RESEARCH ON VIDEO-BASED HUMAN BODY MOTION TRACKING

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INTRODUCTION: The video-based motion capture system uses cheap equipments, like digital cameras and personal computers, to track a human motion without any sensors or markers attached to the body. This topic has a wide application in areas such as smart surveillance, human computer interaction and athletic performance analysis etc., and it becomes a hot topic of computer vision in recent years. Because of the complexity of the problem and lack of comprehension of human vision system essence, visual tracking is still hard in computer vision.

The background of this research is the project of science and technology for the Olympic Games. Athletic motion analysis requires a motion measure and simulation system without any markers or obstructive. According to this requirement, we use techniques in computer graphics, image processing, sport biomechanics and computer vision to explore new methods of tracking and simulating human 3D motion from multi-camera videos.

METHOD: Firstly, we design a multi-camera body tracking environment. It includes a parameterized skeleton model, a body shape model and a practicably multi-camera calibration algorithm. According to these models, we set up an experimental platform for 3D human body tracking in multi-camera environments. Then, we propose a human body tracking framework based non-linear optimization. Three methods, including gray value, edge and silhouette, are combined with this tracking framework to construct the tracking object function. By defining the body model, projection process and the similarity function, we define our tracking object function as a form of sum of squared residuals. Finally, we use Gaussian-Newton algorithm to optimize this object function.

In order to solve the body covering and error accumulation, which are two difficult problems in the human body tracking, we propose some methods to improve the algorithm adaptability to decrease covering, noise and changes of environment, such as shape matching and using the priors knowledge, including self-intersection limitation, skin color region constrain and symmetry constrain.

CONCLUSION: In this study we achieve a primitive weight lifting sport tracking system. This system can accurately track the barbell motion parameter automatically, such as the displacement of the center of the barbell. In addition, this system can track the athletes' motion automatically, for example, the displacement of the different joint points. However, the result of tracking is not so accurate as the result of barbell.