April 23 (RCHM 009)

9:30 am: Andrew Marinaccio

Simulation of a School of Fish

Aggregation patterns of large groups of animals are of high interest to the scientific community. I use the model of Viscido, Parrish, and Gruenbaum to simulate the behavior of a school of fish. The positions and velocities of all fish are updated each time step using the Euler method. I analyze the average distance between pairs of fish as a function of time.

9:55 am: Jeanine Shea

Facilitation of Tumor Invasion by Microenvironmental pH

Cancer remains largely a mystery to scientists, even though it is the second leading cause of death worldwide. Thus, there is significant current research directed at better understanding cancer and, in particular, understanding how it forms and develops. We investigate one aspect of cancer growth, the influence of microenvironmental pH (or H+ ion concentration), on the development of cancer through a numerical simulation based on the model proposed by Robert A. Gatenby and Edward T. Gawlinski. Specifically, we investigate how the correlation between H+ concentration and death of normal cells affects the overall contours of the cancerous cell wavefront, normal cell wavefront, and H+ ion concentration wavefront; the velocity with which the cancerous wavefront propagated; and the growth rate of the cancerous region. We determined that lower correlations between H+ concentration and normal cell death allowed for regions of coexistence for cancerous and normal cells, whereas higher correlations did not. We also found that, although a higher correlation did increase the growth rate of the cancerous region, it did not increase the velocity with which the cancerous wavefront propagated.

10:20 am: Grant Smith

Predicting Hydroponic Plant Growth using Artificial Neural Networks

In recent years chemists and biologists have developed multidimensional models of nutrient plant uptake and plant growth. We present a brief review of neural networks and their ability to predict plant growth based on days after planting, radiation, temperature, and carbon dioxide. The properties analyzed here are the number of times the network was trained, the amount of hidden layers used, and the amount of nodes in a given layer. We find that a single hidden layer with 10 nodes that was trained 1 million times produces the lowest root mean squared error of value 0.025.

April 25 (RCHM 009)

9:30 am: JJ Simons

Hebbian Learning in Hopfield Networks

We simulated the neural network Hopfield model, implementing a system capable of Hebbian learning. We measured the Hamming distance from the original "memory" arrays as the system evolved in time, Starting from a random initial configuration, we find that the network rapidly equilibrated to a few preferred specific Hamming distances. These specific distances were dependent both on the number of input arrays and which distance correlated with which input array was dependent on the initialization of our starting array.

10:00 am: Coby Sagal

Molecular Dynamics Simulation of a Binary Lennard-Jones System

We use molecular dynamics (MD) simulations to study a binary Lennard-Jones system. The system contains 800 A and 200 B particles. The velocity Verlet algorithm is used to numerically integrate Newton's equations. The system is equilibrated for 10000 MD steps at temperatures above and below the glass transition. We analyse as a function of time the kinetic energy and the potential energy. To study the structure of the equilibrated system, we determine the radial pair distribution.