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3D morphable model for real-time face reconstruction

presented by

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Project 1

BeingTogether Centre

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Teleconferencing scenarios based on head mounted device



Teleconferencing scenarios system*

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*<https://www.microsoft.com/en-us/hololens/developers>

Pipeline

- 3D face reconstruction
- Real-time runtime
- 3D face re-enactment

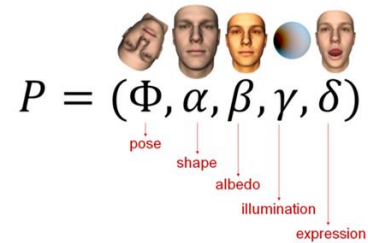
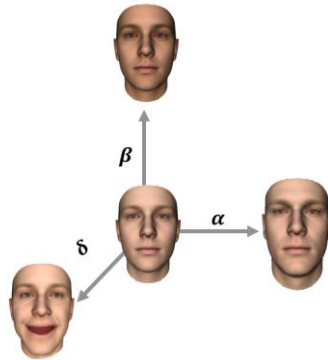
3D morphable model

- 3D face dataset*



3D morphable model

- Parametric model*



$$\begin{aligned} \mathcal{M}_{\text{geo}}(\alpha, \delta) &= \bar{\mathbf{a}}_{\text{id}} + E_{\text{id}} \cdot \alpha + E_{\text{exp}} \cdot \delta, \\ \mathcal{M}_{\text{alb}}(\beta) &= \bar{\mathbf{a}}_{\text{alb}} + E_{\text{alb}} \cdot \beta. \end{aligned}$$

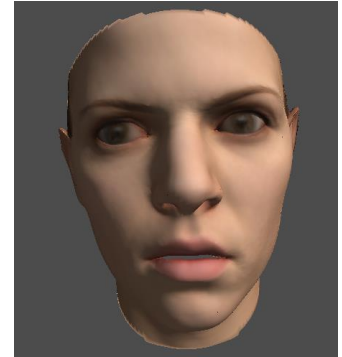
3D morphable model reconstruction

- Model fitting (inverse render)



$$P = (\Phi, \alpha, \beta, \gamma, \delta)$$

pose shape albedo illumination expression



- Optimization

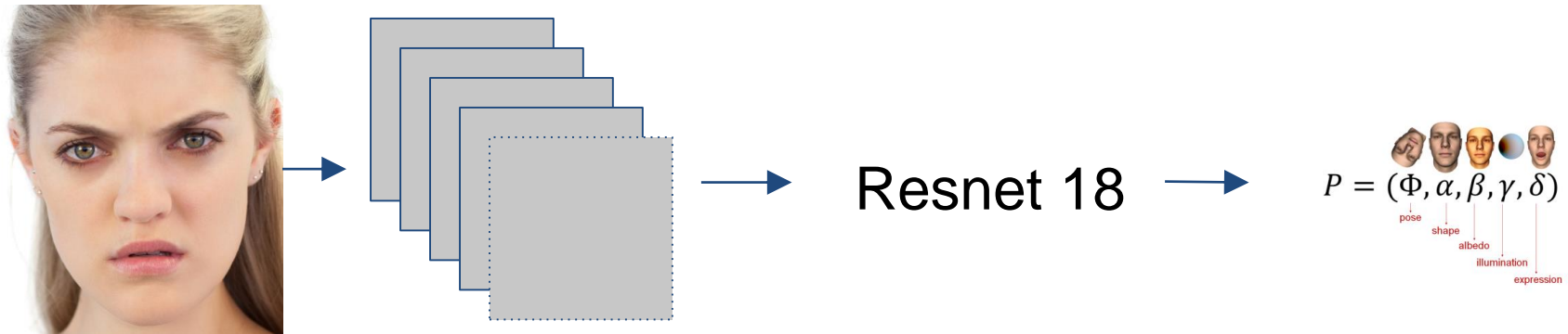
- Color function:

$$C_S(p) = L^T \phi(n_p) \cdot \rho_p$$

- Energy function:

$$E(\mathcal{P}) = \underbrace{w_{col} E_{col}(\mathcal{P}) + w_{lan} E_{lan}(\mathcal{P})}_{data} + \underbrace{w_{reg} E_{reg}(\mathcal{P})}_{prior}$$

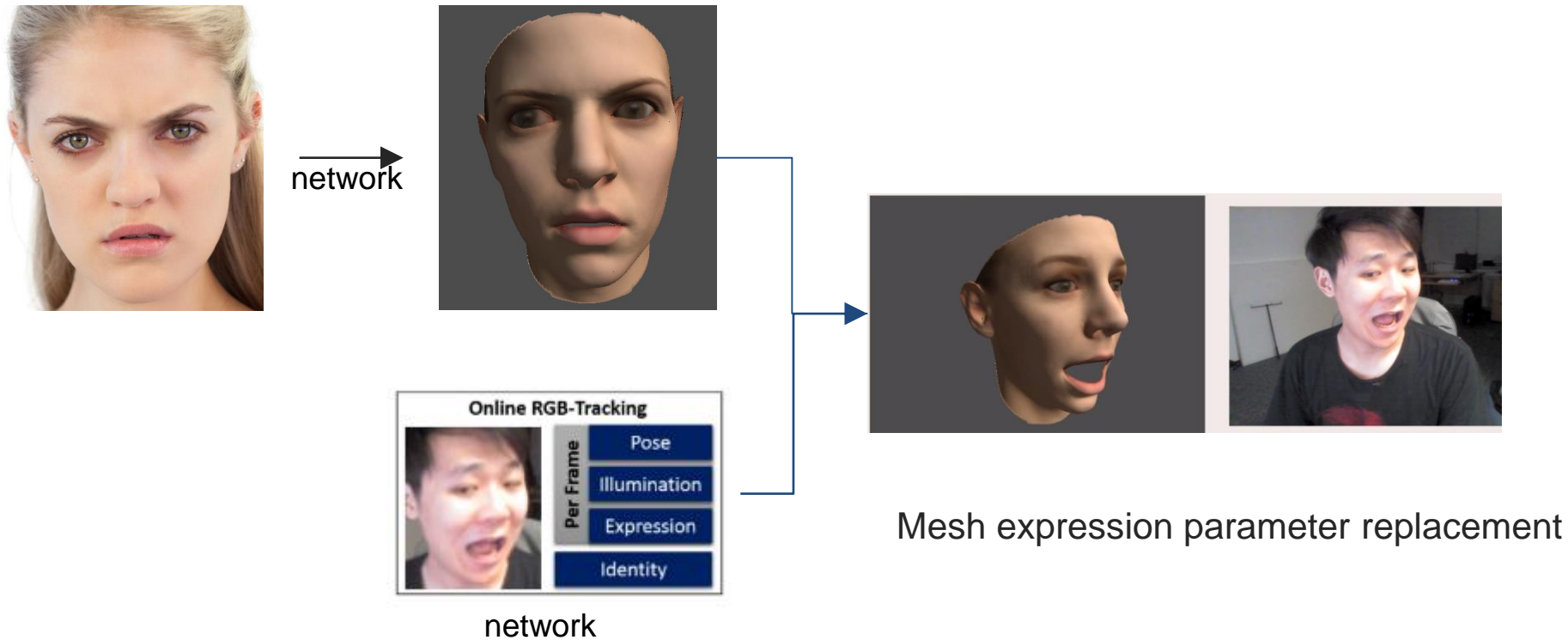
Solver acceleration using network



Regression problem

3D Face Re-enactment

- Expression Transfer



Papers and Publications

- Papers in processing

[1] Conditional adversarial synthesis of 3D facial action units.

[2] 3D face reconstruction with large HMD occlusion.

Q & A