Character animation technique produces realistic looking bends at joints

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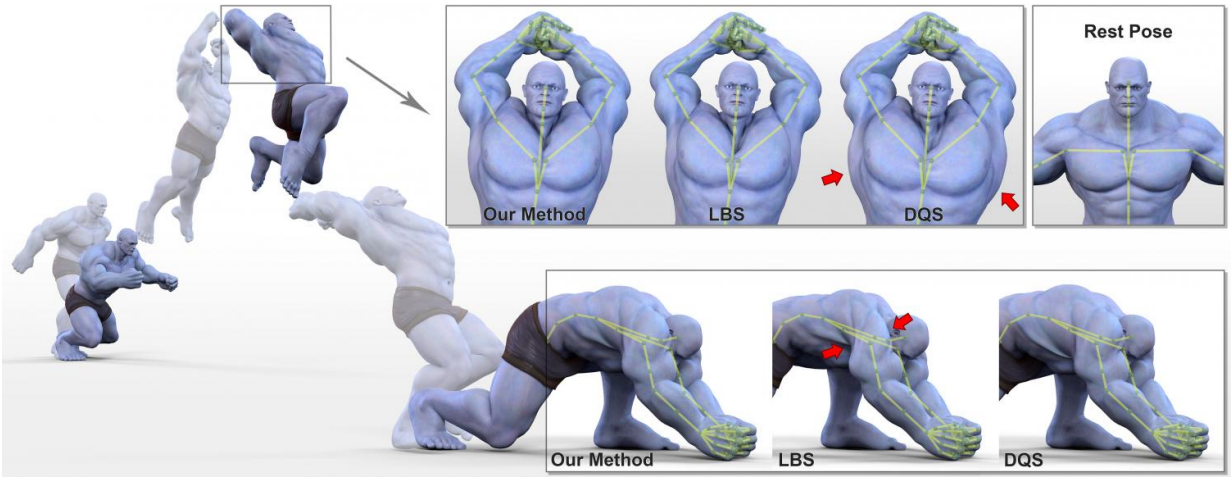

Credit: Disney Research

Bending of an elbow or a knee is common in most computer animations of human or animal figures, but current techniques often result in unwanted pinching or bulging near the joints. Disney Research has found a way to eliminate those artifacts even when the animation algorithm is running in real-time.

Jessica Hodgins, vice president at Disney Research, and Binh Huy Le, a post-doctoral researcher, were able to pre-compute an optimized center of rotation for each vertex in the character model, so those centers of rotation could be the basis for calculating how the skin around each joint

is deformed as it is bent.

"It's a very simple idea," Hodgins said. "The pre-computation enabled us to significantly reduce the joint distortions that often plague these animations, preserving the volume of the skin surface around the joint. And this method can be dropped into the standard animation pipeline."

Hodgins and Le will present their skeletal skinning method July 24 at the ACM International Conference on Computer Graphics & Interactive Techniques (SIGGRAPH) in Anaheim, Calif.

Computer animators will often use a virtual skeleton to control the pose of a character and then use a skinning algorithm to define the surface of the character. Two skinning methods, called linear blend skinning (LBS) and dual quaternion skinning (DQS), are widely used in computer game engines, virtual reality engines and in 3D animation software and have been the standard for more than ten years.

But both have difficulty with certain poses. When an elbow is flexed, for instance, LBS can cause a volume loss at the area around the joint, resulting in a crease resembling a bent cardboard tube. When the forearm is twisted, a similar volume loss results in an appearance similar to a twisted candy wrapper. DQS eliminates those problems of volume loss, but creates one of its own - a bulging of the joint.

Pre-computing the centers of rotation, by contrast, improves the ability to properly weight the influence of each bone in the joint on the skin deformation, Le said.

The result is that the volume losses of LBS and the bulging associated with DQS are minimized or eliminated.

The method uses the same setup as other skeletal-based skinning models,

including LBS and DQS, so it can be seamlessly integrated into existing animation pipelines. The required inputs are just the rest pose model and the skinning weights that also are required by the existing algorithms. The method also can fully utilize current graphics hardware (GPUs).

More information: "Real-time Skeletal Skinning with Optimized Centers of Rotation-Paper" [PDF, 39.61 MB]

Provided by Disney Research