Overview
• Dynamic texture overlay for real-time visualization of garments
• Tracking of complex garment deformations from monocular images exploiting optical flow constraints
• Illumination and shading recovery from original image

Optical Flow Based Garment Tracking
• We exploit the optical flow constraint along with a predefined motion model. Finding the best transformation amounts to minimizing a quadratic error that can be solved in a least squares sense:

\[ E = \sum_{i,j} \left( \nabla I(x_i,y_j) \cdot d(x_i,y_j) + \frac{\partial I}{\partial t}(x_i,y_j) \right)^2 \]

• We use a mesh-based motion parameterization:

\[ d(x_i,y_j) = \sum_{j=1}^{3} B_j(x_i,y_j) \cdot \delta \bf{v}_j \]

• Incorporating additional smoothing constraints yields:

\[ E = \sum_{i,j} \left( \nabla I(x_i,y_j) \cdot d(x_i,y_j) + \frac{\partial I}{\partial t}(x_i,y_j) \right)^2 \]

\[ + \lambda \sum_{k=1}^{N} w_k E_s(\delta \bf{v}_k) \]

with

\[ E_s(\delta \bf{v}_k) = \left( \delta \bf{v}_k - \frac{1}{|N_k|} \sum_{n \in N_k} \delta \bf{v}_n \right)^2 \]

Self-Occlusion Handling
• Foldings of the 2D mesh at self-occlusion boundaries cause inaccuracies during tracking. Self-occlusions are handled by weighting the smoothing constraints locally according to the self-occlusion of a region [1].

Illumination and Shading Recovery
• Tracking and retexturing from monocular images without 3D reconstruction requires an estimation of illumination and shading.

• The input images already exhibit the illumination and shadows to be rendered onto the virtual texture.

• We use textures that consist of points, lines or curves and a shading map is established by removing the structure and interpolating the intensity of the texture pixels.

• The result is a smooth shading map that preserves shadows at main wrinkles and fold overs.

Results
• Robust deformable surface tracking method from monocular images sequences that can cope with strong deformations and partial self-occlusions.

• The exploitation of real lighting for retexturing increases the realistic perception of the virtual texture.

• The method is integrated into a real-time Virtual Mirror setup for virtual garment fitting.

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References

Cloth tracking and retexturing. Original images and augmented results (left to right)