

Chapter 7

Conclusions and Suggestions for Future Works

7.1 Conclusions

In this study, a system for automatic real-time generation of talking cartoon faces has been implemented. The system is based on the analysis of 2D sequential facial images. Several techniques of image processing were utilized. The system consists of three components: a facial feature tracker, a face model transformer, and an animation generator.

The facial feature tracker is designed to track facial features from sequential facial images by the use of a facial feature region segmentation method and a facial feature tracking method proposed in this study. The tracking method includes the techniques for extraction of facial features and correction of errors. Some errors are endured and ignored to raise the stability of the proposed facial feature tracking method. Besides, a head turning detection method was proposed to create head-turning cartoon faces. An integer value is detected to control the direction and the range of head turnings.

A face model of 72 facial feature points is used in this study. By the face model transformer, the image feature points extracted by the facial feature tracker are transformed into the face model control points in the face model. This is achieved by the use of image feature point transformation method proposed in this study according

to the geometric ratio principle.

Finally, the animation generator generates the talking cartoon face in real time by the use of a cartoon face creation method proposed in this study. The cartoon face can be simply skewed as head turnings by an integer value. And a method was proposed to synchronize the images and speeches in real time.

Based on the proposed system for automatic real-time generation of talking cartoon faces, a server and client system for application uses on networks was proposed. By the integration of the server subsystem and the client subsystem, several applications that utilize the proposed techniques can be implemented. An application of multi-role avatar broadcasting and another application of web TVs for avatar tutors, avatar reporters, and avatar singers have been implemented. Good experimental results showed the feasibility of the proposed approaches.



7.2 Suggestions for Future Works

Several suggestions to for future researches are listed as follows.

- (1) Improvement on facial feature detection --- For the stability of the real-time talking cartoon face generation, the performance of the facial feature detection must be improved. Improvements on image processing techniques should be tried to extract facial features more stably.
- (2) Rendering cartoon faces with more types --- To raise the quality of the resulting talking cartoon faces, more face types should be supported. It need not be only for human faces; some face types for animals and nonhuman objects can be supported.
- (3) Detection of facial features with more features --- In order to make the facial

expressions of talking cartoon faces plentiful, more facial features can be detected. For example, the eyebrows can be detected to let talking cartoon faces be angry, sad, etc.

- (4) Real-time realistic virtual face generation --- By using the existing techniques for facial feature tracking of sequential facial images, a method for image feature point transformation with realistic faces can be proposed. Then it is potential for real-time realistic virtual face generation.
- (5) Improvement on integration of server and client system --- In the proposed server and client system, only the images and speeches are transmitted from the server. For some applications, like avatar reporters and avatar singers, the script of speeches can be transmitted from the server and be shown according to the timing of speeches.
- (6) Improvement on learning of environments --- In order to raise the accuracy of real-time facial tracking and the performance of real-time talking cartoon faces, more facial information can be obtained in the process of learning of environments.

