



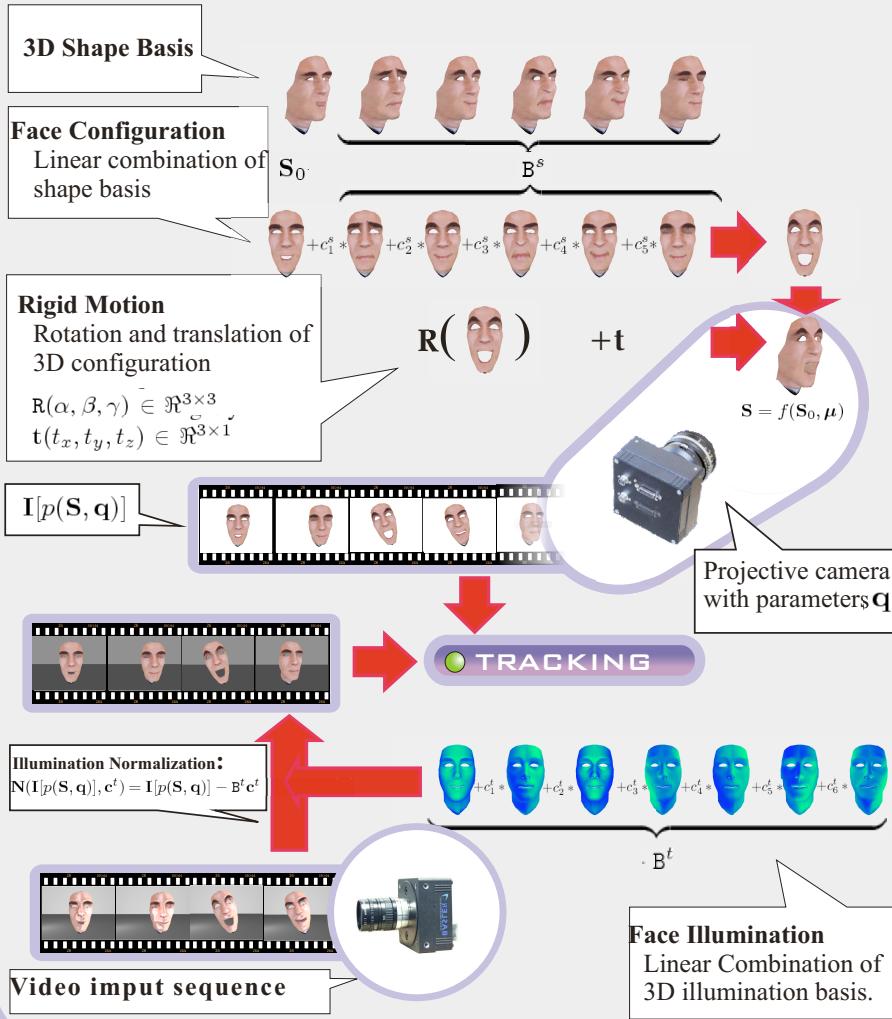
EFFICIENT MODEL-BASED 3D TRACKING OF DEFORMABLE OBJECTS

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THE MODEL



TRACKING

Tracking amounts to minimize:

$$\min_{\delta\mu, \delta c^t} \|N(I[p(f(S_0, \mu_t), q), t + \delta t], c_t^t) - N(I_r[p(f(S_0, \delta\mu), q_r)], c_r^t + \delta c^t)\|^2$$

This equation is linearly solved :

$$\begin{bmatrix} \delta\mu \\ \delta c^t \end{bmatrix} = (M_0^\top M_0)^{-1} M_0^\top \mathcal{E}(t + \delta t)$$

Error term:

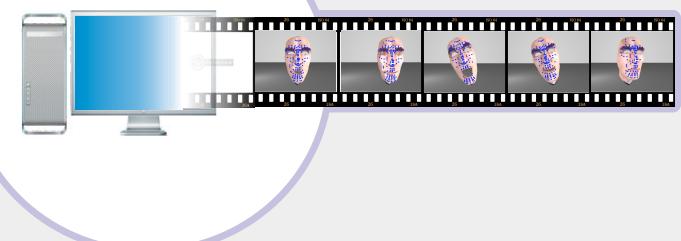
$$\mathcal{E} = I[p(f(S_0, \mu_t), q), t + \delta t] - I_r - B^t(c_t^t - c_r^t)$$

 M_0 is constant for the whole sequence

ALGORITHM

- **Off-line:**
 1. Compute M_0 .
 2. Compute and store $M^+ = (M_0^\top M_0)^{-1} M_0^\top$.
 3. Compute and store $I_r = I_r[p(f(S_0, q_r)]$.
- **Online:**
 1. $\mathcal{E} = I[p(f(S_0, \mu_t), q), t + \delta t] - I_r - B^t(c_t^t - c_r^t)$.
 2. Compute $[\delta\mu, \delta c^t]^\top = M^+ \mathcal{E}$.
 3. Update $c_{t+\delta t}^t = c_t^t - \delta c^t$.
 4. Update $R_{t+\delta t} = R_t \delta R^\top$, $t_{t+\delta t} = t_t - R_t \delta R^\top \delta t$.
 5. Update $c_{t+\delta t}^t = c_t^t - \delta c^t$.

RESULTS



CONCLUSIONS

We have introduced an efficient and simple model-based 3D tracking algorithm applicable to the full projective camera case.

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