety of evolutionary experiments, while allowing multiple human users to meaningfully contribute. The WIN framework is first validated through two experimental domains, image evolution and a new two-dimensional virtual creature domain, Indirectly Encoded SodaRace (IESoR), that is shown to produce a visually diverse variety of ambulatory creatures. Finally, an Android application built with WIN, #filters, allows users to interactively evolve custom image effects to apply to personalized photographs, thereby introducing the first CIE application available for any mobile device. Together, these collaborative experiments and new mobile application establish a comprehensive new platform for evolutionary computation that can change how researchers design and conduct citizen science online.

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Approved for distribution by Kenneth Stanley, Committee Chair, on April 28, 2015.

The public is welcome to attend.