EFFICIENT SEGMENTATION AND REPRESENTATION OF MULTI-VIEW IMAGES

Jesse Berent and Pier Luigi Dragotti

Communications and Signal Processing Research Group, Electrical and Electronic Engineering Department, Imperial College London.

INTRODUCTION

- Image Based Rendering allows to render photorealistic images of scenes from virtual viewpoints
- Some methods use many images and no scene geometry
- Other methods use less images and complex geometric proxies
- We propose a coherent layer representation based on approximate geometry and an unsupervised layer extraction scheme

COHERENT REGIONS IN LIGHT FIELDS

The light field is a 4D function where light rays are parameterized by the camera location (s,t) and the image plane (u,v)

\[
\begin{pmatrix}
X \\
Y \\
Z \\
t
\end{pmatrix} = \begin{pmatrix}
u/s \\
v/t \\
-1/Z \\
t
\end{pmatrix}
\]

Coherent regions are defined as a collection of corresponding layered regions in the light field images. These layers are modelled with a simple geometric proxy (i.e. fronto-parallel for example).

\[
\text{Coherent region } C_n \iff \mathcal{H}_n \text{ 4D volume}
\]

A GLOBAL SEMI-PARAMETRIC VARIATIONAL APPROACH

- Contours of layers are extracted using the level set method [3] (i.e. no parameterization)
- Dependencies between views and occlusions are constrained by the camera setup (i.e. easily parameterized)

\[\epsilon_n = \sum_{n=1}^{N} \mathcal{H}_n \text{ 4D hypersurface}
\]

\[\mathcal{E}_n = \int \epsilon_n d^4s \]

\[\epsilon_n = [d_{\text{int}}(s) - d_{\text{ext}}(s)]n_s
\]

\[\text{Gradient descent}
\]

The coherent regions are extracted using a 4D energy functional to minimize

\[\mathcal{E}_n = \sum_{n=1}^{N} \mathcal{H}_n \text{ 4D hypersurface}
\]

where \(d_n\) are descriptors measuring the consistency with each region. The steepest descent leads to an evolution equation for the hypersurfaces

\[\mathcal{E}_n \rightarrow \min
\]

\[\n_n = \left| d_{\text{int}}(s) - d_{\text{ext}}(s) \right| n_s
\]

APPLICATION I: VIEW INTERPOLATION

Conventional sparse light field rendering

Our approach

REFERENCES