Joint Face Alignment and 3D Face Reconstruction

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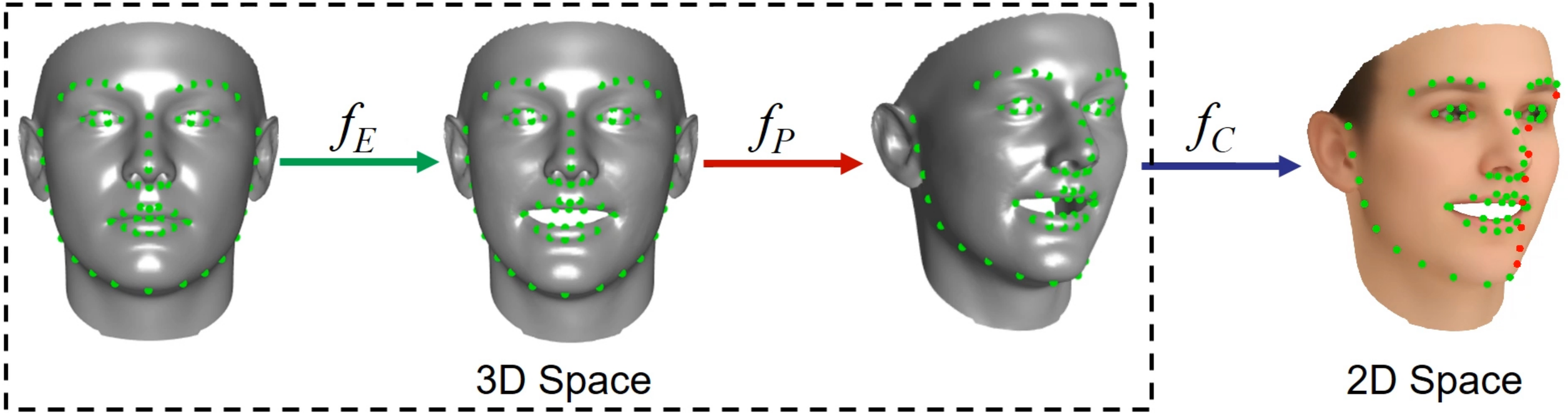
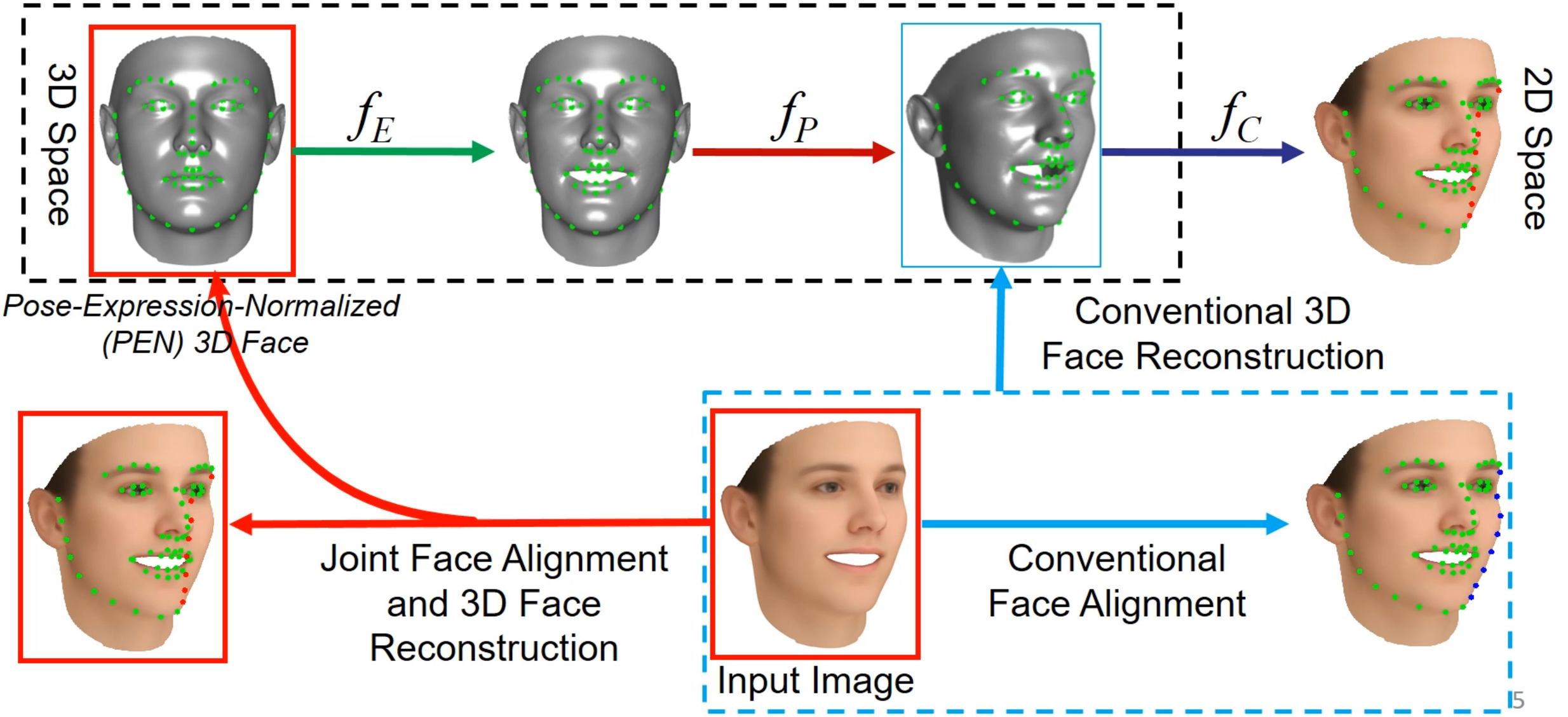
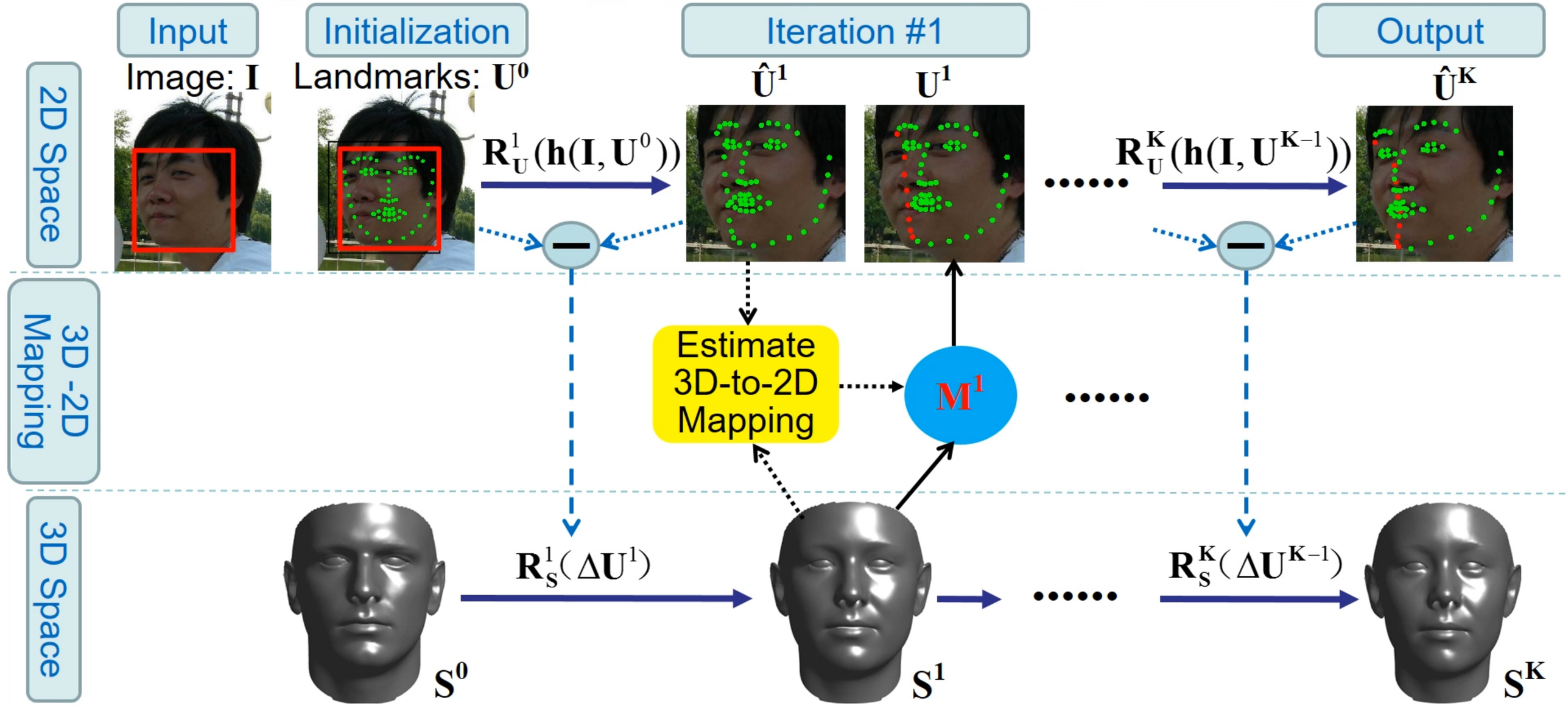
The problem: 3D shape vs 2D landmarks



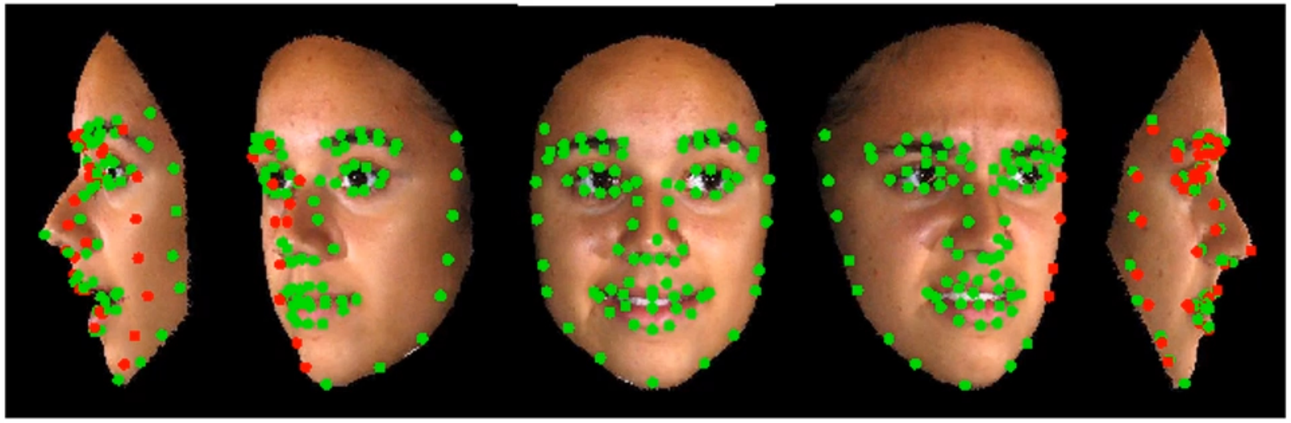
The problem: 3D shape vs 2D landmarks



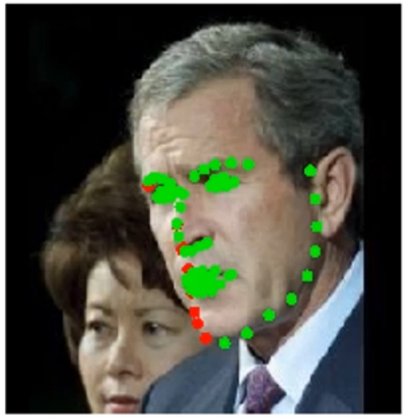
Cascaded Coupled-Regressors Method



Training Data



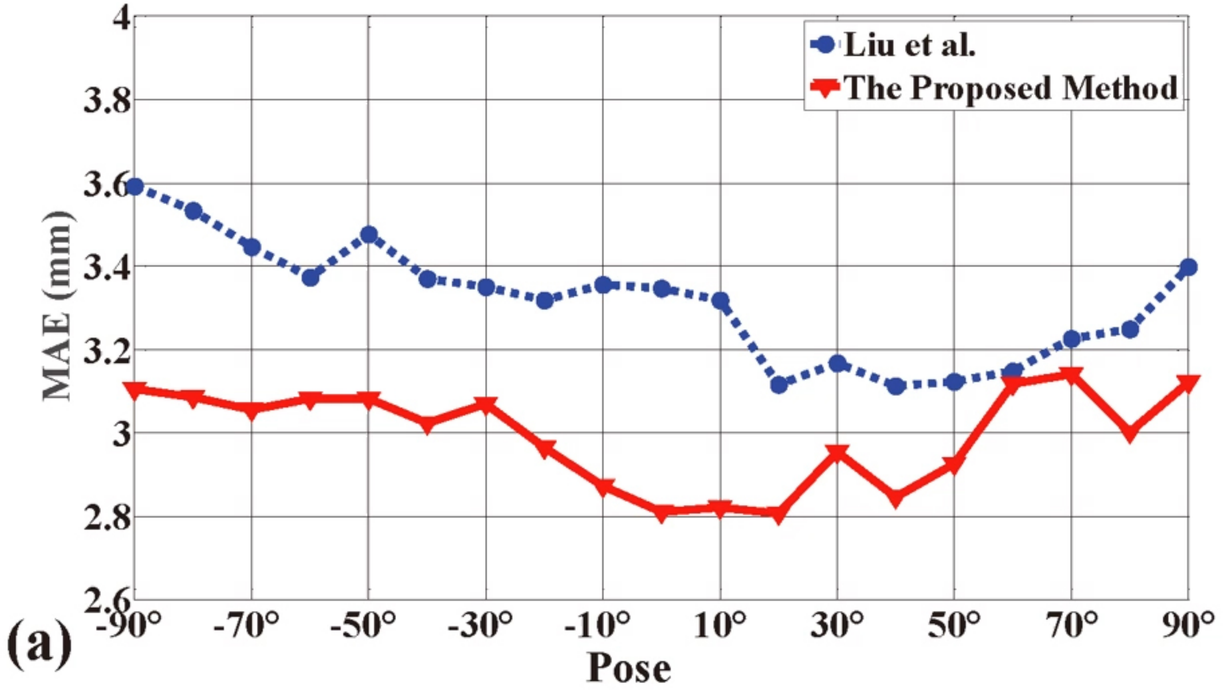
BU3DFE data:
Images : 13,300 (100 Subjects, 7 expressions, 19 poses)
3D scans: 100 (frontal, neutral)

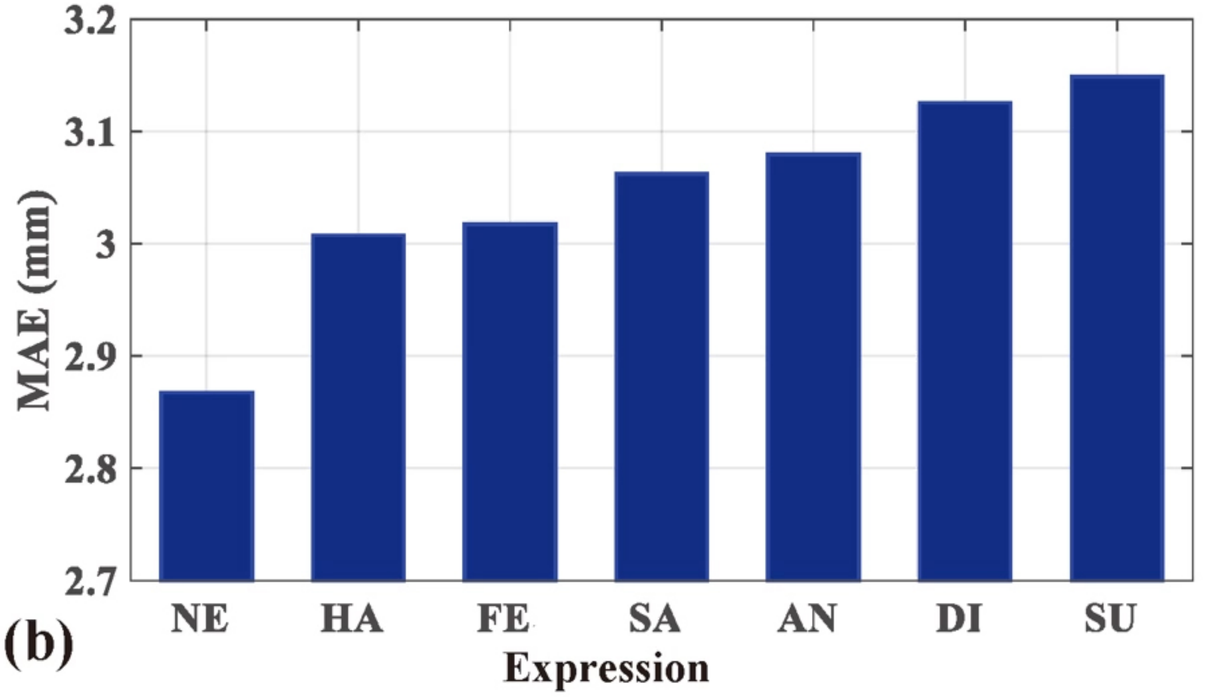


LFW data:
Images: 4,149 (150 subjects)
3D scans: 150 (frontal, neutral)

Result I: 3D Face Reconstruction Accuracy

3D face reconstruction accuracy on BU3DFE database





MAE of the proposed method on BU3DFE (a) under different yaw angles and (b) under different expressions.

Result II: Face Alignment Accuracy

Face alignment accuracy on AFW database

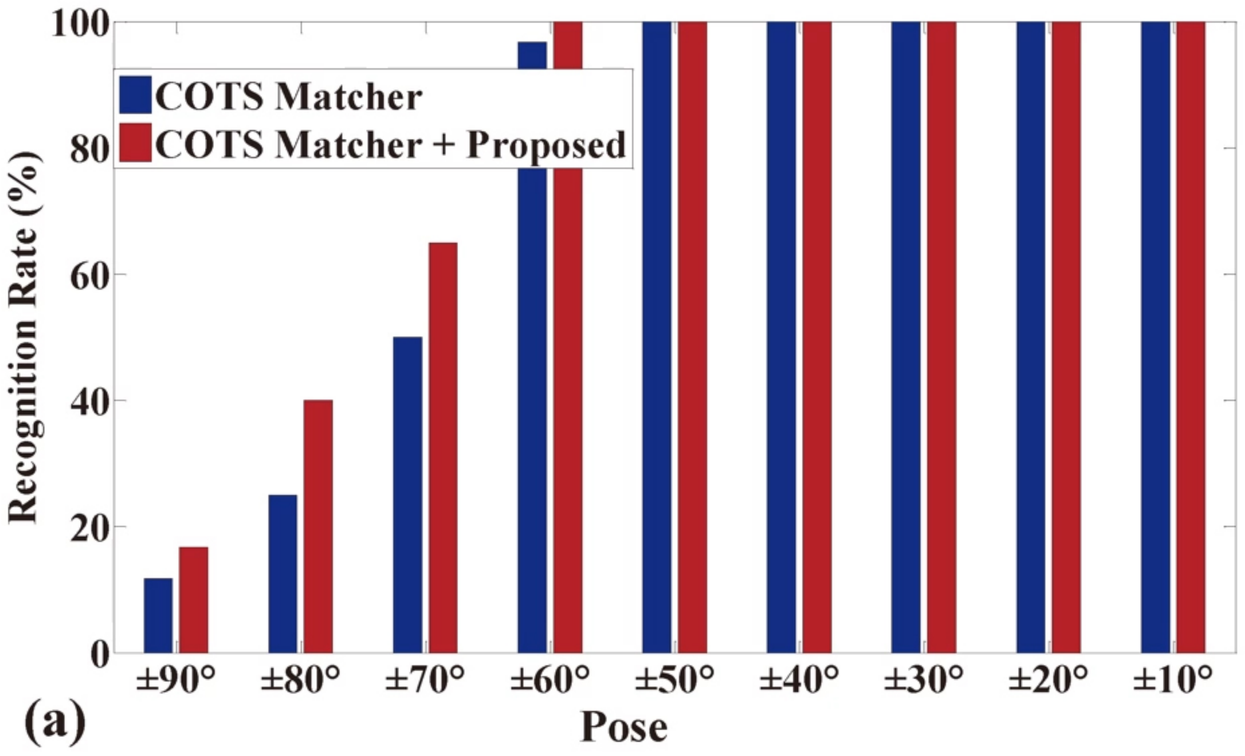
Method	CDM (ICCV'13)	PIFA (ICCV'15)	The proposed method
NME	7.52%	5.60%	3.15%

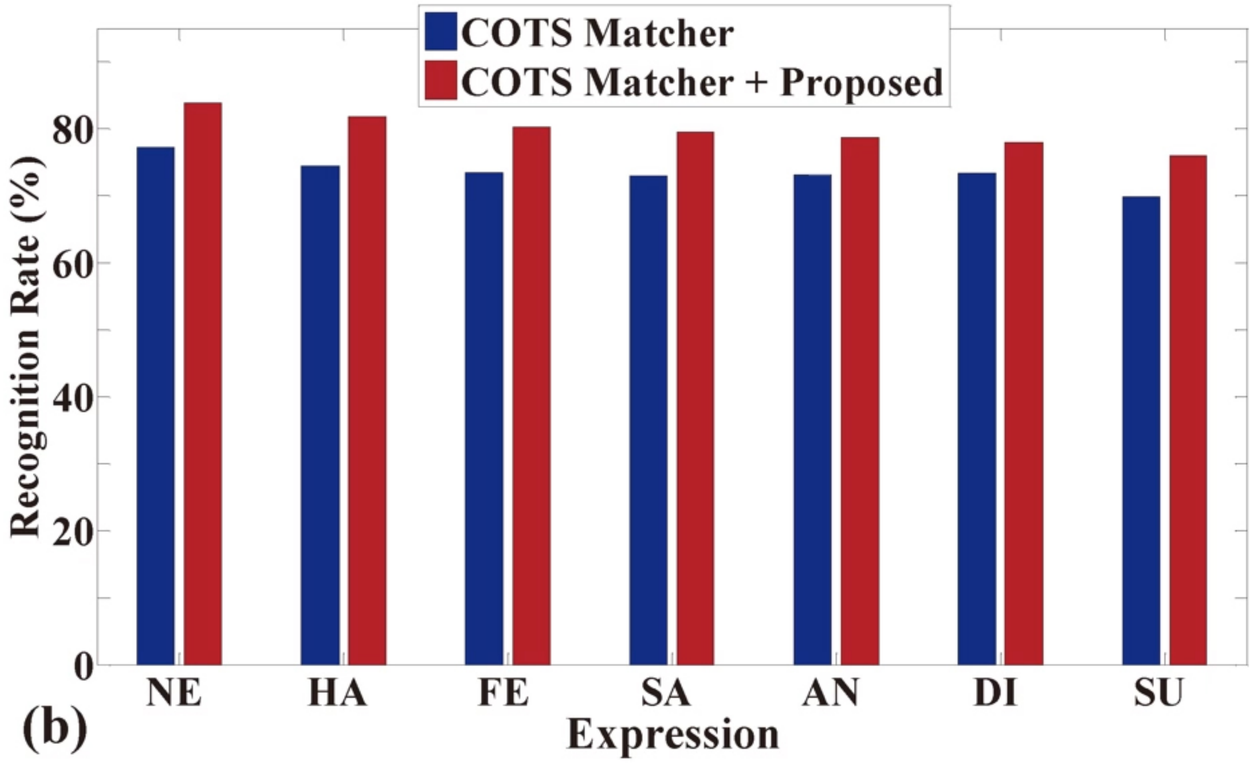
NME of the proposed method and two baseline methods on AFW.

$$NME = \frac{1}{N_T}\sum_{i=1}^{N_T}\left(\frac{1}{d_i}\frac{1}{N_i^{v}}\sum_{j=1}^{l} v_{ij} \left\| (\hat{u}_{ij}, \hat{v}_{ij}) - (u_{ij}^{*}, v_{ij}^{*}) \right\|\right)$$

Result III: 3D Face Recognition

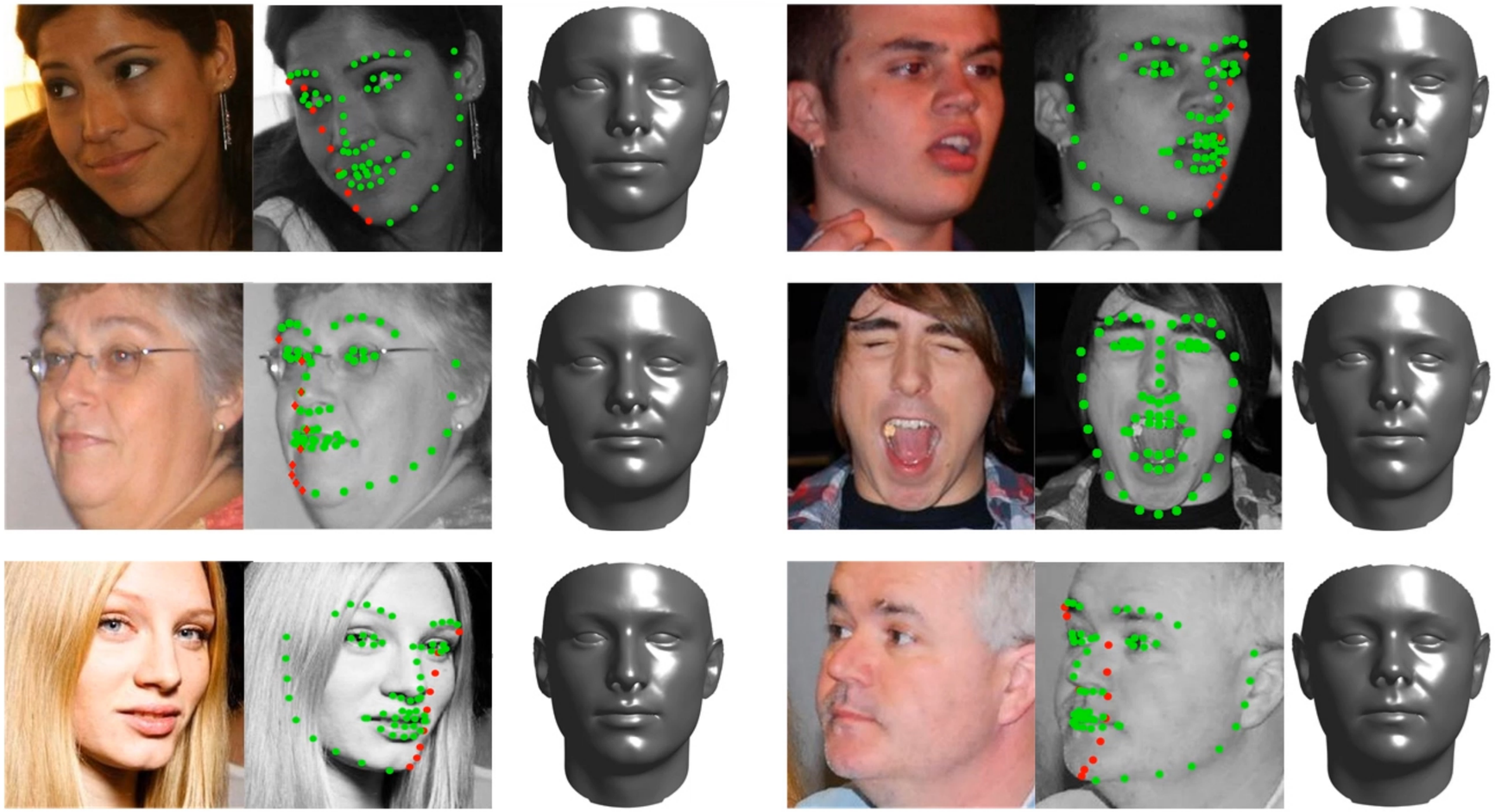
7-fold cross validation on BU3DFE database





Face recognition results of commercial off-the-shelf (COTS) 2D face matcher and its fusion with proposed reconstructed 3D face based matcher under varying (a) poses and (b) expressions.

Additional Results



Computational Efficiency: ~26FPS (i7-4710 CPU, MATLAB implementation, 5 iterations)