Efficient Multi-viewpoint Acquisition of 3D Objects Undergoing Repetitive Motions

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Computer graphics applications such as movie effects, video gaming, and product demonstration demand 3D models of dynamic objects. For this purpose, numerous methods, such as light fields, stereo reconstruction and visual hulls have been extended to model dynamic objects. These methods use multiple cameras to acquire images simultaneously and use the synchronized samples to reconstruct the model for each time instance. However, a large number of cameras is required to obtain compelling results. We introduce an efficient acquisition and modeling schema for dynamic objects with repetitive motions. Our method requires as few as two cameras. The key idea is that repetitive motions can be described by a finite number of states. Images capturing the same state can be grouped together and fed to the later modeling phase as if they are captured from multiple cameras simultaneously. Our work includes an acquisition system with interactive feedback, a graph traversal algorithm to help obtain a near minimum subset of images to sample the object and its motion, and a space-time image optimization method. We demonstrate this system using several datasets with different complexity of motion, and different number of desired viewpoints.