

# 4D Temporally Coherent Light-field Video

Armin Mustafa, Marco Volino, Jean-Yves Guillemaut, Adrian Hilton



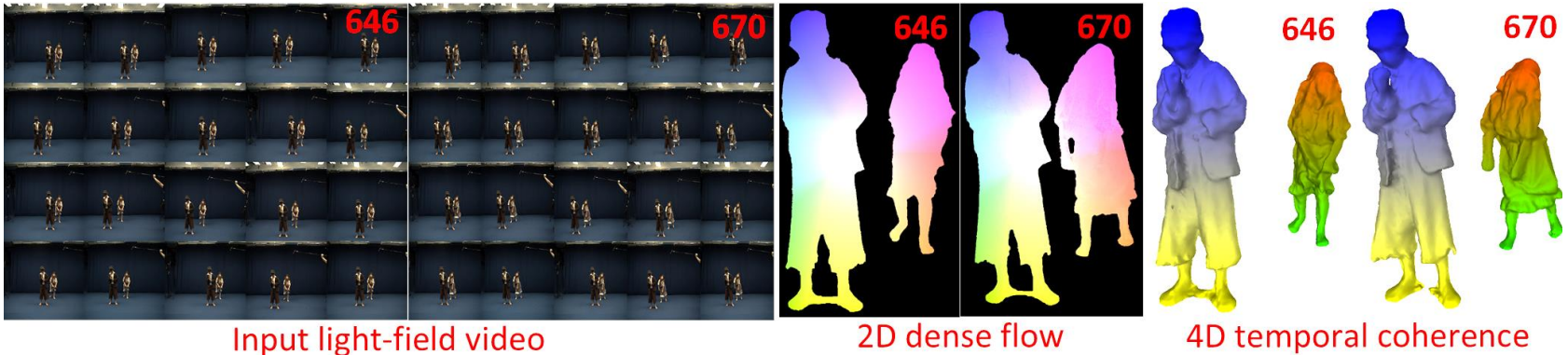
# Problems

Existing light-field methods suffer from following limitations:

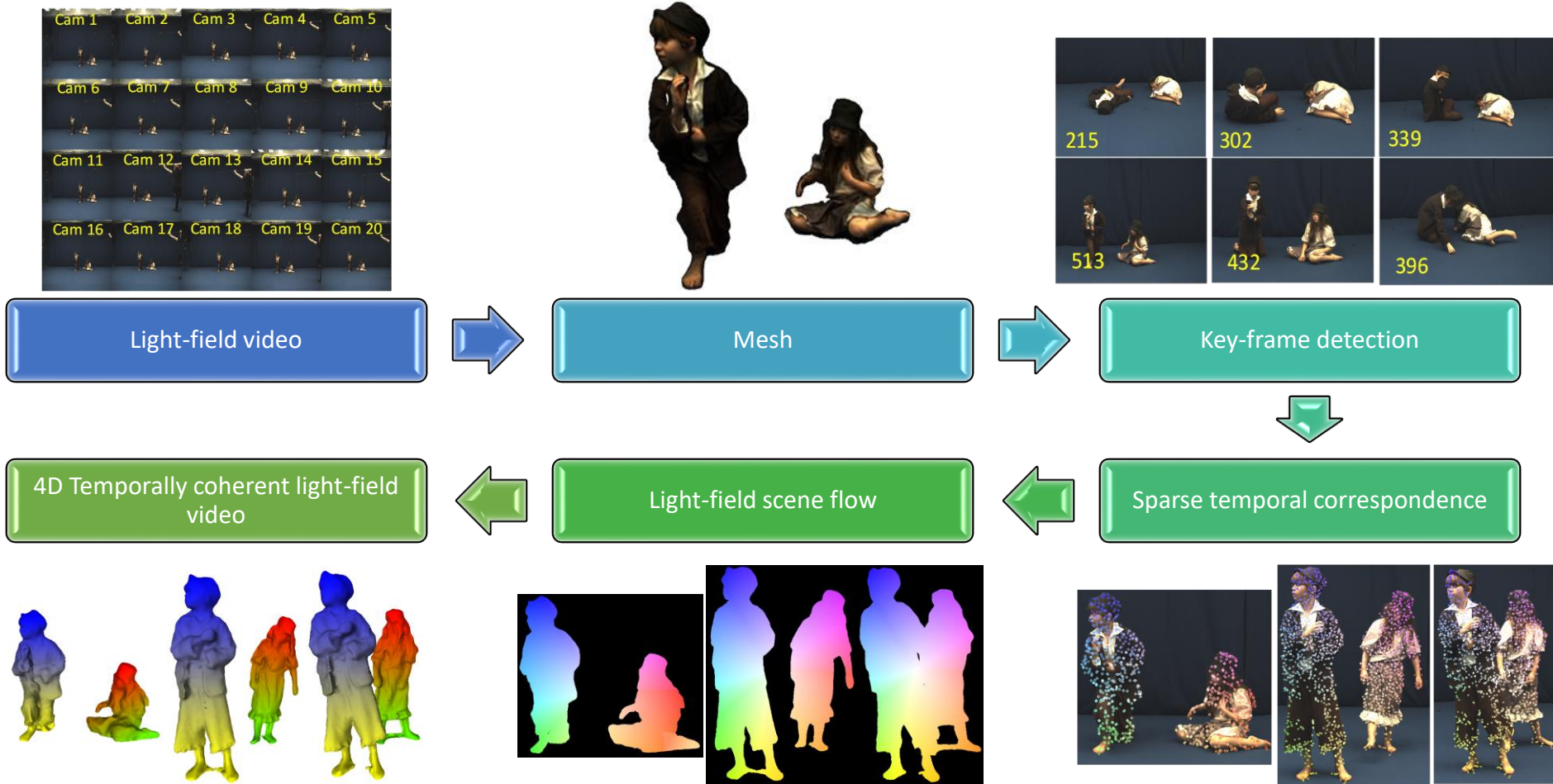
- Limited to static scenes;
- Requirement to acquire a dense scene representation;
- Large amount of data;
- Lack of temporal coherence;
- Challenges in storage, compression and editing.

# Contributions

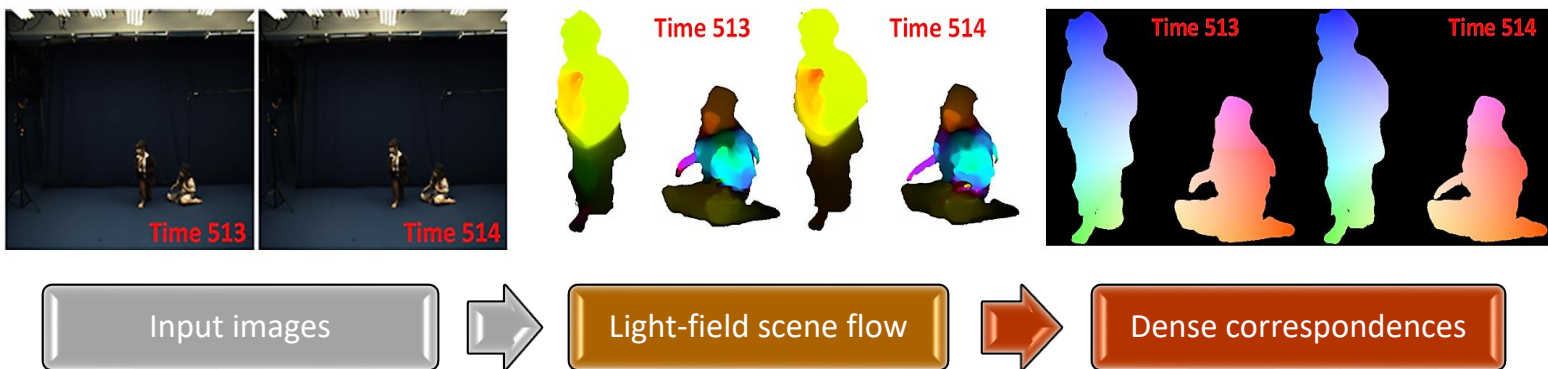
- 4D Temporally coherent dynamic light-field video
- EPI from sparse light-field video for spatio-temporal correspondence
- Sparse-to-dense light-field scene flow exploiting EPI image
- Efficient representations to facilitate editing for live action VR



# 4D Temporally coherent light-field video



# Light-field scene flow

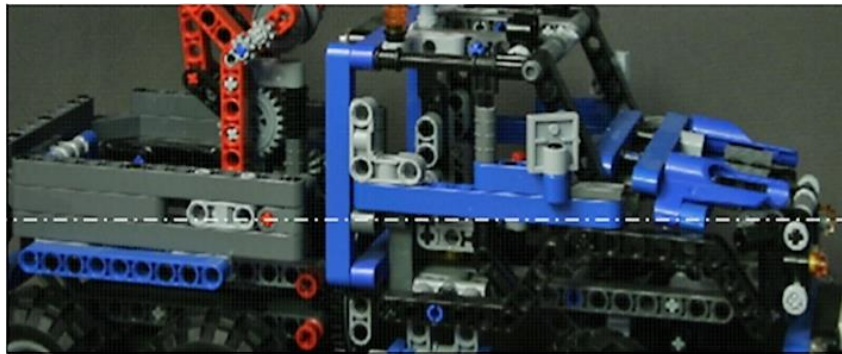


# Light-field scene flow

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

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

- *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

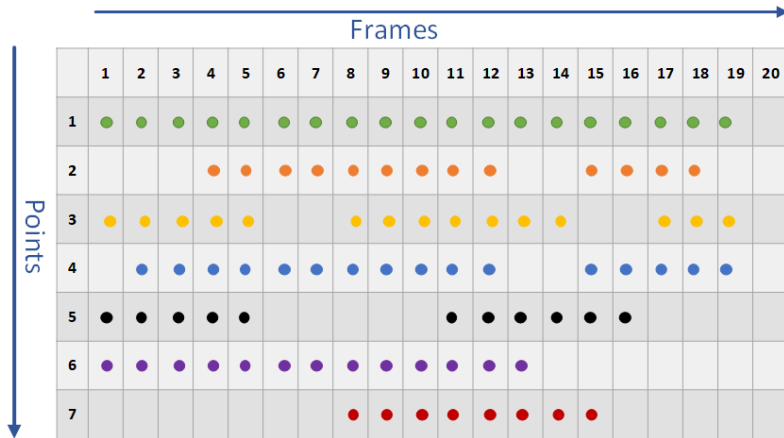
Sparse acquisition

# Light-field scene flow

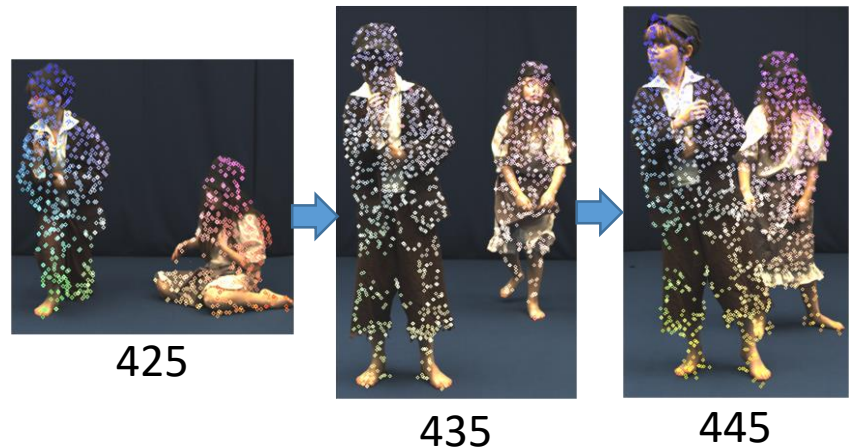
$$E(M) = \sum \alpha E_L(p, m_p) + \beta E_C(p, m_p) + \eta E_R(p, m_p)$$

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



# Light-field scene flow

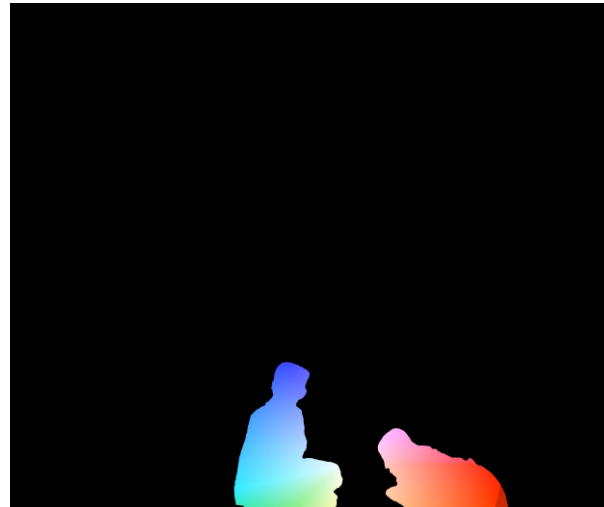
$$E(M) = \sum \alpha E_L(p, m_p) + \beta E_C(p, m_p) + \eta E_R(p, m_p)$$

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

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



Input video



Light-field scene flow

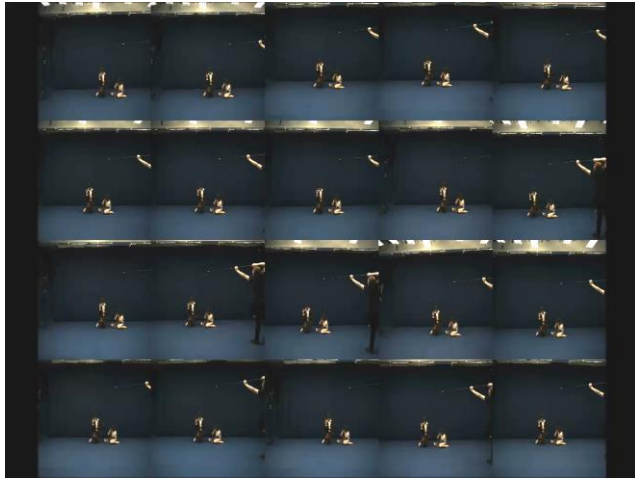


# 4D Temporally coherent light-field video

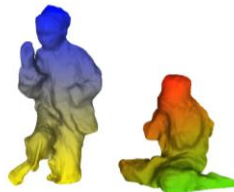


# Results

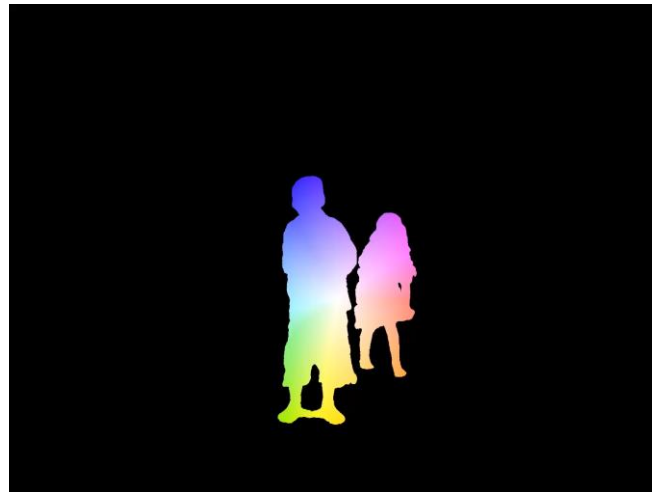
Light-field video



Camera 2 video



4D temporally coherent light-field video



Light-field scene flow

# Results

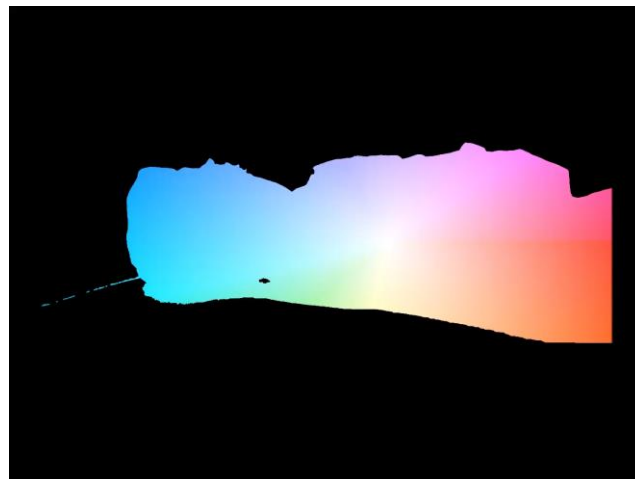
Light-field video



Camera 2 video



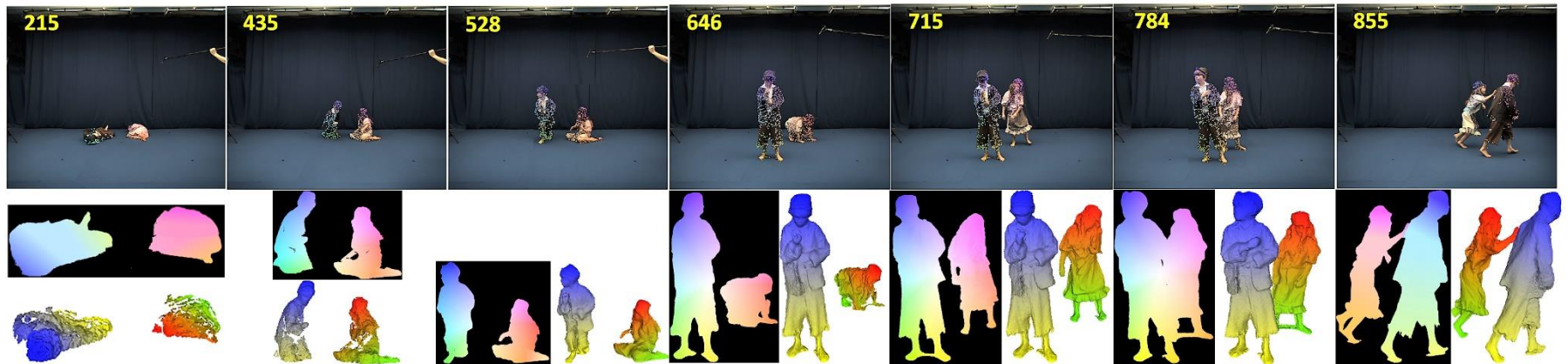
4D temporally coherent light-field video



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