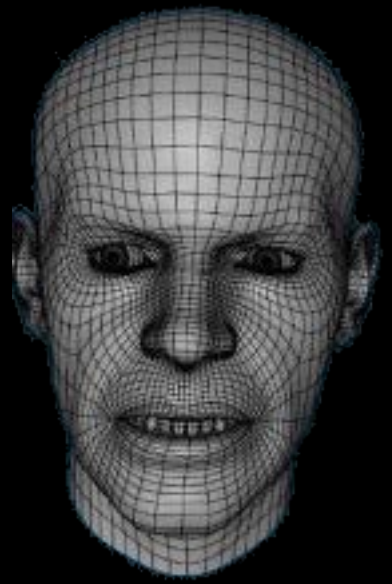
SE

3D Reconstruction for Human Faces

Final Presentation by Group 26

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.

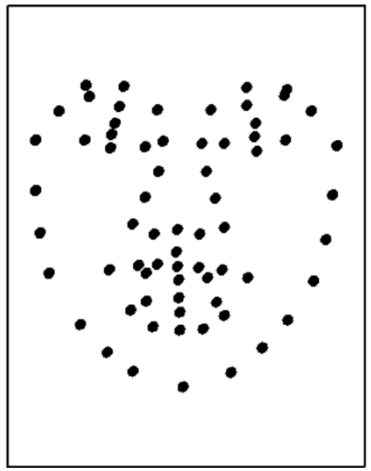
Proposed by Cao et al

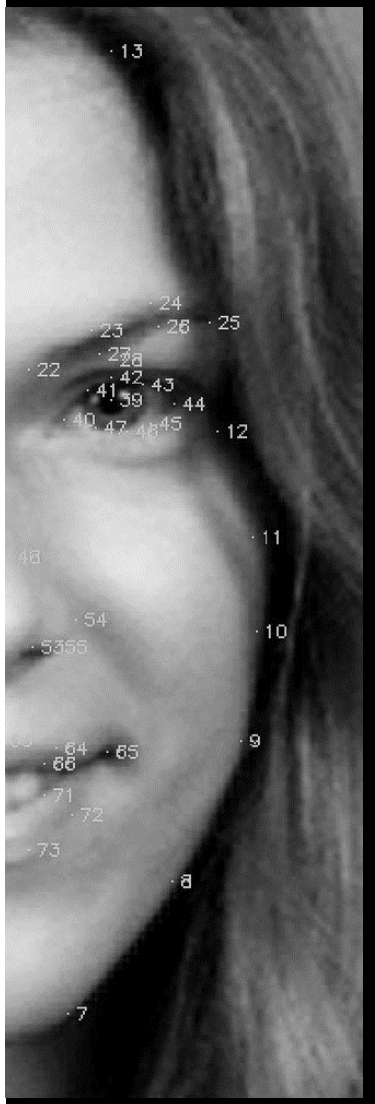
Color-Only based Model

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

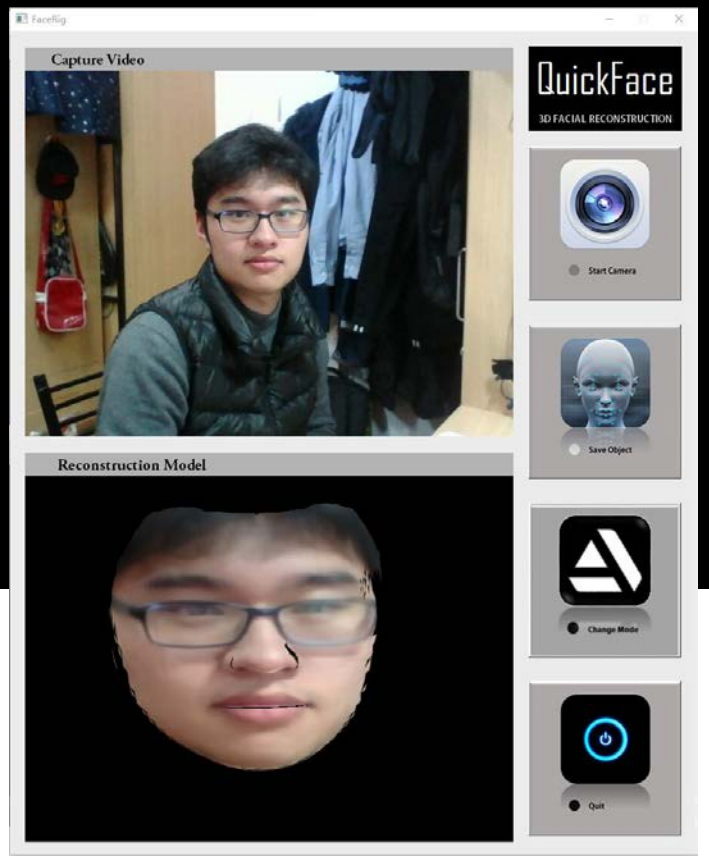
3D Reconstruction

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

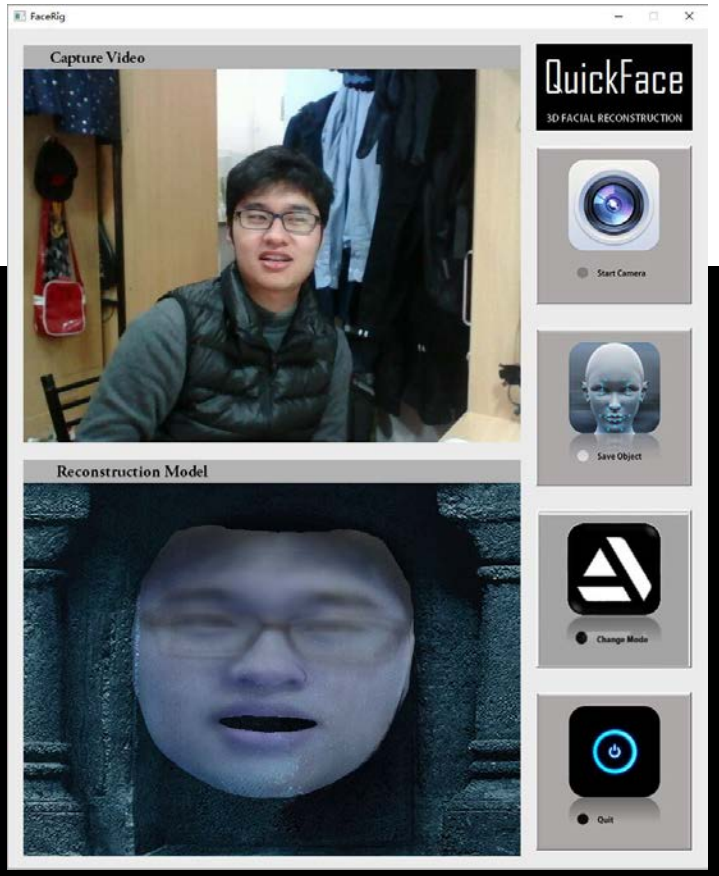




Function and UI Design



Camera capture
Save object
Change mode



Active Appearance Model

Core Algorithm Implementation

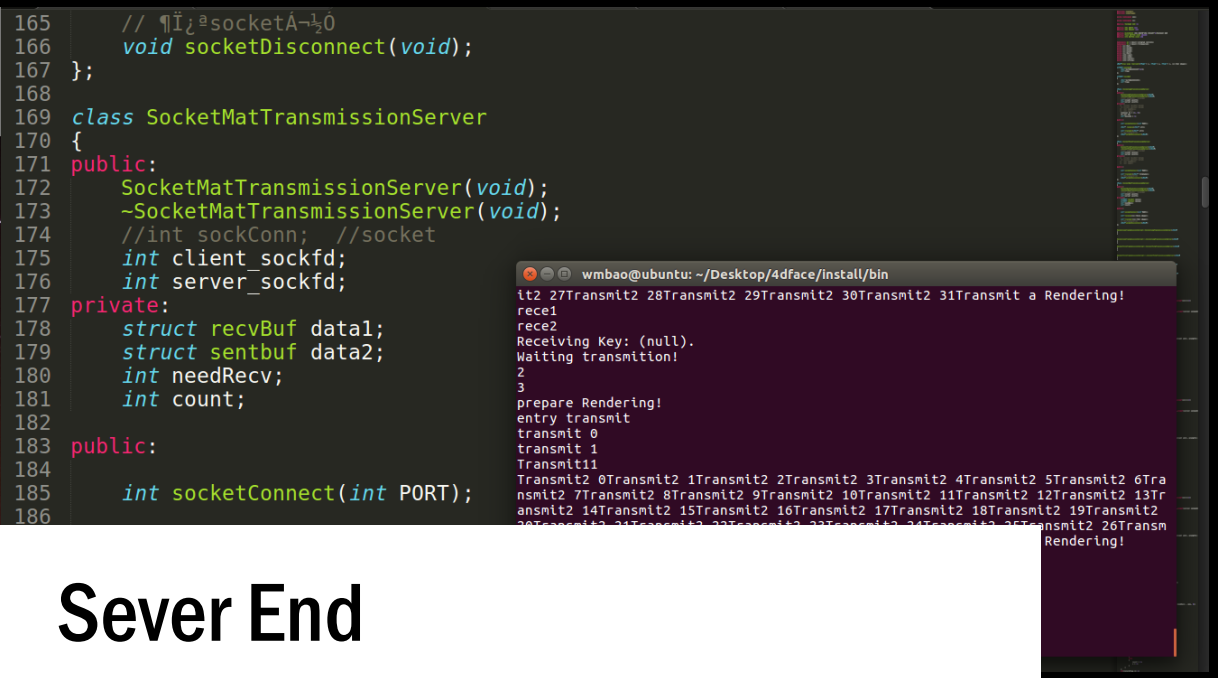
ASM

- 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

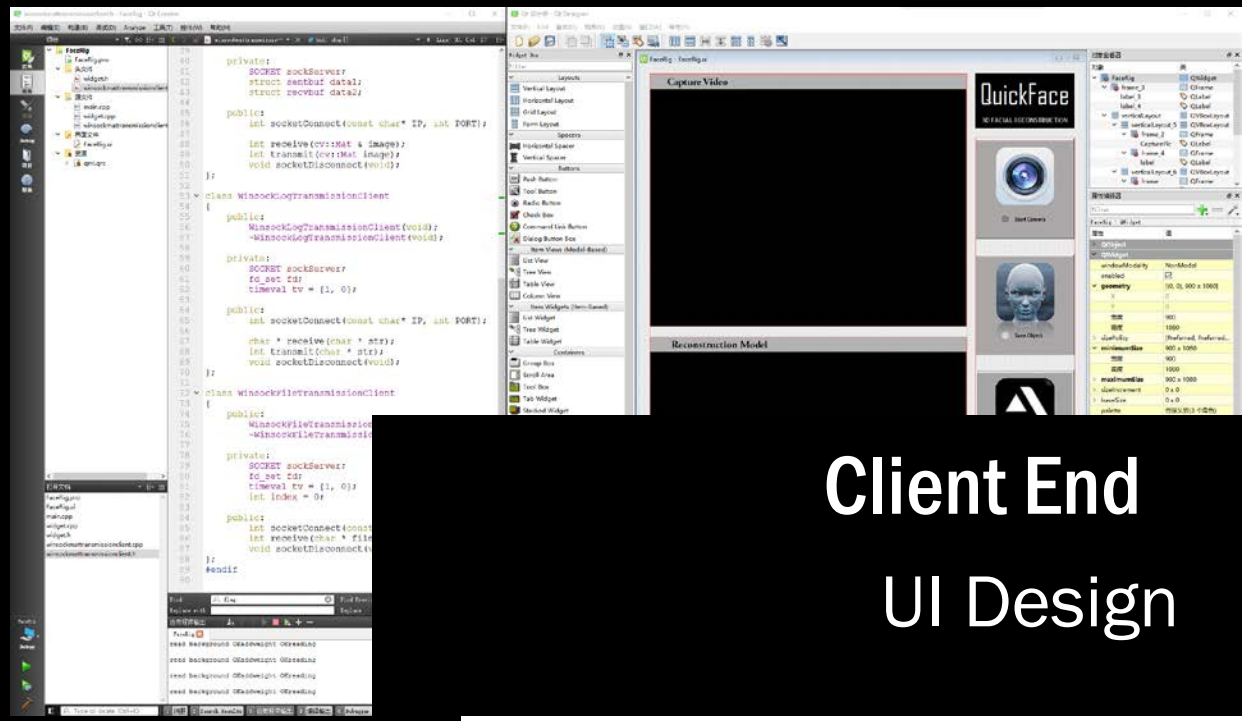
Function and UI Design



Sever End

Divided into sever end and client end with high performance

Socket Based



Client End

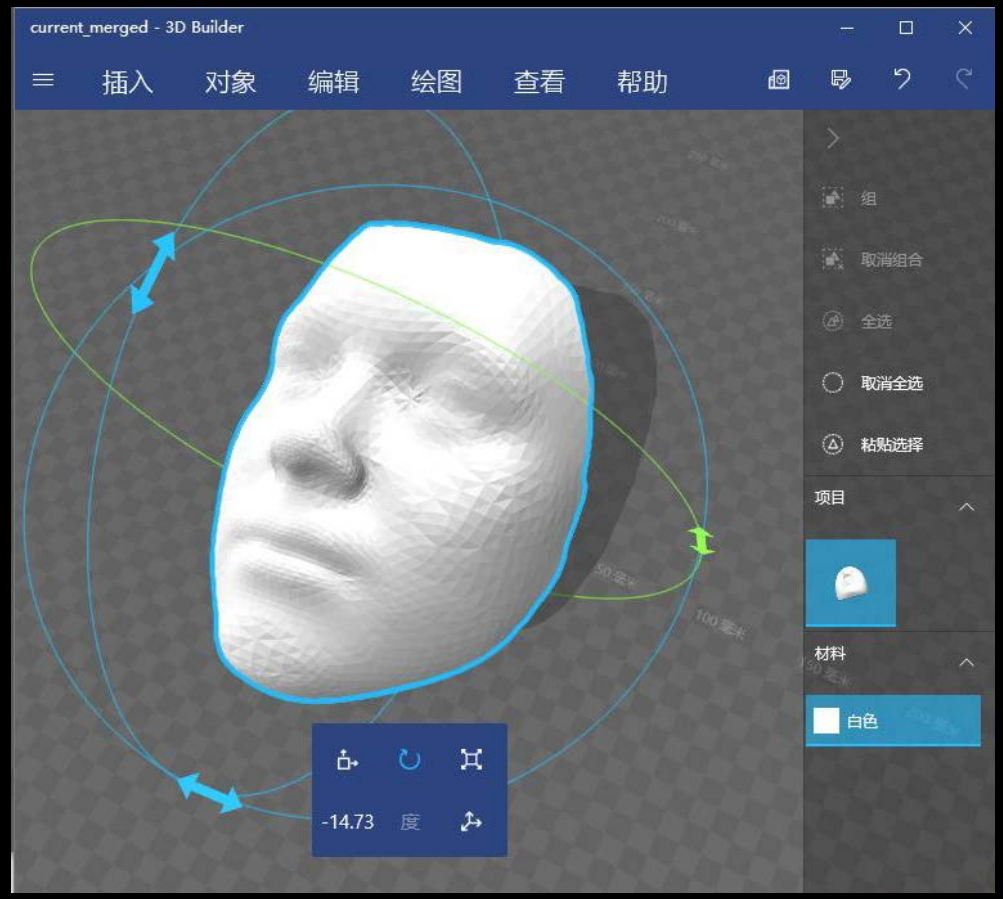
UI Design

Graphical buttons with Minimalist design make it easy to use

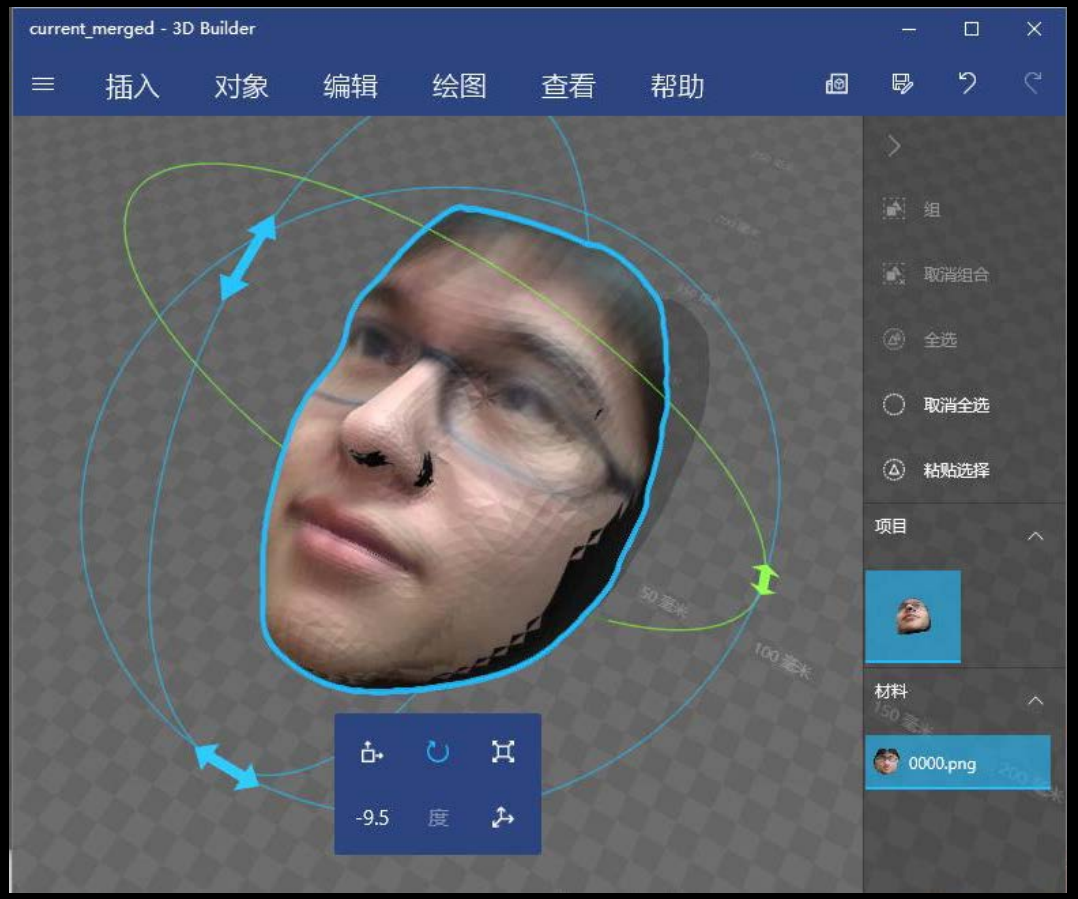
Function show

3D Reconstruction of Human Faces

Save 3D facial model



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.