

摘要

随着计算机技术特别是多媒体技术的不断发展，如何能够让计算机能够更加人性化的表达自己并同人们自然交流引起了研究者越来越多的关注。真实感三维人脸动画技术作为一种重要的人机交互方式，可以应用于人性化人机交互、虚拟主持人、网络会议、可视电话、远程教学、远程医疗诊断、电影制作、游戏娱乐等诸多领域。计算机动画电影制作以及电脑游戏产业的发展推动了计算机动画技术的发展。近年来，由于基于 MPEG-4 的人脸动画系统有动画数据通用性强、动画数据量小、运算复杂度低等优点，并且有适合于网络实时动画的架构，已经开始快速发展。本文的研究目标是探讨基于 MPEG-4 的人脸动画系统中人脸运动数据的获取方法以及基于 MPEG-4 的自动化的任意拓扑结构人脸模型真实感动画实现方法，最终在已有基础上实现一个全自动的基于 MPEG-4 的任意拓扑结构三维人脸动画系统。

计算机三维人脸动画的主要研究内容包括人脸建模以及人脸动画控制两个大的方面。由于已有精确的三维人脸模型可以使用，所以本文的主要研究工作集中在人脸动画控制方面。人脸动画控制的研究包括人脸运动数据的获取以及如何利用动画控制数据驱动人脸模型。本文分别研究了基于 MPEG-4 的人脸运动数据获取方法以及任意拓扑结构人脸动画定义表的自动构造方法，分别对应于人脸运动数据获取和人脸动画控制。

在人脸运动数据获取方面，本文针对基于 MPEG-4 的语音驱动人脸动画的需要，实现了一种基于标注图像的 MPEG-4 人脸运动参数 (FAP) 获取算法。通过变换色彩空间以及简单的图像分割技术，本文精确的获取了话者人脸运动数据，为系统实现语音信号到唇动模式的映射打下了基础。

在动画控制方面，本文提出了自动构造任意格式人脸模型人脸动画定义表的方法。在基于 MPEG-4 的人脸动画系统中，人脸动画定义表的作用是指导动画系统如何在得到人脸运动参数以后变形特定人脸模型以产生预期的动画效果，所以人脸动画定义表是实现基于 MPEG-4 的人脸动画的关键所在。本文在原有人脸动画定义表构造方法的基础上提出了一种自动构造任意拓扑结构人脸模型所对应的人脸动画定义表的方法。

在我们的人脸动画系统中，如果要驱动不同于标准人脸模型拓扑结构的任意拓扑结构三维人脸模型，必须在三维模型上添加嘴缝。本文通过充分利用三维网格的深度信息以及嘴部网格的拓扑结构，实现了在三维人脸模型上自动添加嘴缝并修改嘴部顶点拓扑结构以适应动画需要的算法。本文还实现了自动校正嘴部错误运动因子的算法。通过这些手段，实现了对原有动画系统的全自动化，使原有动画系统更具实用性。

关键词：MPEG-4, 人脸动画, 人脸建模, 人脸动画定义表, 任意拓扑结构人脸模型, 三维人脸特征定位, 自动化

An automatic MPEG-4 based realistic 3D facial animation method

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Along with the quick development of computer technology, especially the multimedia technology, the research of humanoid human-computer interaction interface comes to the focus. Three-dimensional computer facial animation is an important way for human-computer interaction, and it can be applied to various areas of virtual reality environments such as virtual presenter, net meeting, videophone, remote education, remote medical diagnosis, movie effects and games etc. Since the MPEG-4 based facial animation system has the advantage of little data, computationally cheap and can perform real time animation, it receive more and more attention in recent years. The most important advantage of the MPEG-4 based facial animation system is that it's a much more universal facial animation system. This dissertation focuses mainly on the capture of real human facial animation data and the automatic MPEG-4 based arbitrary topology facial animation method.

The study areas in 3D facial animation include facial modeling and facial animation. The facial animation research includes study of facial motion capture and facial animation control strategy. This paper mainly deals with the problem of facial animation data capture and facial control strategy in the MPEG-4 based facial animation system.

Facial motion capture plays an important role in any facial animation system. In this paper we implemented the method to capture real facial motion data by making marks on facial images, and then transform these motion data into the form of the MPEG-4 FAPs (Facial animation parameter).

The key point in a MPEG-4 based facial animation system is the construction of the FaceDefTables corresponding to the specific facial model. In this paper, by using the ASM (Active shape model) and texture mapping, we proposed an automatic method to locate feature points on 3D facial models. Then based on the 3D feature points on the 3D facial model, we construct FaceDefTables for arbitrary topology facial model automatically.

We also make our facial animation system more automatic than previous by automatic add of the lip line and the automatic fix of the wrong motion factor at the mouth region.

Keywords: MPEG-4; Facial Animation; Facial Modeling; FaceDefTables; Arbitrary topology facial model; 3D facial features location; automate