# CoCo Seminar Series
# Fall 2015

## Evolving Foraging Behaviors of Virtual Creatures in a Simulated Ecosystem

**Dr. Nesrine Ouannes**
**Assistant Professor of Computer Science**
**University of Biskra, Algeria**

**Wednesday December 2nd, 2015**
**9:30-10:30am at Engineering Building R-3**
**(SSIE Conference Room) *Note the irregular time***

Because of its important ecological underpinnings, the study of interactions between animals as well as with their environment is a research area of major interest in Biology. The work presented here belongs to the field of Artificial Life, a scientific discipline devoted to the study of natural phenomena inherent to living organisms by reproducing them by synthetic means. The aim of this research is to exploit the power of evolutionary techniques to cause behaviors of artificial creatures to emerge in a simulated ecosystem. The overarching problem of our work is to evolve foraging behaviors in artificial creatures. Two models have been developed. The first model exploits bacterial chemotaxis to overcome the problem of resource detection (or features in its environment). The cell chemotactic pathway is modulated by a hybrid approach that reproduces the receptor group activity using an algebraic model, the adaptation dynamics using differential equations, as well as a metabolic model that converts nutrients into biomass. We developed a type of analysis of motion from selected bacteria and their influence on the evolved population's behavior. We observed that the evolutionary process improves the bacteria's capacity to react to their environment as well as their ability to grow, effectively improving their ability to survive. We are studying now the effect of bacterial communication that allows new species to emerge, which exploits colony dynamics. Some of the obtained behaviors have been tested in separate environments in order to show how inter-bacterial communication can impact their behavior. The second model is about the development of 3D physically realistic creatures (herbivores) that feed on resources available in their environment. A genetic algorithm coupled to a neural network guarantees the emergence of a variety of behaviors such as the search of nutrients that are spread across the virtual ecosystem. The evolutionary process takes advantage of the virtual creature's physical properties and an external multimodal fitness function to lead to the expected behaviors. Experiments designed to evolve virtual creatures displaying locomotion abilities shows that they attempt to reach at least one of the food sources placed on their trajectory. Our best creatures are able to reach multiple food sources within the imparted simulation time.

Nesrine Ouannes is an Assistant Professor of Computer Science at the University of Biskra, Algeria, and a visiting scholar of the CoCo Center. Her research interests include the emergence of intelligent collective behaviors of artificial creatures at cellular and organismal levels.

For more information, contact Hiroki Sayama (sayama@binghamton.edu) http://coco.binghamton.edu/