Visual Effects

submitted by

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Chapter 1

Introduction

"*Birds are the most accomplished aeronauts the world has ever seen. They fly high and low, at great speed, and very slowly. And always with extraordinary precision and control.*" [**?**]

Chapter 2

Previous Work

2.1 Data Capture

2.2 Sparse Reconstruction

2.3 Blendshape Optimisation

2.4 Skin Rendering

Rendering realistic skin is a challenging task. As social beings we interact with interact with other individuals on a daily basis, which has made human perception quite sensitive to skin appearance, even more so with human faces. Skin is composed of several layers with different properties, to accurately simulate skin the light transport between this layers has to be simulated. The full effect of light scattering between two points on the surface can be modelled using a Bidirectional Surface-Scattering Distribution Function (BSSRDF).

Weyrich et al [WMP*06] proposed a two-layer model for skin rendering, the outer layer simulates the air-oil interface and the inner layer models the subsurface scattering in the skin. The authors considered the scattering to be homogeneous, with this assumption they measured the skin BRDF of several subjects in a light dome, while the scattering was sampled at three points in the face with a custom made sensor. The BRDF data was fitted to a Blinn-Phong and a Torrance-Sparrow isotropic models, and the scattering was fitted with a single transport coefficient. Donner et al [DWd*08] also proposed a two-layer model, however the authors allow for the layers to be heterogeneous. With this addition they are able to introduce the effects of haemoglobin, veins and tattoos. Emotional induced haemoglobin variations have also been explored [JSB*10]. The authors measured the haemoglobin distributions of several subjects in different poses, then a linear combination of the captured data would determine the final haemoglobin distribution for a new sequence. Recently, Iglesias et al [IGAJG15] introduced a five-layer model to handle skin ageing. Haemoglobin, collagen and fat changes with age are modelled using the different layers.

Normal maps are use to alter the normals of the scene objects during rendering. This technique is used to add geometric detail to an object at rendering time without actually changing the geometry. Normal maps for skin rendering are usually captured using expensive light domes with a number of synchronized cameras [GTB*13, WMP*06].

Another technique to increase the quality of a face render is to scale the resolution of the textures being used. Ashikhmin et al [Ash01] presented a method to generate new textures using a goal image by greedily extending existing patches whenever possible. Hertzmann et al [HJO*01] extended Ashikhmin et al [Ash01] method by adding a second example image and using more complex distance metric to choose the next synthesized pixel. Graham et al [GTB*13] applied Hertzmann et al [HJO*01] example-based filter to generate bump maps with increased quality for skin rendering. An alternative approach using a dictionary of samples was presented by Jianchao et al [YWHM10]. This method is restricted to generating super-resolution images, however, the previous methods support a wide variety of filter effects. For an in depth analysis of super-resolution techniques, we refer the readers to Tian et al [TM11] survey.

Chapter 3

Methodology

3.1 Data Capture

3.2 Sparse Reconstruction

3.3 Blendshape Optimisation

3.4 Skin Rendering

Our objective in skin rendering is to generate a face that would indistinguishable from a real one. To be more specific, we have have taken a 3D scan of a subject and our aim is to improve the realism of it. For this task we will mainly look at the techniques presented by Hertzmann et al [HJO*01] and Graham et al [GTB*13].

Before we begin, lets explain the Image Analogies framework [HJO*01] in more detail. Given three images A, A' and B, where A is an unfiltered example, A' is a filtered example, and B is an input image, the algorithm will generate an output image B' such that B' relates in the same way to B as A' does to A, as shown in Figure 3-1. A k-d tree for an Approximate Neighbour Search is built using a feature vector from a neighbour pixel p in A and A'. The closest match for a neighbourhood in pixel q in B and B' is located in the tree. Following Ashikhmin et al [Ash01] method, a match that is coherent to what has been already synthesized is computed as well. These two candidates are weighted and the best one is chosen. The whole process is carried in a multiresolution pyramid, as shown in Figure 3-1, where l indicates the current level, in essence what this means is that the neighbourhoods also include the previous level in the search.

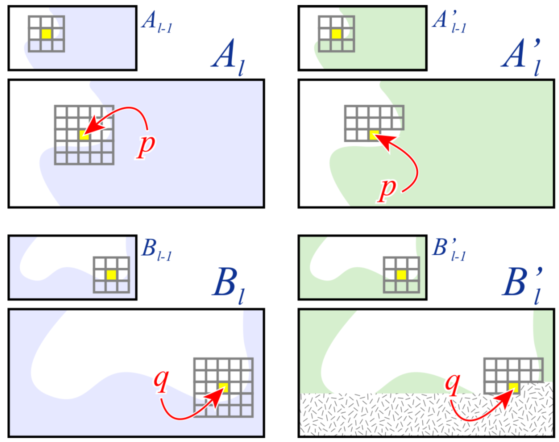

Figure 3-1: Neighbourhood matching for the Image Analogies framework, image taken from [Ash01].

A first approach is to see how far can the be pushed.

Chapter 4

Results

Chapter 5

Conclusions

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