

Keynote Address

Artificial Animals and Humans: From Physics to Intelligence

Demetri Terzopoulos
New York University



Abstract

The confluence of virtual reality and artificial life, an emerging discipline that spans the computational and biological sciences, has yielded synthetic worlds inhabited by realistic, artificial flora and fauna. Artificial animals and humans are complex synthetic organisms. As self-animating graphical characters, they are of interest in computer graphics because they can dramatically advance the state of the art of production animation and interactive game technologies. More broadly, these biomimetic autonomous agents in their realistic virtual worlds also foster deeper, computationally oriented insights into natural living systems.

Our artificial life approach has led to computational models of animals that include the relevant biomechanics, anatomy, and ethology. We have created physics-based virtual worlds inhabited by artificial animals possessing muscle-actuated bodies, eyes, and brains with motor, perception, behavior, and learning centers. The latter incorporate machine learning algorithms that enable artificial animals to learn muscle-actuated locomotion and acquire higher-level motor skills guided by sensory perception.

Our work on virtual humans addresses the challenges of biomechanical facial modeling/animation, of controlling physics-based anthropomorphic models, and of animating pedestrians in urban environments through the integration of (reactive) behavioral and (deliberative) cognitive components. In particular, we go well beyond the animation of "crowds" to develop a comprehensive model of individual pedestrians, yielding results of unprecedented fidelity and complexity for fully autonomous multi-human animation in large-scale urban environments.

Bio

Demetri Terzopoulos holds the Lucy and Henry Moses Professorship in Science at New York University and is Professor of Computer Science and Mathematics at NYU's Courant Institute. He is also affiliated with the University of Toronto, where he is Professor of Computer Science and Professor of Electrical and Computer Engineering. He graduated from McGill University and received the PhD degree (EECS) from MIT in 1984. Prior to becoming an academic in 1989, he was a program leader at Schlumberger corporate research labs in California and Texas. His published work comprises hundreds of research papers and several volumes, primarily in computer graphics, computer vision, medical imaging, computer-aided design, artificial intelligence, and artificial life. He has given hundreds of invited talks around the world, including numerous distinguished lectures and keynote addresses. A Fellow of the IEEE, Professor Terzopoulos has been a Killam Fellow of the Canada Council for the Arts, a Steacie Fellow of the Natural Sciences and Engineering Research Council of Canada, a Fellow of the Canadian Institute for Advanced Research and a Fellow of UCLA's Institute for Pure and Applied Mathematics. His many honors include computer graphics awards from Ars Electronica, NICOGRAPH, Computers and Graphics, and the International Digital Media Foundation, and computer vision awards from the IEEE, the Canadian Image Processing & Pattern Recognition Society, the American Association for Artificial Intelligence, and the International Medical Informatics Association. He is co-chair of the 2005 ACM SIGGRAPH/Eurographics Symposium on Computer Animation. He has been a founding editorial board member of four journals spanning the graphics, vision, and medical imaging fields. Professor Terzopoulos is a member of the European Academy of Sciences.