군중 시뮬레이션을 위한 그래프기반 모션합성에서의 충돌감지

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Detecting Collisions in Graph-Driven Motion Synthesis for Crowd Simulation

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Virtual human characters are an essential part of many interactive environments, such as games, visualizations, and simulations. Motion capture data has come to dominate human skeleton animation due to its realism and maturing capture and editing technologies. However, the motion capture itself does not guarantee the visual realism in virtual environment where a lot of character shares the environment at the same time. Minimum requirement is that characters should not interpenetrate each other. In this paper we propose an efficient algorithm for detecting collisions between characters whose motion is specified by motion capture data. In this algorithm, we introduce a hierarchical bounding volume, the Motion Oriented Bounding Box tree (MOBB tree). A MOBBtree is a space-time variant of OBB trees targeted at skeletal motion clips, and can be viewed as a continuous collision detection technique based on hierarchies of swept volumes. The design of MOBB trees is motivated by several motion specific properties: the agent's path is densely point sampled in time and can be arbitrarily shaped the time steps are large compared to typical physically based simulation; the aim is to avoid collisions entirely, so we require a yes/no intersection test and have no need for contact points etc.; and agents are moving on the ground plane, so the problem is 2D with time (we are looking for intersections between circles extruded in time − thin disks in space-time). These properties primarily drive the way in which an MOBB tree is constructed, but also influence the intersection testing algorithm.

Our primary goal is crowd simulation, where many characters occupy the same environment and move in relatively close proximity. In such a space, we are not concerned with the fine grained interactions of agents (such as a hand shake) but rather with ensuring that the agents maintain reasonable separation as they move. So, we model the character with bounded sylinder and seek intersections between vertical bounding cylinders placed around the agent at each time-step. To validate our approach, We performed a series of experiments to explore the benefits of MOBB trees

under an application workload. Our test environment is a crowd simulator in which agents wander through the world avoiding collisions. The agents are animated with 51 Snap-Together Motion] style motions, which guarantee visual continuity when we connect them. The motions have an average length of only 2.1 seconds, or 63 frames. As a result, we showed that MOBB trees performance improvements ranging between two and an order of magnitude. The performance depends on the length of the motion. If we use relatively long motions, then our algorithm is turned out to be ten times faster than brute-force frame-by-frame checking method.