VIRTUAL CREATURES CONTROLLED BY DEVELOPMENTAL AND EVOLUTIONARY CPM NEURAL NETWORKS

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ABSTRACT—In this paper, a system where virtual creatures called *bugs* navigating a grid-based environment, which is controlled by developmental and evolutionary CPM neural networks, is presented. Each bug is born with a certain amount of energy that decreases in the navigation and increases only when the bug gets food. The bug can accumulate experience, i.e. training instances, in its life, which is used to incrementally tune its CPM network to improve the chance of making good decisions in later navigation. If two bugs meet then they may fight each other or produce an offspring, which is determined by their gender. The controlling organ, i.e. the CPM neural network, of the offspring is inherited from its parents in a specific way that the experience, i.e. the training instances, of its parents instead of the knowledge, i.e. the architectures or the weights, of them is genetically transmitted. Simulations show that the CPM networks are valuable to the longevity of the bugs, which exhibits not only the importance of the interaction of the developmental and evolutionary processes to virtual creatures, but also the feasibility of introducing evolution at the level of training instances into artificial neural networks.

Key Words: Artificial life, artificial neural networks, evolution, virtual creatures, coulomb potential model