Reflectance from Images:
A Model-Based Approach for Human Faces

Martin Fuchs, Volker Blanz, Hendrik Lensch, and Hans-Peter Seidel
MPI Informatik

Spatially varying reflectance properties increase the realism of 3D face models. By applying analytical models, an image-based method using few input images is sufficient to create a detailed surface model, which enables the rendering of new poses and novel lighting.

Acquisition

We take pictures of the face in up to seven point-light conditions. For each, we take up to three images in different poses. The light position is determined observing reflexes on steel spheres [1]. For global scaling, we measure three distances on the face.

Registration

By fitting a Morphable Model [2] to theses images, a geometry estimate (a) and a texture atlas of radiance data (b) are obtained. The parameterization of the atlas is feature-consistent for all human faces, delivering correspondence between different input images (c). In this universal parameterization, clusters of materials can be defined a-priori (d).

BRDF model fitting

Knowing the point light positions, we can now treat the radiance maps as reflectance samples. For each of the clusters defined above, we fit the parameters of an analytical BRDF model (such as Lafortune). Afterwards, we fit locally varying diffuse terms for each of the surface texels in order to increase spatial detail.
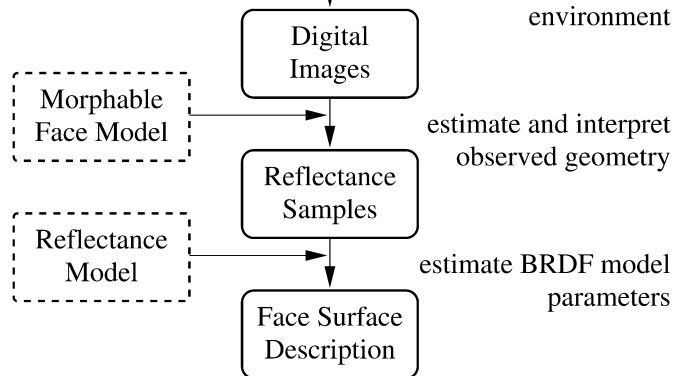
Results

The face surface model allows new poses and new, complex lighting conditions. Due to the feature-consistent parameterization, one can easily map the surface reflectance from above on geometry from different faces (see below). This work has been published in [3].

[1] H.P.A. Lensch, J. Kautz, M. Goesele, W. Heidrich, and H.-P. Seidel: "Image-Based Reconstruction of Spatial Appearance and Geometric Detail", ACM trans. Graphics, vol. 27, no. 2, April 2003
[2] V. Blanz and T. Vetter: "A Morphable Model for the Synthesis of 3D Faces", Computer Graphics Proc. SIGGRAPH '99, 1999
[3] M. Fuchs, V. Blanz, H.P.A. Lensch, and H.-P. Seidel: "Reflectance from Images: A Model-Based Approach for Human Faces", IEEE Transactions on Visualization and Computer Graphics, vol. 11., no. 3, May 2005
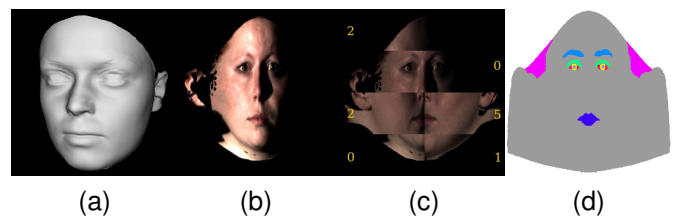
Input images

take photos in calibrated environment

Digital Images

Morphable Face Model

estimate and interpret observed geometry

Reflectance Samples

Reflectance Model

estimate BRDF model parameters

Face Surface Description

Registration

(a)   (b)   (c)   (d)

Novel pose and lighting

Surface transfer