Disney automated system lets characters leap and bound realistically in virtual worlds

February 26 2016

Virtual game characters can leap, roll and climb so realistically that simply watching them could seemingly exhaust a player. Generating the precise instructions that govern such characters in increasingly complex environments is also quite labor intensive and, unlike a game, downright tedious.

Scientists at Disney Research, however, have developed an automated approach to generating life-like character motions in interactive environments, helping game designers by both easing their workload and by providing instant feedback on how characters will perform in 3-D space.

The researchers will present their new approach Feb. 27 at i3D 2016, the SIGGRAPH Symposium on Interactive 3D Graphics and Games, in Redmond, Wash.

"Motion synthesis techniques that govern how virtual characters interact with their environment simply have not been designed to scale to the complex virtual worlds and increasingly detailed character motions that are now possible," said Markus Gross, vice president at Disney Research and a co-author of the research paper. "Our new method is a breakthrough in how characters can navigate through a game environment, enabling acrobatic movements normally only seen in big-budget Hollywood films."

Character motion itself is not a problem - both motion capture and artist-

created content have made it possible for characters to move in natural and pleasing ways, said Robert W. Sumner, associate director at Disney Research, who leads the research group on animation and interactive graphics. The problem is where the character makes contact with the environment; designers now must manually annotate how a character grasps a pole, where to set a character's foot before a leap or even determine what motions are possible in a given space.

"It can be very tedious, especially for motions that involve intricate contacts between the character and the environment," Sumner said.

Mubbasir Kapadia, assistant professor of computer science at Rutgers University and formerly a Disney researcher, said the system automatically analyzes a database of motion clips to define a character's motion signature - what motion skills the character possesses, the pose of hands and feet when they make contact with a surface or grasp an edge, and how the joints and limbs respond when a character collides with a surface.

The system also analyzes the 3-D environment, identifying the spatial relationships between surfaces, identifying what surfaces could physically support a character and determining what motions are possible in a given space.

"Our system seamlessly integrates into existing navigation and animation pipelines to produce virtual characters that can autonomously reason about their environments while employing an expanded repertoire of motion skills to navigate through complex spaces," Kapadia said.

In an evaluation of the system, the Disney researchers showed it could employ 16 motion skills - climbing, squat and roll, double hand vaults, precision jumps and more - while controlling 10 characters in a complex environment. The system operates in real-time, so players can

manipulate the environment - moving around objects in the virtual world that the characters must navigate around, or allowing the player to control one character while being chased by two other characters.

In addition to Gross, Sumner and Kapadia, the research team included Maurizio Nitti of Disney Research, Xu Xianghao of ETH Zurich, Marcelo Kallmann of the University of California, Merced, and Stelian Coros formerly of Disney Research and now at Carnegie Mellon University's Robotics Institute.

Provided by Disney Research