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Bio-Inspired Imaging and the Deep Learning of Neuromuscular Sensorimotor Control for Realistic Human Simulation

Computer simulation of the human body -- not just the bones, joints, and muscles, but also the sensory organs and, of course, the brain, is essential in the quest for artificial intelligence/life. In this context, I will present our recent advances in biomimetic human simulation and sensorimotor control. Our framework features an unprecedentedly detailed biomechanical human musculoskeletal model actuated by numerous muscles, with functional eyes whose retinas have many nonuniformly distributed photoreceptors. This bio-inspired imaging apparatus feeds the sensorimotor center of our virtual human's brain, which currently incorporates two dozen (deep) neural networks organized as a visual sensory subsystem that drives a neuromuscular motor subsystem. Synthesizing its own visual and motor training data, our fully autonomous virtual human learns efficient, online, active visuomotor control of its eyes, head, torso, and limbs to perform a variety of nontrivial sensorimotor tasks n!

ever before achieved in realistic biomechanical human simulations or anthropomimetic robotics.

Bio:

Demetri Terzopoulos is a Distinguished Professor and Chancellor's Professor of Computer Science at the University of California, Los Angeles, where he directs the UCLA Computer Graphics & Vision Laboratory. He is also Co-Founder and Chief Scientist of VoxelCloud, a multinational company that applies artificial intelligence to healthcare. He received his PhD degree ('84) in Artificial Intelligence from MIT. He is or was a Guggenheim Fellow, a Fellow of the ACM and IEEE, a Fellow of the Royal Society of London and the Royal Society of Canada, among other organizations. His research is primarily in computer graphics, computer vision, medical imaging, computer-aided design, and artificial intelligence/life. His many awards include an Academy Award for Technical Achievement from the Academy of Motion Picture Arts and Sciences for his pioneering work on physics-based computer animation, and IEEE's Computer Pioneer Award, Helmholtz Prize, and inaugural Computer Vision Distinguished!

Researcher Award for his pioneering and sustained research on deformable models and their applications. Prior to joining UCLA in 2005, he held a chaired professorship in computer science and mathematics at New York University, and previously he was a professor of computer science and electrical and computer engineering at the University of Toronto.