SE

3D Reconstruction for Human Faces

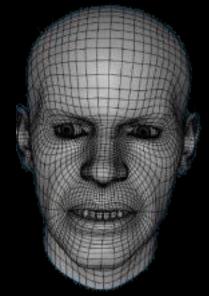
Final Presentation by Group 26

Reconstruction for Human Faces

Real-time facial animation

Capture a face with a camera Reconstruct 3D model











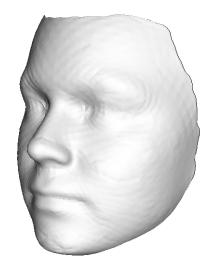
Proposed by Weise et al.

User-Specific Blendshape Model

This methods has a great robustness to illumination changes, but it may fail for faces with large rotations or occlusions and it cannot recover motions of the occluded regions.

Proposed by Cao et al **Color-Only based Model**

This is a regression method but requires user-specific training and calibration

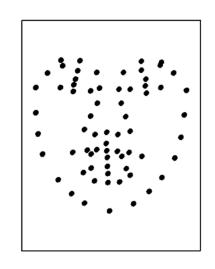


Core Model: AAM model

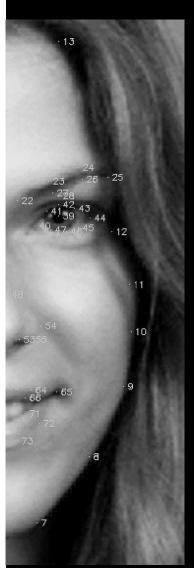
3D Reconstruction

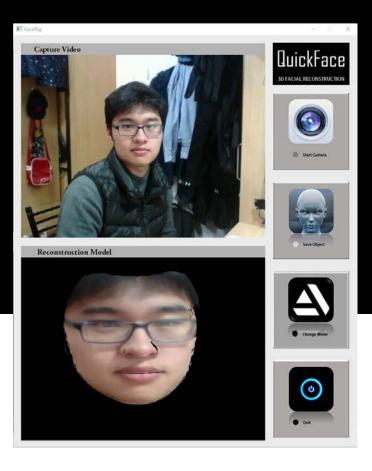
An *Active Appearance Model* (AAM) is a computer vision algorithm for matching a statistical model of object shape and appearance to a new image.











Camera capture Save object Change mode



Core Algorithm Implementation

ASM

- > Confirm the key points
- > Build training set
- > Training the ASM model
- Using affine transformation to get the initial model
- Match the initial model with the input face and get the key points of the input
- Mapping the key points to the face model



AAM

- Based on ASM
- Model the texture of the 3D model intend to get a surface model
- It is a value iteration method
- Calculate the deviation between the input texture and the model texture
- Fitting the model's texture

Function and UI Design

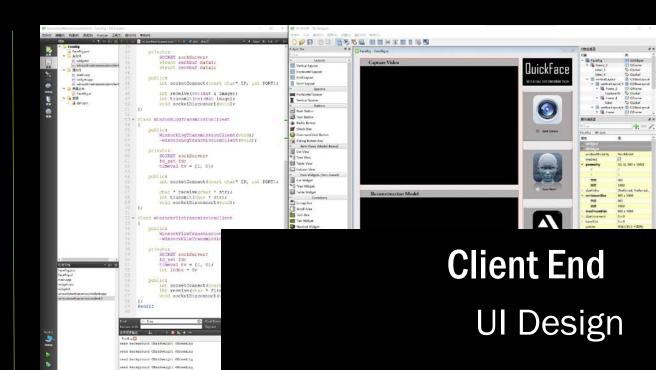
```
void socketDisconnect(void);
     class SocketMatTransmissionServer
          SocketMatTransmissionServer(void);
          ~SocketMatTransmissionServer(void);
174
          int client sockfd;

    mbao@ubuntu: ~/Desktop/4dface/install/bin

          int server sockfd;
                                                   it2 27Transmit2 28Transmit2 29Transmit2 30Transmit2 31Transmit a Rendering!
          struct recvBuf data1;
                                                   rece2
                                                   Receiving Key: (null)
Waiting transmition!
179
          struct sentbuf data2;
          int needRecv:
          int count;
                                                   prepare Rendering!
                                                   transmit 1
184
                                                   Transmit11
                                                   Transmit2 0Transmit2 1Transmit2 2Transmit2 3Transmit2 4Transmit2 5Transmit2 6Tra
          int socketConnect(int PORT);
                                                   nsmit2 7Transmit2 8Transmit2 9Transmit2 10Transmit2 11Transmit2 12Transmit2 13Tr
                                                   ansmit2 14Transmit2 15Transmit2 16Transmit2 17Transmit2 18Transmit2 19Transmit2
   Sever End
```

Divided into sever end and client end with high performance

Socket Based

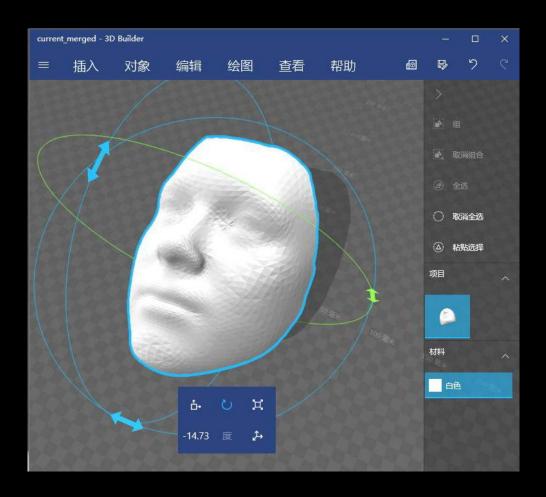


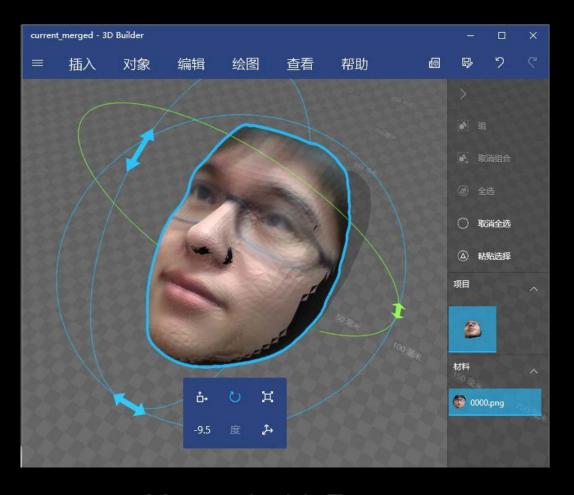
Graphical buttons with Minimalist design make it easy to use

Function show

3D Reconstruction of Human Faces







3D mesh model

Mapped with Texture

Conclusion and Future Work

- Reconstruct 3D faces automatically
 - Without special devices
 - No manual operation
- User-friendly interface
 - Concise and artistic
 - Easy to use

- More interaction with user
 - Interesting games
- Advanced functions
 - Emotion recognition
 - VR applications

Reference

- [1] BEELER, T., HAHN, F., BRADLEY, D., BICKEL, B., BEARDSLEY, P., GOTSMAN, C., SUMNER, R. W., AND GROSS, M. 2011. High-quality passive facial performance capture using anchor frames. ACM Transactions on Graphics (TOG) 30, 4, 75.
- [2] CAO, C., WENG, Y., ZHOU, S., TONG, Y., AND ZHOU, K. 2014. Facewarehouse: a 3d facial expression database for visual computing. Visualization and Computer Graphics, IEEE Transactions on 20, 3, 413–425.
- [3] EZZAT, T., AND POGGIO, T. 2000. Visual speech synthesis by morphing visemes. International Journal of Computer Vision 38, 1, 45–57.
- [4] LI, H., YU, J., YE, Y., AND BREGLER, C. 2013. Realtime facial animation with on-the-fly correctives. ACM Trans. Graph. 32, 4, 42.
- [5] XIE, L., AND LIU, Z.-Q. 2007. A coupled hmm approach to videorealistic speech animation. Pattern Recognition 40, 8, 2325–2340.