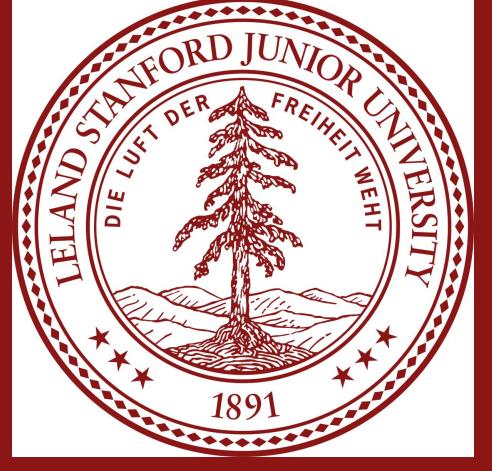




DESKTOP-BASED 3D FACE RECONSTRUCTION FOR EVERYONE

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Background

Face Reconstruction is used to recover human's face geometry and texture, widely applied in the movie and game industry and even can guide the doctors for plastic surgery. To reconstruct human faces, firstly, we need to get a bunch of human's face images from different angles and lighting conditions, then we can move to the geometry and texture reconstruction process.

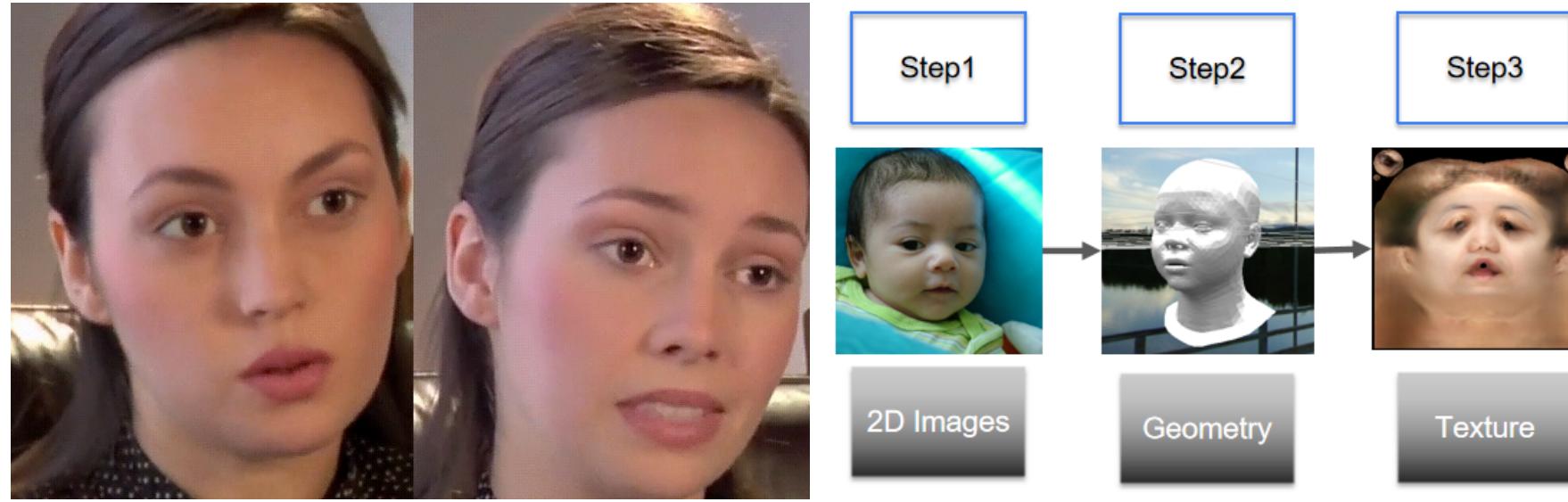


Fig. 1: Left Pic: left half is a CG render one while the right one is the real image; Right Pic: Methods Pipeline
Light stage[1], is an instrument to capture and render human subjects under almost any illumination condition, which helps to get the human's geometry and texture. Most light stages consist of room-scale, spherical arrays of brightly-flashing colored lights and cameras.

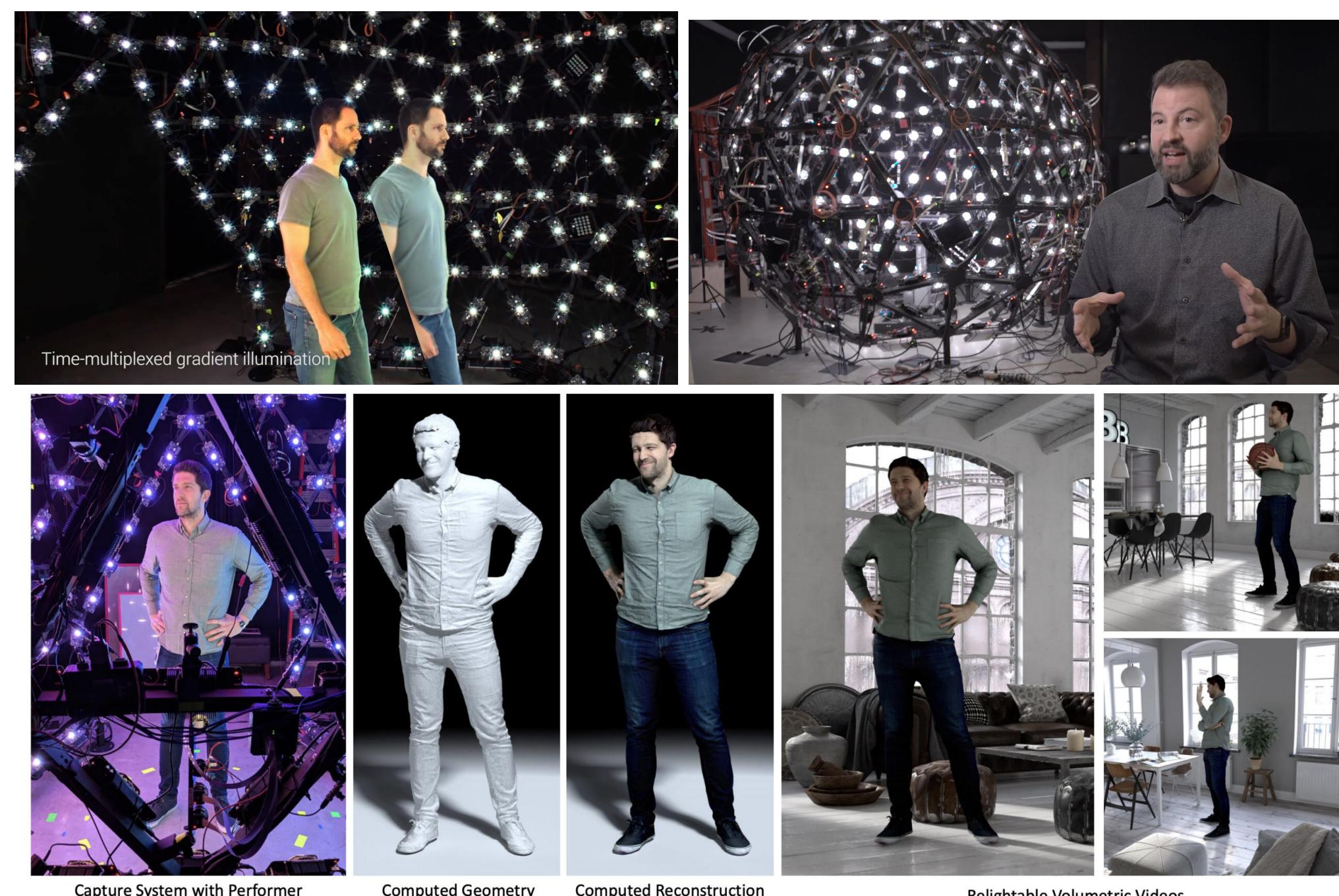


Fig. 2: Light Stage Introduction

Unfortunately, very few researchers have access to a light stage, as only a few exist in the world. Furthermore, light stage is a heavy setup. Therefore, it motivates us using webcam and computer's screen as the light source to build up a simplified "light stage". Our goal is to use this setup for human face geometry and texture generation.

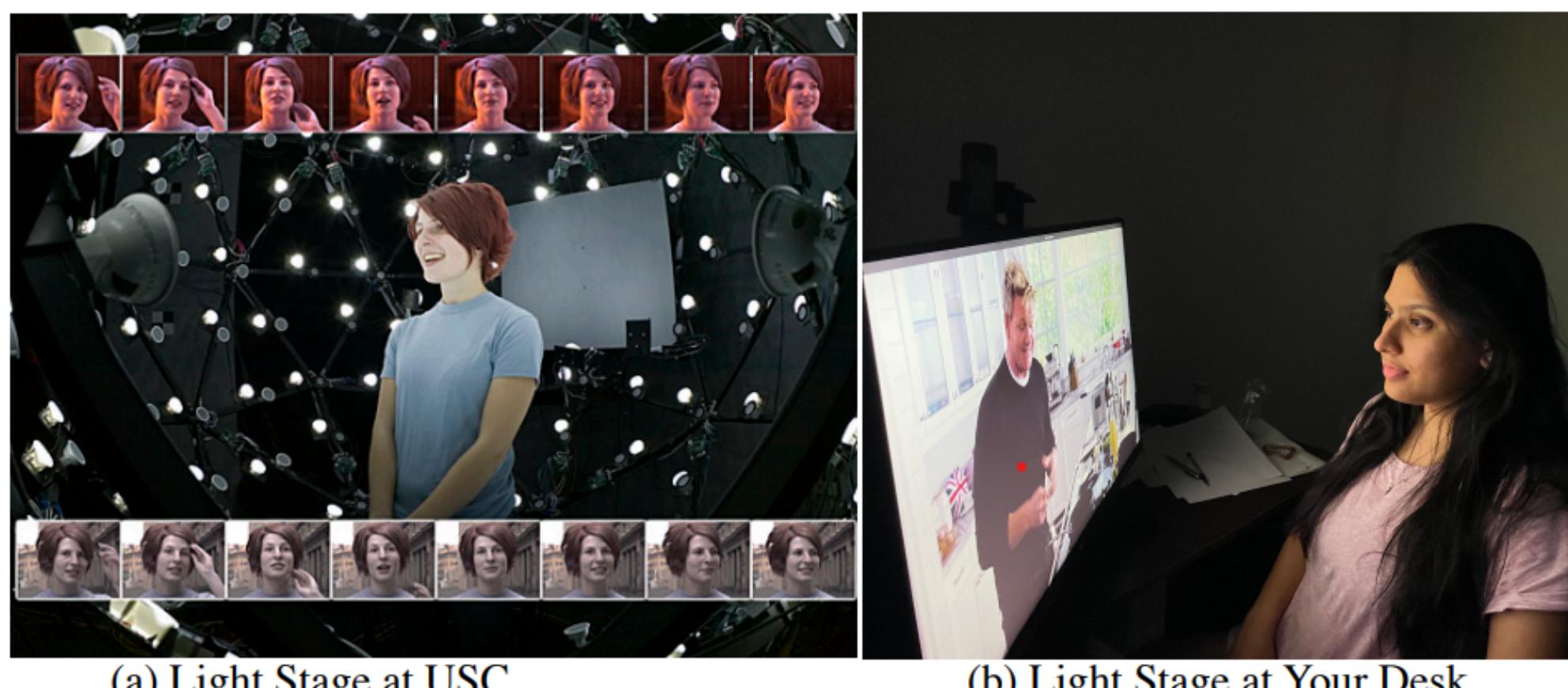


Fig. 3: Desktop "Light stage" set up

Design

We design the 3×3 light patterns for computer's screen.

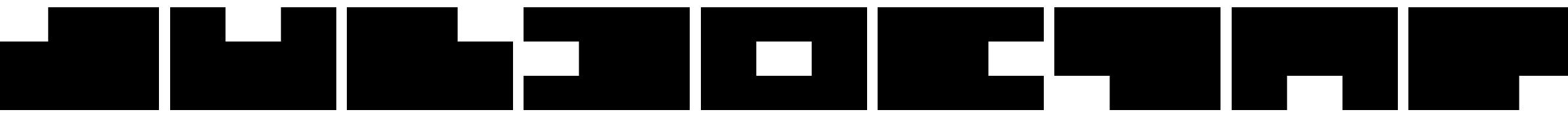


Fig. 4: Light patterns design, it served as a simplified light stage providing different light conditions

Geometry

We use **FLAME Model** [3] to generate our geometry of the face. In fact, FLAME Model is a human head geometry generator depends on a set of shape parameters, one can have a bunch of different virtual head geometries by changing such parameters.

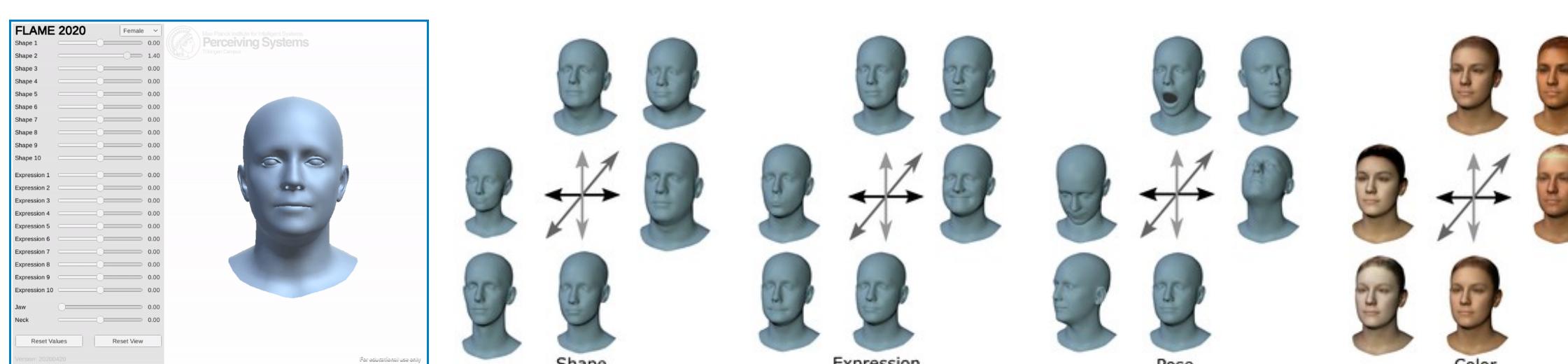


Fig. 5: Flame model

Therefore, our target turns to learn the shape parameters. We are doing this by comparing CG render images and real images, we optimize for the best shape parameters by minimizing the difference between two sets of images.

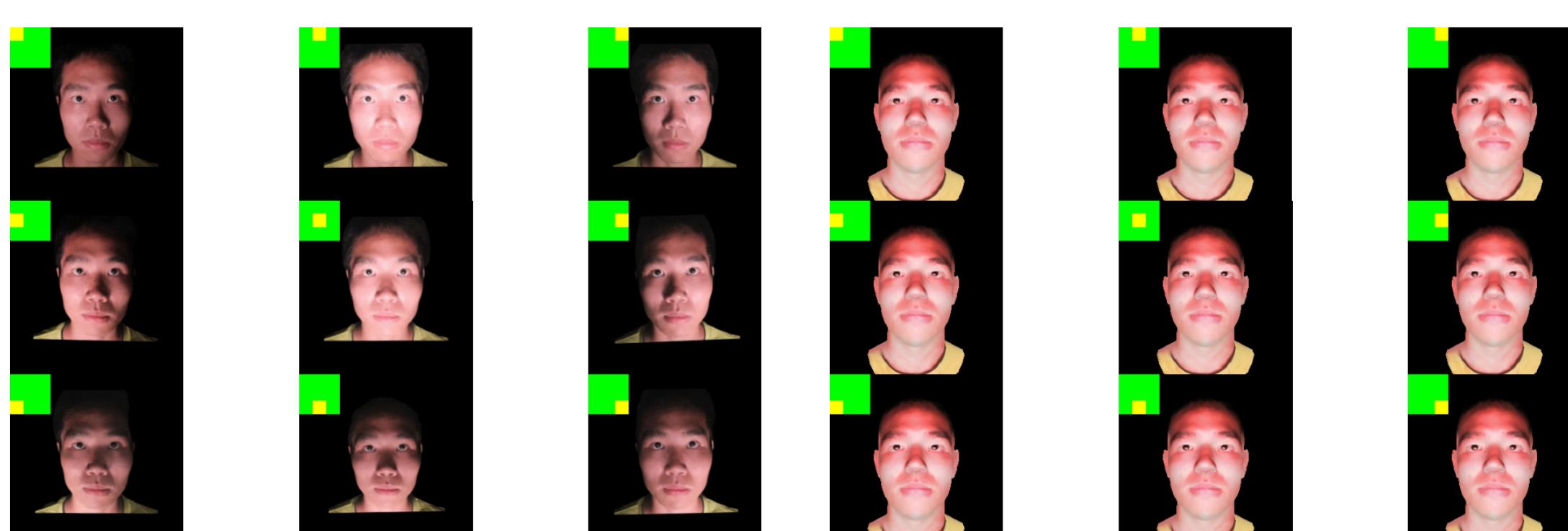


Fig. 6: Comparison between render images and real images, here we use both color loss and face landmark loss.

Texture

We can use a similar setup but different light patterns as the geometry part. Using the algorithm in [2], firstly generating the diffuse and specular light maps and normal maps, then we can get the final diffuse texture and specular texture.

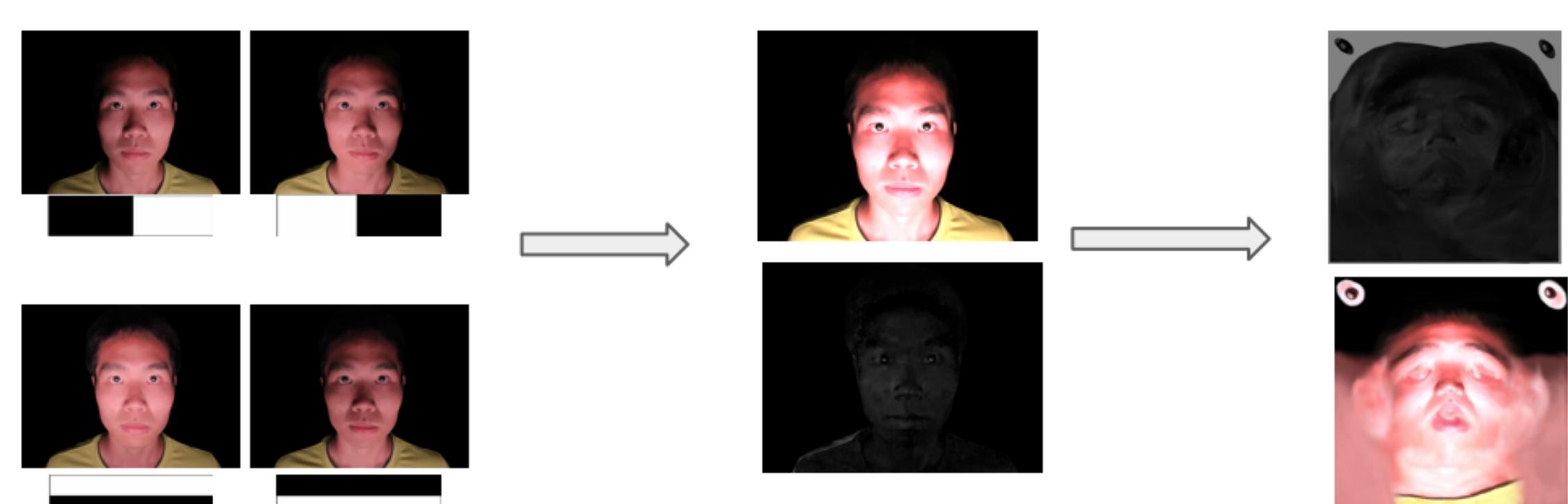


Fig. 7: Texture generation pipeline

Results

Using the methods introduced in the geometry block and texture block, we can get both optimized geometry model and face texture, applying the texture on the geometry, we successfully reconstruct the human face.

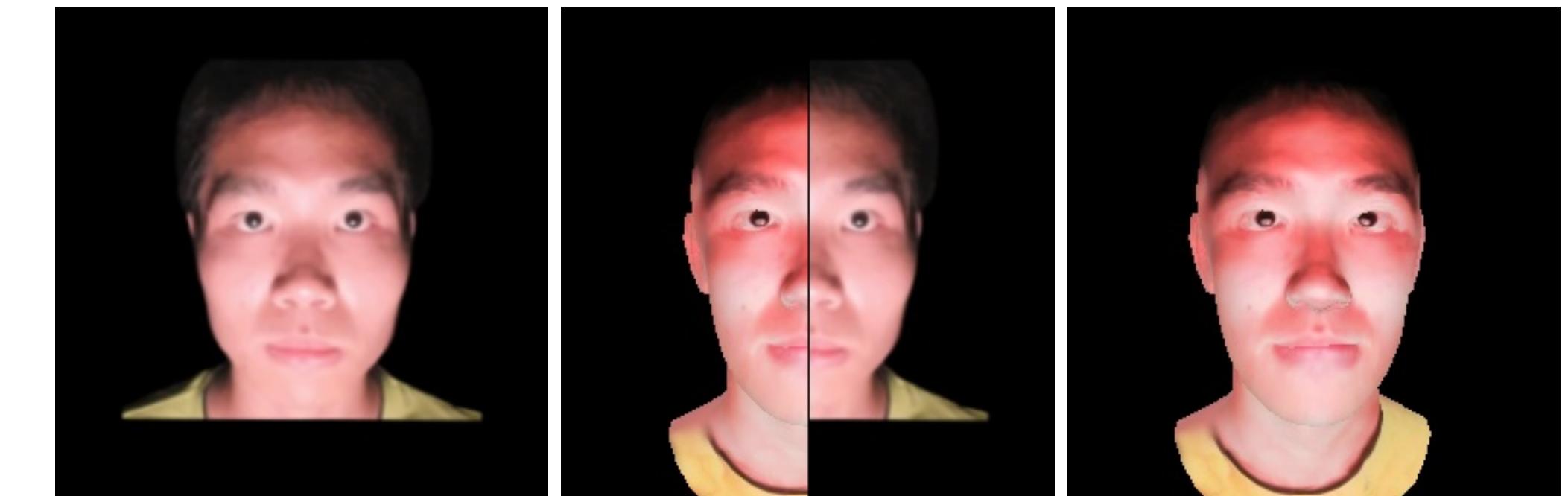


Fig. 8: Left image is the real one taken from webcam, middle is the combination of the CG render one and the real image, the right one is a total CG render image

Conclusion and Future Work

- Conclusion** We present a novel desktop setup, which is composed of only computer and webcam. This setup successfully work in reconstruct human faces.
- Future Work** We will go through a geometry-texture optimization loop, that is take turns to optimize these two sides, each side will use the old result from the other one.

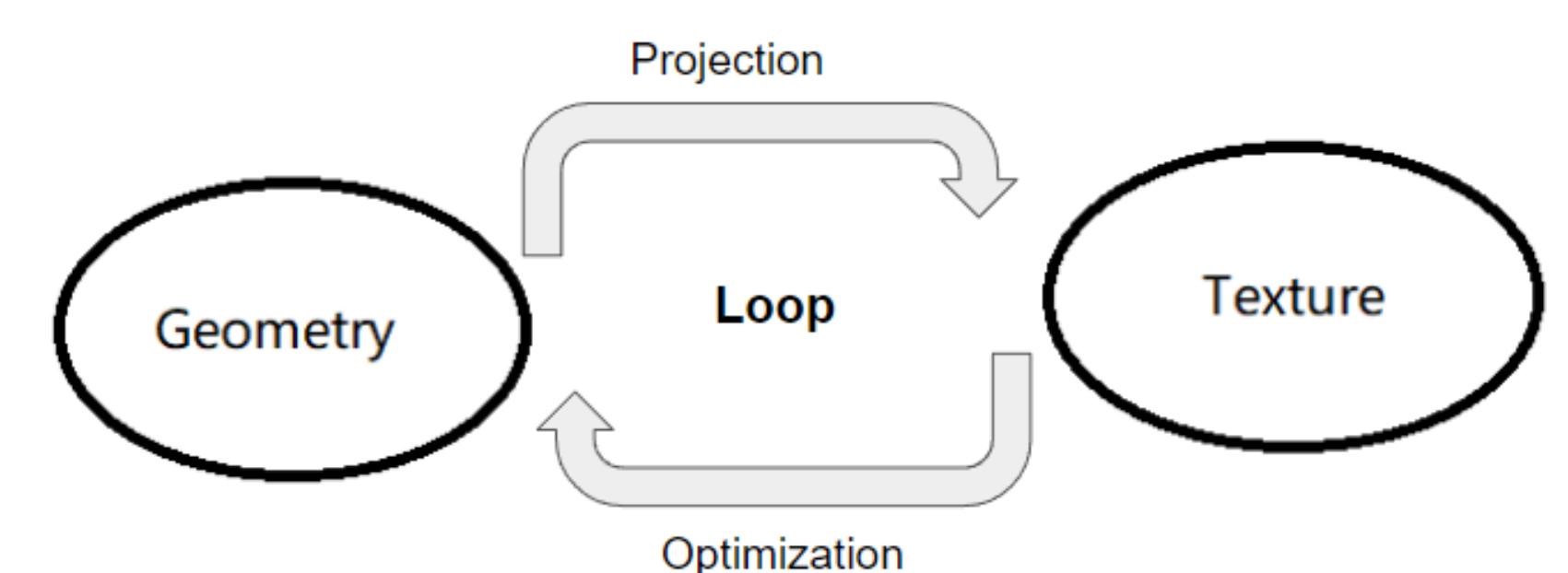


Fig. 9: Future Work

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