NeuroAnimator: Fast Neural Network Emulation and Control of Physics-based Models

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Abstract

Animation through the numerical simulation of physics-based graphics models offers unsurpassed realism, but it can be computationally demanding. Likewise, finding controllers that enable physics-based models to produce desired animations usually entails formidable computational cost. This paper demonstrates the possibility of replacing the numerical simulation and control of model dynamics with a dramatically more efficient alternative. In particular, we propose NeuroAnimators, a novel approach to creating physically realistic animation that exploits neural networks. NeuroAnimators are automatically trained off-line to emulate physical dynamics, by observing physics-based models in action. Depending on the model, our approach yields physically realistic animation one or two orders of magnitude faster than conventional numerical simulation. By exploiting NeuroAnimator structure, we furthermore develop a fast algorithm for learning controllers that enable either physics-based models or their neural-network emulators to synthesize motions satisfying prescribed animation goals. We demonstrate NeuroAnimators for passive and active (actuated) rigid body, articulated, and deformable physics-based graphics models.

You can get the pdf file of the paper from

http://www.dgp.toronto.edu/people/radek/home.html

also the paper has been published in the Conference Proceedings of ACM SIGGRAPH'98.