ABF Based Face Texturing

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Abstract. A new approach of generating textures from multi-view images is presented in this paper. The generated textures can be mapped onto a 3D face model seamlessly. Angle Based Flattening(ABF) surface parameterization is used to build the correspondence between a 3D face model and its 2D texture domain. Feature points on face model are defined according to face anatomy, and their counterparts on images are automatically extracted with AAM method, plus by some little user interaction. The correspondence between feature points on 3D model and 2D images sets up the correspondence between images and the texture domain. With above methods, we can efficiently synthesis texture seamlessly from multi-view images, and map it onto the 3D face model.

Keyword: texture mapping, texture generation, ABF method, AAM.

1 Introduction

Texture mapping is one of the oldest techniques in Computer Graphics [7]. Originally, it is used to convey realism of objects, see [4][5]for an overview . As the methods of texture mapping are throughout computer graphics and image processing [4], its popularity is undoubted. In recent years, it is fast developed and powerfully used in all kinds of modeling not only because it makes the model, like a face, more vivid, but also because the low -cost hardware support for this technique is available. It has already achieved great success in high quality image synthesis [4] and attracts more and more focus from researchers.

In face texturing, there are mainly two kinds of ways to get the texture: 3D scanner, like Cyberware, and image-based texture mapping [5][6].The former one generates both the model and the texture by scanning the real object. It needs a large database which is costly and the generated texture is not so satisfying [3]. A more common way is to use input images. We focus our attentions on these previous works and represent our method in section 1.1..

1.1 Previous Work

In images-based texture generation, we have to solve such a problem: generating a complete, seamless texture from a series of images, and then mapping it on to a 3D face model. Commonly, three or more images are required, and these images are

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usually unregistered. In[2], Rocchini et al first calibrate a camera by the corresponding feature points in 3D models and images. Then, they create a texture patch for each triangle in 3D model. This is a common way, and deduces to a lot of approaches in the actual implemention of every step. Rocchini's work is effective and can map a texture with lots of details very well, but it can't generate mip-maps as in its texture domain, the textures from all the images are side by side, thus forming a patch structure.

Texture mapping based on parameterization can satisfy the mip-map. It constructs a parameterization for a 3D model over a 2D domain. Then a texture can be created in this parameterization domain. Special parameterizations are used for different kinds of models. In[12], Sheffer et al proposes Matchmaker to improve the parameterization used in face texturing. They embedded a feature mesh (matchmaker) into the original mesh in parameterization result, achieving a low distortion of face model. However, this algorithm is time consuming, and the boundaries are visible in the mapped model. Maroc[1] et al used a view-dependent parameterization to enhance the visual quality of textures, and a multiresolution splines method was applied to remove the boundaries. It works effectively, except that it needs 80 minutes to do the parameterization, and 15-25 minutes more to do the interaction for defining the feature points in 3D model and images.

Most methods of face texturing need lots of manual tuning. To smooth the transitions in the generated texture, additional complex methods are needed after the texture has been generated in texture domain. All above takes lots of time and is not convenient for application. Allowing for these problems, we proposed a new approach to achieve seamless face texturing quickly with few interaction. The paper is organized as follows: First we introduce the anatomy based face feature points detection in section 2. Section 3 is a brief introduction of ABF used in our system. Then, in section 4, we detail the seamless texture generation. The results are shown in section 5. Finally, section 6 gives the conclusion and future work.

2 Anatomy Based Face Feature Point Detection

This is a preparing procedure of the texturing. In order to set up the correspondence between 3D face model and its 2D texture domain, we first find the anatomy based face feature points both in 3D model and 2D image domain. Since in surface parameterization, every vertex in 3D face model has a unique counterpart in texture domain, the texture of these feature points can be acquired directly. Then based on this, every 3D vertex can find its correspondence in images, as well as its texture (see details in section 4.1). First of all, the feature points are defined; then, followed by two parts of works: face image feature detection and 3D model feature detection.

2.1 Feature Points Definition

We define 41face feature points. 25 of which are totally anatomy based [16], denoting eyes, mouth, nose and the face contour. In front image, as the triangulation of these 25 feature points can't cover the whole face, we need another 8 more. In each side image, we define 4 more on each ear. See the defined feature points in figure 1 and 2, both in 3D model and 2D image domain.