4D Temporally Coherent Light-field Video

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Problems

Existing light-field methods suffer from following limitations:

- Limited to static scenes;

- Requirement to acquire a dense scene representation;

- Large amount of data;

- Lack of temporal coherence;

- Challenges in storage, compression and editing.

Contributions

- 4D Temporally coherent dynamic light-field video

- EPI from sparse light-field video for spatio-temporal correspondence

- Sparse-to-dense light-field scene flow exploiting EPI image

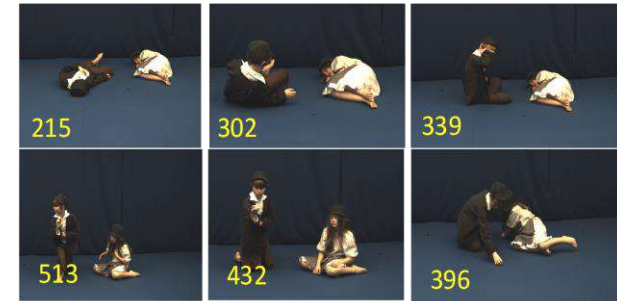- Efficient representations to facilitate editing for live action VR

Input light-field video   2D dense flow   4D temporal coherence

4D Temporally coherent light-field video
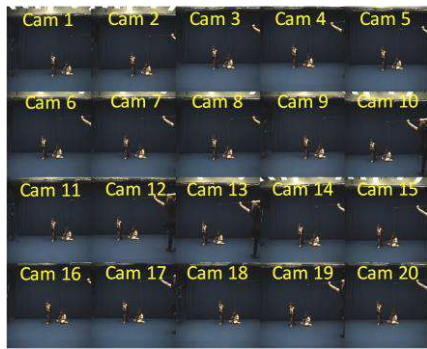
Light-field video

Mesh

Key-frame detection

215   302   339

513   432   396

4D Temporally coherent light-field video

Light-field scene flow

Sparse temporal correspondence

Light-field scene flow
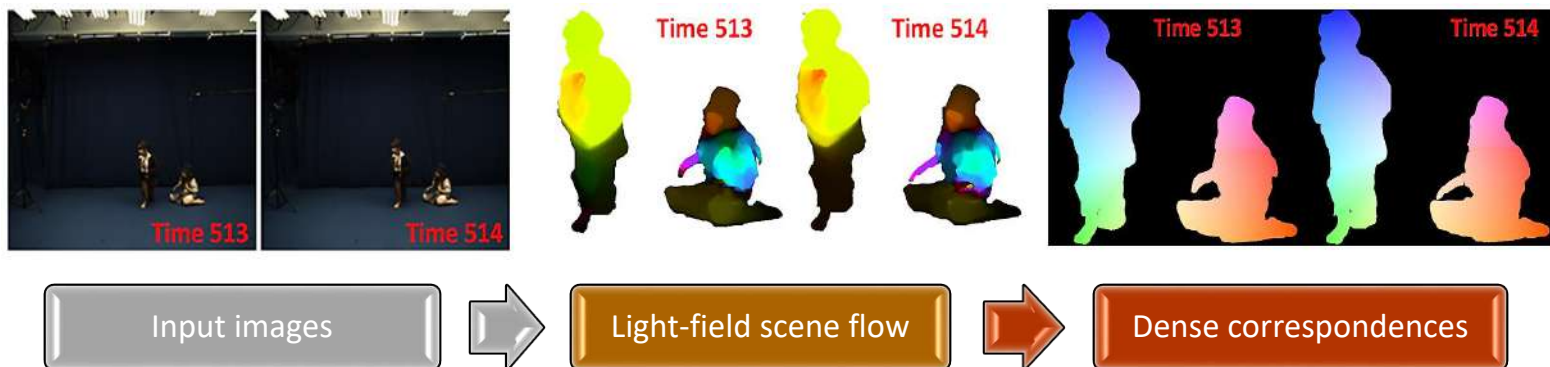
Input images → Light-field scene flow → Dense correspondences
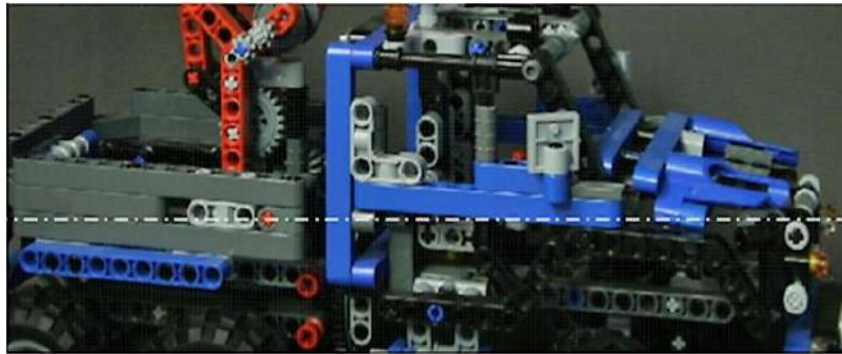
5

Light-field scene flow

$$E(M) = \sum \boxed{\alpha E_L \, (p, m_p)} + \beta E_C(p, m_p) + \eta E_R(p, m_p)$$

where M is the flow, p is the pixel and m_p is the flow at that pixel

- *Light-field consistency exploiting EPI image information.*

Light-field dataset captured with 17 X 17 camera array

EPI Image

Dense acquisition

Light-field dataset captured with 4 X 5 camera array
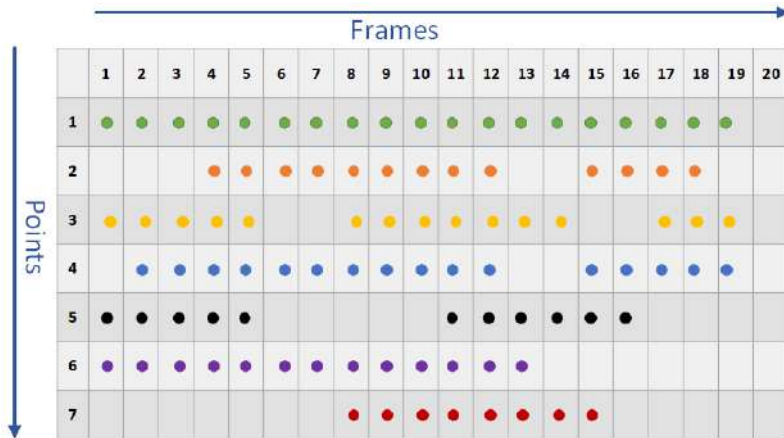
EPI Image

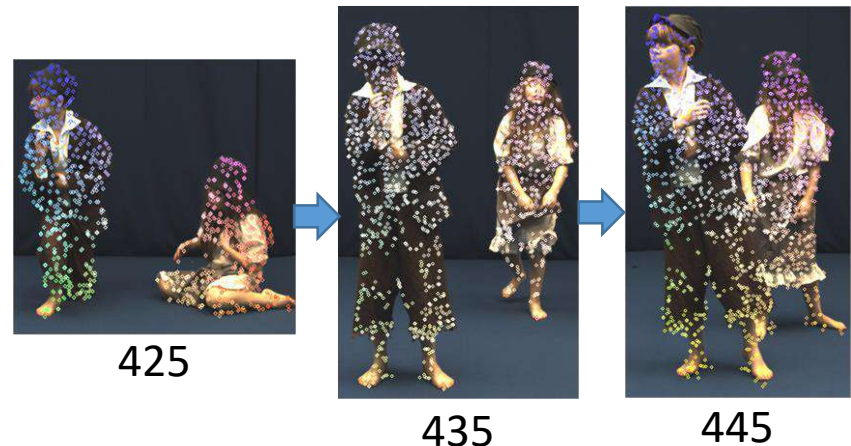Sparse acquisition

Light-field scene flow

$$E(M) = \sum \alpha E_L (p, m_p) + \beta E_C(p, m_p) + \eta E_R(p, m_p)$$

where M is the flow, p is the pixel and m_p is the flow at that pixel

- *Appearance consistency constraint by sparse temporal matches.*

Sparse temporal correspondence tracks

425

435

445

Light-field scene flow

$$E(M) = \sum \alpha E_L\,(p, m_p) + \beta E_C(p, m_p) + \boxed{\eta E_R(p, m_p)}$$

where M is the flow, p is the pixel and m_p is the flow at that pixel

- **To enforce motion smoothness and handle occlusions in areas with low confidence**

Input video
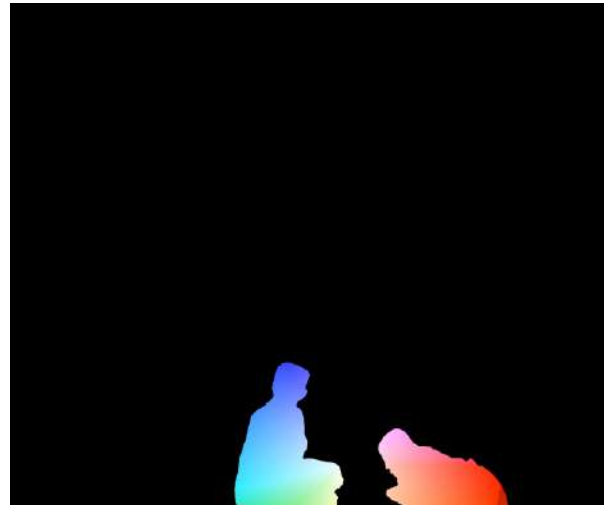
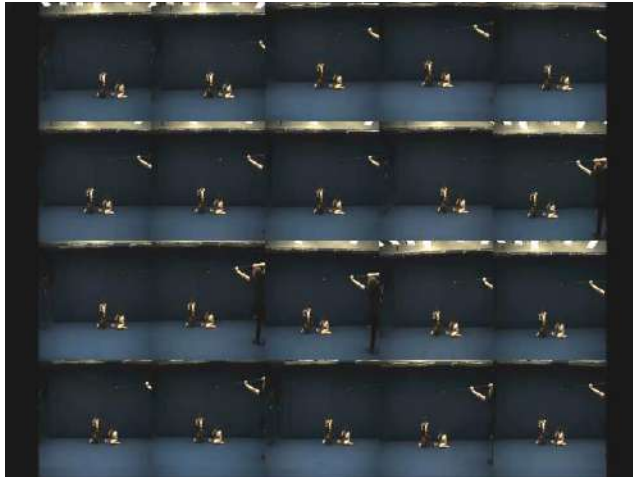Light-field scene flow

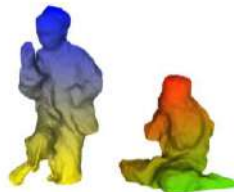# 4D Temporally coherent light-field video

Results

Light-field video
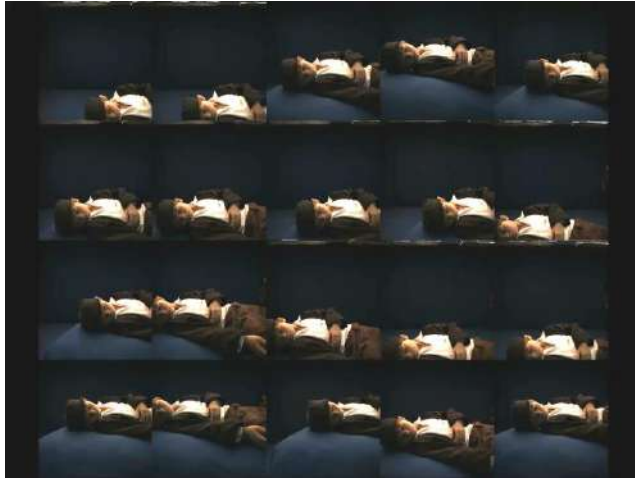

Camera 2 video

4D temporally coherent light-field video
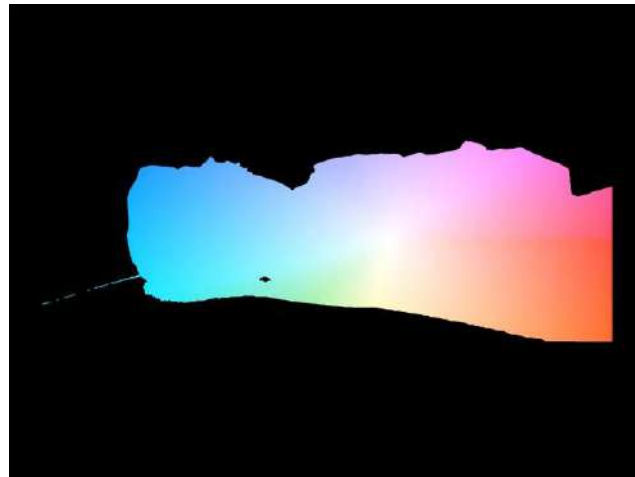
Light-field scene flow

Results

Light-field video
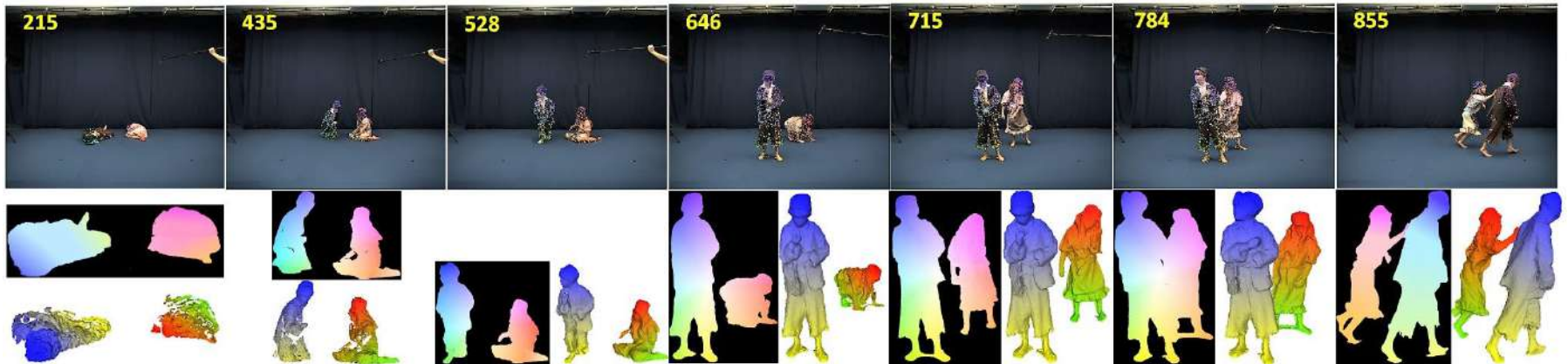
Camera 2 video

4D temporally coherent light-field video

Light-field scene flow

Conclusions

- 4D Temporally coherent dynamic light-field video

- EPI from sparse light-field video for spatio-temporal correspondence

- Sparse-to-dense light-field scene flow exploiting EPI image

THANKS FOR YOUR ATTENTION!

Walking Dataset
Input light field video