



Chapter XI

Synthesis and Analysis Techniques for the Human Body: R&D Projects

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Abstract

This chapter presents a number of promising applications and provides an overview of recent developments and techniques in the area of analysis and synthesis techniques for the human body. The ability to model and to recognize humans and their activities by vision is key for a machine to interact intelligently and effortlessly with a human inhabited environment. The chapter analyzes the current techniques and technologies available for hand and body modeling and animation and presents recent results of

synthesis and analysis techniques for the human body reported by R&D projects worldwide. Technical details are provided for each R&D project and the results are discussed and evaluated.

Introduction

Humans are the most commonly seen moving objects in one's daily life. The ability to model and to recognize humans and their activities by vision is key for a machine to interact intelligently and effortlessly with a human inhabited environment. Because of many potentially important applications, examining human body behavior is currently one of the most active application domains in computer vision. This survey identifies a number of promising applications and provides an overview of recent developments in this domain (Hillis, 2002).

Hand and body modeling and animation is still an open issue in the computer vision area. Various approaches to estimate hand gestures and body posture or motion from video images have been previously proposed (Rehg & Kanade, 1994; Lien & Huang, 1998; Zaharia, Preda & Preteux, 1999). Most of these techniques rely on 2-D or 3-D models (Saito, Watanabe & Ozawa, 1999; Tian, Kanade & Cohn, 2000; Gavrilu & Davies, 1996; Wren, Azarbayejani, Darell & Pentland, 1997) to compactly describe the degrees of freedom of hand and body motion that has to be estimated. Most techniques use as input an intensity/color image provided by a camera and rely on the detection of skin color to detect useful features and to identify each body part in the image (Wren, Azarbayejani, Darell & Pentland, 1997). In addition, the issue of hand and body modeling and animation has been addressed by the Synthetic/Natural Hybrid Coding (SNHC) subgroup of the MPEG-4 standardization group to be described in more detail in the following.

In Sullivan & Carlsson (2002), view-based activity recognition serves as an input to a human body location tracker with the ultimate goal of 3D reanimation. The authors demonstrate that specific human actions can be detected from single frame postures in a video sequence. By recognizing the image of a person's posture as corresponding to a particular key frame from a set of stored key frames, it is possible to map body locations from the key frames to actual frames using a shape-matching algorithm. The algorithm is based on qualitative similarity that computes point-to-point correspondence between shapes, together with information about appearance.

In Sidenbladh, Black & Sigal (2002), a probabilistic approach is proposed to address the problem of 3D human motion modeling for synthesis and tracking. High dimensionality and non-linearity of human body movement modeling is

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