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Chapter VI

Techniques for Face Motion & Expression Analysis on Monocular Images

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Abstract

This chapter presents a state-of-the-art compilation on facial motion and expression analysis. The core of the chapter includes the description and comparison of methods currently being developed and tested to generate face animation from monocular static images and/or video sequences. These methods are categorized into three major groups: “those that retrieve emotion information,” “those that obtain parameters related to the Face Animation synthesis used,” and “those that use explicit face synthesis during the image analysis.” A general overview about the processing fundamentals involved in facial analysis is also provided. Readers will have a clear understanding of the ongoing research performed in the field

of facial expression and motion analysis on monocular images by easily finding the right references to the detailed description of all mentioned methods.

Introduction

Researchers from the Computer Vision, Computer Graphics and Image Processing communities have been studying the problems associated with the analysis and synthesis of faces in motion for more than 20 years. The analysis and synthesis techniques being developed can be useful for the definition of low-rate bit image compression algorithms (model-based coding), new cinema technologies, as well as for the deployment of virtual reality applications, videoconferencing, etc. As computers evolve towards becoming more human-oriented machines, human-computer interfaces, behavior-learning robots and disable-adapted computer environments will use face expression analysis to be able to react to human action. The *analysis of motion and expression from monocular (single) images* is widely investigated because non-stereoscopic static images and videos are the most affordable and extensively used visual media (i.e., webcams).

This chapter reviews current techniques for the analysis of single images to derive face animation. These methods can be classified based upon different criteria:

1. the nature of the analysis: global versus feature-based, real-time oriented;
2. the complexity of the information retrieved: general expression generation versus specific face motion;
3. the tools utilized during the analysis: for instance, the cooperation of a 3D head model;
4. the degree of realism obtained from the Face Animation (FA) synthesis; and
5. the environmental conditions during the analysis: controlled or uniform lighting, head-pose dependence or not.

Table 1 depicts a rough evaluation of the techniques that we review in this chapter by comparing these criteria, considering the data provided by the referenced articles, books and other bibliographical material, as well as the judgment of the authors.

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