Student Presentations

3D VISUALIZATION OF SIMULATED TROPHIC CASCADES

by
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In an ecosystem, organisms may be described as being producers or consumers. These organisms create a hierarchy of dependence, commonly referred to as a "trophic cascade". A specific aquatic ecosystem exists which contains phytoplankton, Daphnia, and Hydra. Using the breve simulation environment, interactions between these organisms are modeled in 3D, allowing the visualization of organismal interaction. Parametric changes made to the organisms and their environment result in changes to the ecosystem as a whole.

UNSUPERVISED LEARNING AND EVOLUTION OF NEURAL CONTROLLERS FOR BIPEDAL BALANCE IN A 3D PHYSICS ENVIRONMENT

by
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A small simple feed forward neural controller is evolved in an unsupervised learning environment using a bipedal ragdoll physics model in the full 3D physics simulation environment known as Breve. Our goal is to achieve basic standing and balancing behaviors. Learning is applied to the ragdoll agent's knowledge of how it is oriented in the world, with two free hanging balance pendulums constantly delivering x, y, z orientation vectors to the neural network. A second, larger network is used in later runs to compare scalability of results, emerged behaviors, and fitness functions, and to test if generally bigger (more hidden nodes) is better. We use a simple but effective fitness function: maximum height achieved by the ragdoll form during simulation. The results of test runs validate our model. Empirical data show increasing fitness of individuals and populations over long-term evolution (e.g., 600 generations), while visual observation of sampled, high-fitness individuals reveals emerged, anthropomorphic behaviors (e.g., elbow-propping). We also find surprising anomalies exploited by evolution that teach us how to improve future simulations.

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