Mathematics and Computer Science

Student Presentations

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ANALYSIS AND 3D VISUALIZATION OF MULTIPLE TROPHIC CASCADE SCENARIOS

Brian J. Krent, Joshua M. Cook, Matthew J. Knox
Adviser: Randy R. Appleton

In this work we analyze the behaviors of multiple tropic cascade scenarios in simulated ecosystems. Extending upon previous work (cf. "3D Visualization of Simulated Trophic Cascades", Christopher E. Wells, 2008), we exhaustively search numerous subsets of the problem space by adding or removing different organisms, adjusting initial quantities of interacting agents, and altering several other environmental aspects. We accomplish this by refining and parallelizing the existing codebase for a cluster computer. Further, we examine the resulting data through extensive visualization.

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A STUDY OF PARALLEL MULTIPLICATION ALGORITHMS VIA GPGPU

Jaclyn R. Beck, David E. Lyon, Darren M. St. Amour, Esther M. Su
Adviser: Michael R. Kowalczyk

We implement several multiplication algorithms (such as lattice multiplication) within the setting of parallel computation using specialized hardware. This is accomplished by utilizing General-Purpose computation on Graphics Processing Units (GPGPU), an emerging technology which is steadily becoming more widely available and more practical for speeding computation. These empirical results are compared and contrasted with theoretical predictions of algorithm performance, with an emphasis upon optimizing runtime performance on the multiplication of large integers.

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EVOLUTION OF MOTILITY PATTERNS IN SIMPLE, BLIND ORGANISMS IN A BOUNDED ENVIRONMENT

Geoffrey S. Riutta
Adviser: Jeffrey Horn

Much of the previous work on artificial life and simulated evolution concerns organisms with sensory inputs. The current work explores the base case, involving a more primitive type of organism, possibly a precursor to creatures with sensory organs. By simulating agents with behavioral mechanisms far simpler than even stimulus-response models, we explore whether such "blind" organisms can evolve some sort of search pattern or other means of coping with a limited food supply to keep a population alive in a bounded area.

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COMPUTATION OF ESCAPE TIMES USING HYBRID MONTE CARLO ALGORITHMS

Paul Ericson and Axel Cisluycis
Adviser: Michael R. Kowalczyk

Monte Carlo techniques apply random samplings to estimate results which may be difficult to solve precisely. In contrast, deterministic algorithms get a precise result but may consume more time and space resources in the process. We study a hybrid approach, where estimations are obtained from Monte Carlo methods and used as guidance to speed the derivation of an exact result. This can also aid in the creation of parallel versions of these algorithms. We compare existing parallel hybrid Monte Carlo algorithms to our own. As an application, we consider the problem of computing escape times on a sparsely connected two-dimensional lattice.

Thursday
November 5, 2009
4:00 p.m.
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Mathematics and Computer Science Colloquium and Seminar Series