FACE RECONSTRUCTION

MTech (Integrated)

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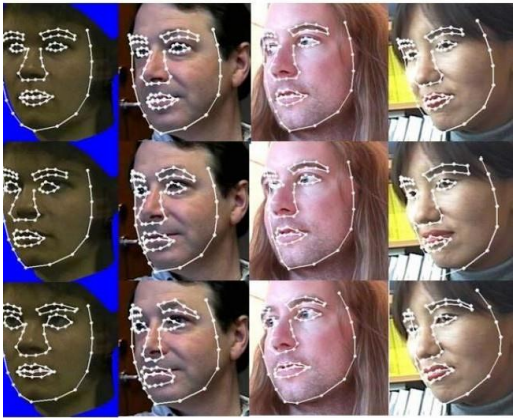
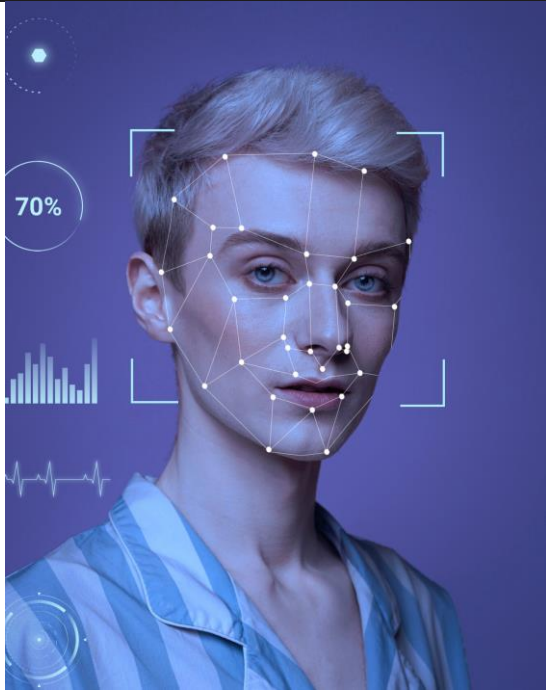


Face Reconstruction

Introduction

Face reconstruction is the process of creating a digital 3D model of a human face. This technology has various applications in fields like forensic science, entertainment, and medicine. It is achieved through the use of 3D scanning and specialized software.

This process requires a high degree of accuracy and attention to detail to ensure that the resulting model is as realistic as possible.



Problem Statement

- The problem of predicting the facial geometry by aligning a facial mesh template, on facial landmark localization, also called face alignment or face registration, arguably one of the most heavily researched topics in computer vision over the last decades, has for a long time been a corner stone of computer vision.
- In this work, we focus on landmark localization, in particular, on facial landmark localization, that is commonly posed in terms of locating relatively few landmarks, or key points.
- Thus, works start to use CNNs to estimate the 3D Morphable Model (3DMM) coefficients or 3D model warping functions to restore the corresponding 3D information from a single 2D facial image, which provides both dense face alignment and 3D face reconstruction results.

Application and use cases

A. BIOMETRIC IDENTIFICATIO N

B. VIRTUAL REALITY (VR) AND AUGMENTED REALITY (AR)

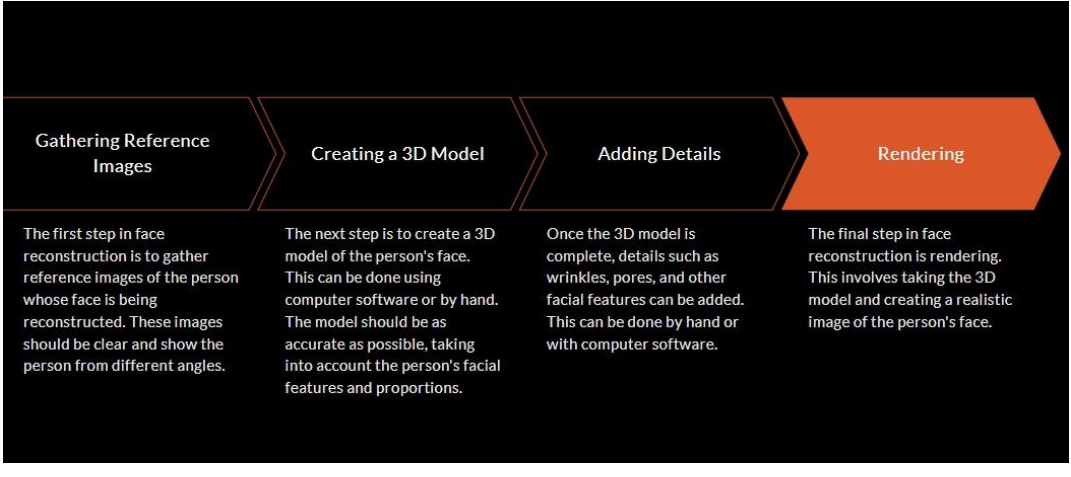
C. FACIAL ANIMATION AND CHARACTER MODELING

D. MEDICAL AND FORENSIC APPLICATIONS

The proposed method consist of three main tasks-

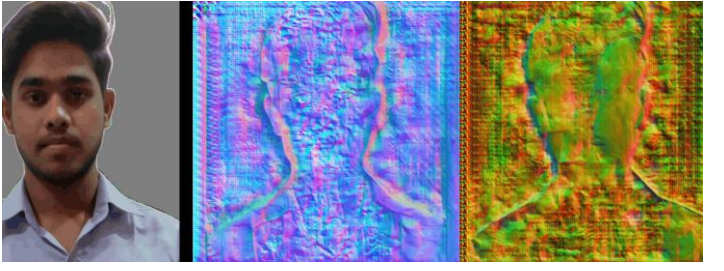
- Face Detection and Tracking
- Face alignments
- Reconstruction of the Face

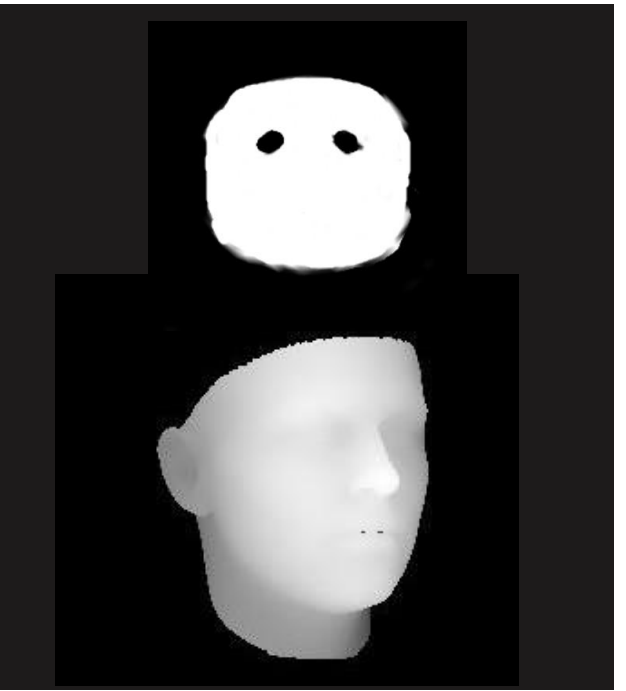
Steps to follow



3D Scanning

The first step in **face reconstruction** is 3D scanning. This involves taking multiple images of the face from various angles and using specialized software to create a 3D model. The accuracy of the 3D model depends on the quality of the images captured.



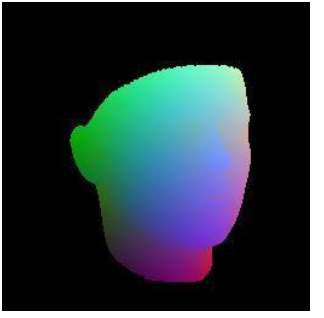


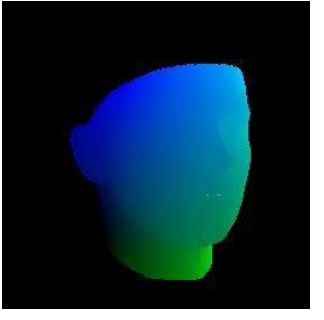
Mesh Creation

Once the 3D model is created, the next step is mesh creation. This involves creating a mesh, or a wireframe, of the face. The mesh is then used to create a surface that can be manipulated to create a digital 3D model of the face.

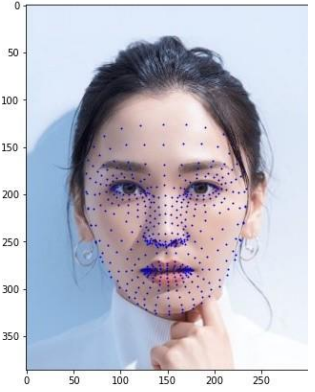
Texture Mapping

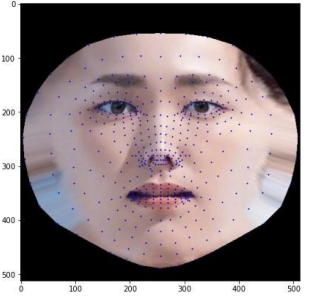
Texture mapping is the process of adding color and texture to the digital 3D model of the face. This is achieved through the use of photographs of the person's face. The photographs are mapped onto the 3D model to create a realistic appearance.



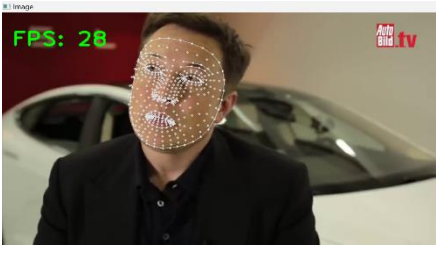


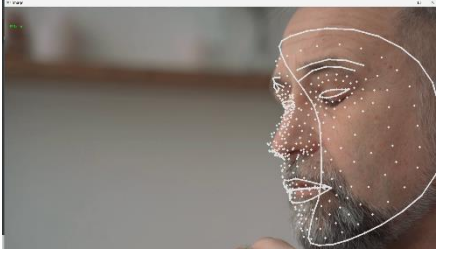
Face alignment and tracking



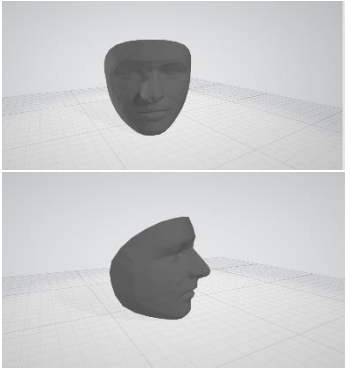


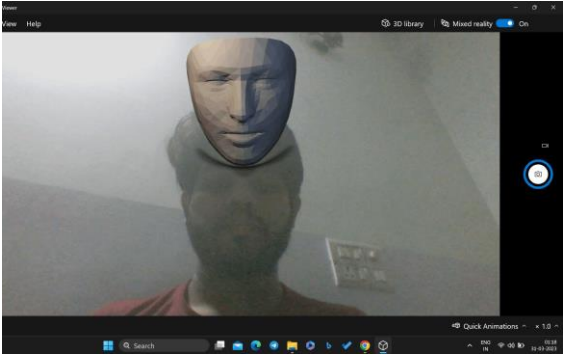
Results





Result of Frontal Face





Future Work

Dynamic reconstruction-

Although we achieved significant improvements compared to original algorithm applied frame-by-frame and our straightforward implementation we believe some modifications could be done to further improve our solution:

- Complete other face related tasks and 3D face reconstruction in the meantime, such as face recognition and face alignment.
- Improve runtime for enhancement.
- Robust cost function such as renderer loss should be used instead of L2 norm, especially for regularization.
- Explicit color or pncc losses should be implemented (exploiting the ability to add non-linear losses).
- Visual tracking or facial landmark detection should be used to ensure better temporal smoothness.
- CUDA version of our code should be finished to achieve real-time performance.

Conclusion

In conclusion, **face reconstruction** technology has a wide range of applications. From creating realistic digital avatars for entertainment purposes to identifying criminals using facial recognition software, this technology has the potential to revolutionize various industries.

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Thanks!